UE "Cell Fate and Plasticity"
HMBS311

Parcours "GenEpi-CDC" and "Cancer Biology"

Signal transduction

- TGFß signaling (Marie-Luce Vignais, INM)
- Nuclear signaling and cancer cell proliferation (Vincent Cavaillès, IRCM)
- Wnt signaling and morphogenesis (François Fagotto, CRBM)
- Tyrosine kinases and phosphatases in cell signaling (Serge Roche, CRBM)

Adhesion in development and cancer

- Integrin- and cadherin-mediated adhesion and signaling (Stéphane Bodin, CRBM)
- Membrane micro domains in cell adhesion and migration (Christine Bénistant, CBS)
- Neural crest cell migration in the developing embryo (Sandrine Faure, PMECM)
- Physiopathology of osteoclasts (Anne Blangy, CRBM)
- Crosstalk between proliferation and migration during invasion (Pierre Roux, CRBM)

Cell fate and RNA metabolism

- Gene expression regulation during cellular differentation (Dominique Helmlinger, CRBM)
- Alternative splicing and physio-pathology (Peggy Raynaud, CRBM)
- Alternative splicing, development and tumor progression (Didier Aubœuf, CRLC, Lyon)

Cell signaling and proliferation

- From the end of mitosis to the final split (Nathalie Morin, CRBM)
- Regulation of centromeric cohesion and its importance in chromosome segregation (Simonetta Piatti, CRBM)
- Centrosomes, cilia and pathologies (Benjamin Vitré, CRBM)
- Atypical functions of cell cycle regulators (Jean-Marie Blanchard, IGMM)
- Signaling from telomeres: Senescence and oncogenesis (Véronique Gire, CRBM)

Methodology

- Basic principles of bio-statistics (Pierrick Labbé, ISEM; Philippe Fort, CRBM)
- Microscopy in cell biology (Virginie Georget, MRI CRBM)

Aims of the course:

Multicellularity represents a major evolutionary transition during which new gene functions have been selected to allow for the development, maintenance and reproduction of a complex adult organism from a single fertilized cell.

Metazoans display a robust developmental process, in which organisms have selected trade-offs between the capacity of cells to commit into specific cell types (the Fate) and to adapt to external cues (the Plasticity). At the adult stage, similar trade-offs have been selected to ensure homeostasis in any situation.

Cell–cell and cell-substrate adhesive structures play key roles in these trade-offs, because they mediate dynamic mechanical linkages that enable formation and homeostasis of tissues and organs and coordinate cell proliferation, motility, differentiation or apoptosis.

In this context, development can be viewed as a series of crosstalk between biochemical cues, mechanical stress and gene expression, supervised by checkpoints that the proper unfolding of events. Similarly, cancer can be viewed as an accumulation of genetic, epigenetic and metabolic incidents, whose combined effects alter cell cycle, apoptosis as well as the normal repertoire and functioning of adhesive structures, leading to local proliferation, dedifferentiation, invasion and eventually to long-distance metastasis.

The course "Cell Fate and Plasticity" is part of the "Gen-Epi-CDC" and "Cancer Biology" Programs within the Master BioMed of Montpellier University.

The objectives are:

i. Provide the basic knowledge on the major signaling pathways and their pleiotropic impacts on cell adhesion and other properties,

ii. Introduce cell adhesion in terms of mechanisms and dynamics in development and cancer,

iii. Present how cells use RNA synthesis and splicing programs to rapidly adapt to new environmental conditions,

iv. Describe protein structures and molecular scaffolds by which cell signaling coordinates proliferation and morphology.

This should give students a general knowledge on the signaling pathways that pertain to multicellularity, and the conceptual tools for a better understanding of the notions proposed by the other UEs of the M2s.

Part of the course is also devoted to tutorials on microscopy in modern cell biology and group works on biostatistics for planning experiments and data interpretation.

Program

Title	Days	Time	Lecturers
Week 1 (19-23 october)			
Atypical functions of cell cycle regulators	Mon 19/10	14:00-16:00	Jean-Marie Blanchard
Gene expression regulation during cellular differentiation	Mon 19/10	16:00-18:00	Dominique Helmlinger
Control of cytokinesis	Tue 20/10	14:00-16:00	Nathalie Morin
Regulation of centromeric cohesion and its importance in chromosome segregation	Tue 20/10	16:00-18:00	Simonetta Piatti
TGFß signaling	Wen 21/10	14:00-16:00	Marie-Luce Vignais
Crosstalk between proliferation and migration during invasion	Wen 21/10	16:00-18:00	Pierre Roux
Microscopy in cell biology	Thu 22/10	14:00-16:00	Virginie Georget
Wnt signaling and morphogenesis	Thu 22/10	16:00-18:00	François Fagotto
Physiopathology of osteoclasts	Fri 23/10	14:00-16:00	Anne Blangy
Integrin- and cadherin-mediated adhesion and signaling	Fri 23/10	16:00-18:00	Stéphane Bodin
Week 2 (2-6 november)			
Neural crest cell migration in the developing embryo	Mon 02/11	14:00-16:00	Sandrine Faure
Membrane microdomains in cell adhesion and migration	Mon 02/11	16:00-18:00	Christine Bénistant
Nuclear signaling and cancer cell proliferation	Tue 03/11	14:00-16:00	Vincent Cavaillès
Tyrosine kinases and cancer	Tue 03/11	16:00-18:00	Serge Roche
Centrosomes, cilia and pathologies	Wen 04/11	14:00-16:00	Benjamin Vitré
Senescence, telomeric instability and oncogenesis	Wen 04/11	16:00-18:00	Véronique Gire
Cell signaling and alternative splicing	Thur 05/11	14:00-16:00	Peggy Raynaud
Alternative splicing, development and tumor progression	Thur 05/11	16:00-18:00	Didier Aubœuf
Basic principles of bio-statistics (I)	Fri 06/11	14:00-16:00	Pierrick Labbé/Philippe Fort
Basic principles of bio-statistics (II)	Fri 06/11	16:00-18:00	Pierrick Labbé/Philippe Fort