Prestige Conference

Structural Biology & Biophysics department

Structure & dynamics of biological membranes

KAI SIMONS

Max-Planck-Institute of Molecular Cell Biology and Genetics, Dresden Germany

9:00 - Welcome message

9:15 ***Invited Speaker***

From lipid rafts to clinical lipidomics

10:20 Etienne Joly

Using fluorescent lipid probes to analyse the physical state of membranes in live cells

10:40 - 11:20 - Coffee Break

11:20 Olivier Saurel

Dynamic of an outer membrane protein by ultra-fast NMR relaxation

BRUNO ANTONNY

Institut de Pharmacologie Moléculaire et Cellulaire, CNRS & Université Nice Sophia Antipolis, France

11:45 ***Invited Speaker***

Playing with double carbon bonds to tune organelle dynamics

12:45 - 14:15 - Lunch

14:15 Flavien Pillet

Using microscopy tools to assess cell wall damages of bacteria exposed to electric field

SIMON SCHEURING

Bio-AFL-lab, INSERM / Université Aix-Marseille, Marseille, France

14:40 ***Invited Speaker***

High-Speed Atomic Force Microscopy: The dawn of dynamic structural biochemistry

Auditorium Fernand Gallais - LCC
205 route de Narbonne,
TOULOUSE

Contact : Marie-Pierre.Rols@ipbs.fr

THURSDAY NOVEMBER 10 2016

IPBS Institut de Pharmacologie et de Biologie Structurale — 1996 - 2016 20 ans — cnrs advancing the frontiers — Université Toulouse III Paul Sabatier — Université de Toulouse

Institut de Pharmacologie et Biologie Structurale
Amphi Gallais/LCC–205 Route de Narbonne - Toulouse

"Prestige Conference"
Structural Biology – Biophysics department

Thursday 10th November 2016

"Structure and dynamics of biological membrane"

8h30: Welcome

9h15: **Kai Simons** (MPI-CBG, Dresden)
From lipid rafts to clinical lipidomics.

10h20: **Etienne Joly** (CNRS-IPBS, Toulouse)
Using fluorescent lipid probes to analyse the physical state of membranes in live cells.

10h40: Coffee break

11h20: **Olivier Saurel** (CNRS-IPBS, Toulouse)
Dynamic of an outer membrane protein by ultra-fast NMR relaxation.

11h45: **Bruno Antonny** (IPMC UMR7275, Sophia Antipolis)
Playing with double carbon bonds to tune organelle dynamics.

12h45: Buffet Lunch

14h15: **Flavien Pillet** (CNRS-IPBS, Toulouse)
Cell wall as the target of Pulsed Electric Fields Inactivation of bacteria.

14h40: **Simon Scheuring** (Bio-AFM-Lab, U1006 INSERM / Aix-Marseille University)
High-Speed Atomic Force Microscopy: The dawn of dynamic structural biochemistry.

15h40: End

High-Speed Atomic Force Microscopy: The dawn of dynamic structural biochemistry:

Simon Scheuring

The advent of high-speed atomic force microscopy (HS-AFM[1]) has opened a novel research field for the dynamic analysis of single bio-molecules: Molecular motor dynamics[2,3] membrane protein diffusion[4], assembly[5] and conformational changes[6] could be directly visualized. Further developments for buffer exchange[7] and temperature control8 during HS-AFM operation provide breakthroughs towards the performance of dynamic structural biochemistry using HS-AFM.

1. Ando et al., **Chem Rev**. 2014 Mar 26;114(6):3120-88.
2. Kodera et al., **Nature**. 2010 Nov 4;468(7320):72-6.
3. Uchihashi et al., **Science.** 2011 Aug 5;333(6043):755-8.
4. Casuso et al., **Nat Nanotechnol**. 2012 Aug;7(8):525-9.
5. Chiaruttini et al., **Cell**. 2015 Nov 5;163(4):866-79.
6. Ruan et al., 2016, in preparation
7. Miyagi et al., **Nat Nanotechnol**. 2016, doi:10.1038/nnano.2016.89
8. Takahashi et al., 2016, submitted

From lipid rafts to cinical lipidomics

Kai Simons

Lipids are important building blocks of life. They have many different biological functions. Their main function is to form the matrix of our cell membranes where they support a variety of functions essential for life. This 2-dimensional fluid matrix has evolved incredible material properties. One is the capability to sub-compartmentalize the fluid into dynamic cholesterol-stabilized sphingolipid-protein assemblies that function in membrane trafficking, signalling and other membrane functions. This capability is a property of cell membranes that are poised close to a phase transition, enabling coalescence into subdomains. For this to occur, the lipid and the protein composition has to be tightly regulated. We have developed a shotgun mass spectrometry platform that now can analyse hundreds of lipids in only a few minutes with absolute quantification. This effective routine of shotgun lipidomics became possible by introducing a unique workflow that combined improved extraction protocols with cutting edge mass spectrometry and novel software. The technology is highly reproducible, achieving an average coefficient of variations of <10% (intra-day), approx. 10% (inter-day) and approx. 15% (inter-site) for most lipid species. The platform is easily transferable allowing the direct comparison of data acquired in different acquisition sites. We have used this technology to analyze blood cells and plasma with the aim to establish multi-parametric lipid signatures that are of diagnostic value.

Playing with double carbon bonds to tune organelle dynamics.

Bruno Antonny

Various proteins remodel the membranes of organelles involved in intracellular transport. Protein coats deform membranes to promote the budding of vesicles. Golgins, sort of molecular strings, tether vesicles to restrict their diffusion. Lipid transporters adjust the membrane composition. Although very different, most of these mechanisms are controlled by small G proteins of the Arf family and by the physical chemistry of membranes. We study these mechanisms through molecular, cellular and in silico approaches. With original assays based on fluorescence and light scattering, we follow elementary reactions such as the assembly cycle of protein coats, the tethering of liposomes by a golgin or the transfer of lipids. With fluorescence light microscopy and electron microscopy, we visualize these events in cells and in reconstituted systems. With molecular dynamics, we describe at the atomic level how specific protein motifs sense the chemistry and curvature of lipid membranes.

1. Magdeleine M., Gautier R., Gounon P., Barelli H., Vanni S. and Antonny B. (2016). **Elife**, 5 () :
2. Moser von Filseck J., Copic A., Delfosse V., Vanni S., Jackson C.L., Bourguet W. and Drin G. (2015). **Science**, 349 (6246) : 432-6
3. Antonny B., Vanni S., Shindou H. and Ferreira T. (2015). **Trends Cell Biol**, 25 (7) : 427-36
4. von Filseck J.M., Vanni S., Mesmin B., Antonny B. and Drin G. (2015). **Nat Commun**, 6 () : 6671
5. Vanni S., Hirose H., Barelli H., Antonny B. and Gautier R. (2014). **Nat Commun**, 5 () : 4916
6. Pinot M., Vanni S., Pagnotta S., Lacas-Gervais S., Payet L.A., Ferreira T., Gautier R., Goud B., Antonny B. and Barelli H. (2014). **Science**, 345 (6197) : 693-7