

OptoBiology : Sensors and Actuators of Cellular Activities

Organizers : Simon de Beco & Nicolas Borghi
Venue : University of Paris (PRG campus)

With the growing amount of data available on all biological phenomena, there is an increasing need for quantification in order to connect the dots and build a comprehensive and integrated understanding of the ever more complex topology of signaling pathways and genetic circuits. This requires to be able to perturb biological systems in a controlled fashion and to measure precisely their response.

Optogenetics is an emerging interdisciplinary approach to fulfill this goal that took an increasing importance in the disciplines of cell biology, development biology and neuroscience over the last 15 years. It is an ensemble of methods based on the interaction between cellular activities and light, that can be separated into 2 major aims: - triggering and controlling precisely signaling pathways and neuronal activities using light, and - reading and measuring quantitatively the signaling activities using light-based biosensors (pH, calcium, molecular tension...). **This interdisciplinary course aims at explaining the major concepts behind these techniques and at showing experimental examples of their use in research, both in cell biology and in neuroscience, thanks to the participation of leading experts in the field.** It will also include a practical course in 2 parts dedicated to image analysis in the context of optogenetics.

Monday

Morning :

9:30 - 12:30 **Jean-Marc Verbavatz** : *Fluorescence microscopy principle*

Afternoon :

13:30 - 15:00 **Claire Wyart**: *optogenetic and chemo-optogenetic approaches in the zebrafish nervous system*

15 :15 - 16 :45 **Arnaud Gautier**: Spying on cells with glowing chemical-genetic hybrids

Tuesday

Morning :

9:30 – 11:00 **Alexandre Mourot** : *Controlling endogenous ion channels with light*

11:15 -12:45 **Nicolas Borghi** : Fluorescence based Biosensors

Afternoon :

14:00 – 17:00 **Simon de Beco/Nicolas Borghi** : practical course on image analysis

Wednesday

Morning :

9:30 - 11:00 **Simon de Beco** : *Optogenetic control of intracellular processes*

11:15 - 12:45 **Marie Erard**: *FLIM and its applications to probe protein-protein interactions*

Afternoon :

14:00 – 17:00 **inverted class/exercise**

Thursday

Morning :

9:30 - 11:00 **Pierre-Yves Plaçais**: *Monitoring cellular energy metabolism in the brain with genetically encoded biosensors*

11:15 - 12:45 **Volker Bormuth** : *TBA (Calcium imaging/Light sheet)*

Afternoon :

14:00 - 17:00 **Simon de Beco/Nicolas Borghi**: practical course on image analysis

Friday

9:00 – 17:00 exam : article presentations