Directors

Grégory GIANNONE, PhD | University of Bordeaux (Bordeaux Neurocampus), France

Grégory Giannone explores the spatiotemporal and mechanical mechanisms driving the dynamics of structures and proteins regulating cell motility. Cell motility and shape are controlled by biochemical and biomechanical signals which induce the local assembly or disassembly of adhesives and protrusive structures. During his PhD (1997-2001) in Kenneth Takeda laboratory (Louis Pasteur University, France), Grégory Giannone studied the correlation between intracellular calcium oscillations and integrin-dependent adhesion site disassembly. During his post-doc (2001-2005) in Michael Sheetz laboratory (Columbia University, New York), he used high resolution microscopy, optical tweezers and quantitative analysis to study the temporal and spatial dynamics of structures involved in cell motility. He has elucidated the periodic nature of cell edge extension and adhesion site initiation. He also demonstrated the fundamental role of mechanical coupling between the actin cytoskeleton and integrins during cell migration. Grégory Giannone started as a CNRS researcher in 2005 in the group of Daniel Choquet. To step towards higher spatial and temporal resolution, from the micron-scale coordination of sub-cellular structures to the nanometer-scale coordination of proteins, he developed projects based on super-resolution imaging and innovative single protein tracking methods. He created a new method of super-resolution imaging allowing for the first time to reveal the dynamics of endogenous proteins at ultra-high density. Using single protein tracking to study synaptogenic adhesion proteins in neurons, he demonstrated that, like integrins, Neuroligin is a ligand-activated adhesion molecule and that its tyrosine phosphorylation controls the formation of inhibitory and excitatory synapses. Since January 2016, Grégory Giannone is leading the new group 'Spatiotemporal and mechanical control of motile structures'. Using super-resolution imaging and single protein tracking his group unraveled the key spatiotemporal molecular events leading to integrins activation by their activators in adhesion sites. In collaboration with the Weaver Group (UCSF, USA), they demonstrated that the mechanical constraints of the glycocalyx in cancerous cells control integrin activation. Using the same approaches his group studied the nanoscale dynamic organization of F-actin regulators in neuronal dendritic spines. They showed that within spines branched F-actin nucleation occurs at the PSD vicinity, while elongation occurs at membrane protrusion tips. This organization is opposite to classical lamellipodial protrusive structures where branched F-actin nucleation and elongation occur at protrusion tips.

Selected publications:

- *A tessellation-based colocalization analysis approach for single-molecule localization microscopy Florian Levet, Guillaume Julien, Rémi Galland, Corey Butler, Anne Beghin, Anaël Chazeau, Philipp Hoess, Jonas Ries, Grégory Giannone, Jean-Baptiste Sibarita.* Nat Commun. *2019-05-30. 10(1)*
- *Self-Interference (SELFI) Microscopy for Live Super-Resolution Imaging and Single Particle Tracking in 3D Jeanne Linarès-Loyez, Joana S. Ferreira, Olivier Rossier, Brahim Lounis, Gregory Giannone, Laurent Groc, Laurent Cognet, Pierre Bon.* Front. Phys.. *2019-05-08. 7*

Tatiana KOROTKOVA, PhD | Max Planck Institute for Metabolism Research, Germany

T. Korotkova studied biology with a focus on human and animal physiology in Lomonosov Moscow State University. During her Ph.D. under the supervision of Dr. R.E. Brown and Prof. H.L. Haas in Düsseldorf she investigated actions of various hypothalamic neuropeptides on aminergic nuclei, particularly on dopaminergic system. As a postdoc in the lab of Prof H. Monyer in Heidelberg, and later in a collaboration with Prof. T. J. Jentsch in Berlin she studied mechanisms of hippocampal network oscillations in behaving transgenic mice. Since 2012 T. Korotkova was a junior group leader at the Leibniz Institute of Molecular Pharmacology (FMP)/Neurocure Cluster of Excellence in Berlin, since April 2017 - a Max Planck Research Group leader at MPI for Metabolism Research. Since April 2019 T. Korotkova is a Full Professor (W3) and Managing Director of Institute for Vegetative Physiology, Faculty of Medicine, University of Cologne. She is a Head of Research Area 3 of Cluster of Excellence "Cellular Stress Responses in Aging-associated Diseases" (CECAD) https://www.cecad.uni-koeln.de/home/, a Head of the Cologne Graduate School of Ageing Research (CGA) https://www.ageing-grad-school.de/home/, and a Vice-Chair of the DFG-funded Graduate School "Neural Circuit Analysis on the Cellular and Subcellular Level" https://rtg-nca.uni-koeln.de/. Her research is supported by the Max Planck Society, ERC Consolidator Grant 2017, and the DFG. T.Korotkova was awarded the Program Grant of the German-Israeli Foundation for Scientific Research and Development (GIF) (2015), the Junior Brain Prize by Lundbeck Foundation (2013), the Human Frontier Science Program (HFSP) Grant (2012), as well as the DFG and Schering foundation research stipends. T. Korotkova is a member of German Neuroscience Society. She supervised 7 Ph.D. and 7 M.Sc. students. Her students were awarded esteemed prizes including HFSP Long-term Fellowship 2019 (to Franziska Bender); Finalist of the FENS-Kavli PhD Prize (2018) (to Marta Carus-Cadavieco); 2017 Vanier Scholarship, McGill University (to Suzanne van der Veldt); The Junior Brain Prize, Lundbeck Foundation (2017) (to Marta Carus-Cadavieco). T. Korotkova co-authored 24 peer-reviewed original publications, 4 reviews, 1 preview as well as one book chapter. Her lab studies neuronal circuits regulating innate behaviors, including feeding-related behaviors. The aim is to reveal and decode functions of multiple hypothalamic neuronal circuits in these behaviors in health and disease. To reveal and decode influence of various neuronal groups and their inputs on innate behaviors, Korotkova lab combines multisite high-density neuronal recordings in transgenic behaving mice, calcium imaging, optogenetics, chemogenetics, subsecond behavioral analysis as well as novel computational and engineering approaches.

Selected publications:

- *Carus-Cadavieco M, Gorbati M, Ye L, Bender F, van der Veldt S, Kosse C, Börgers C, Lee SY, Ramakrishnan C, Hu Y, Denisova N, Ramm F, Volitaki E, Burdakov D, Deisseroth K, Ponomarenko A, Korotkova T (2017). Gamma oscillations organize top-down signaling to hypothalamus and enable food seeking. Nature, 542: 232-236. doi: 10.1038/nature21066.*
- *Herrera CG, Carus-Cadavieco M, Jego S, Ponomarenko A, Korotkova T, Adamantidis A (2016). Hypothalamic feed-forward inhibition of thalamocortical network controls arousal and consciousness. Nature Neuroscience, 19(2):290-8.*

- *Bender F, Gorbati M, Carus-Cadavieco M, Denisova N, Gao X, Holman C, Korotkova T, Ponomarenko A (2015). Theta oscillations regulate speed of locomotion via hippocampus to lateral septum pathway. Nature Communications, 6:8521 doi: 10.1038/ncomms9521.*
- *Fidzinski P, Korotkova T, Heidenreich M, Maier N, Schuetze S, Kobler O, Zuschratter W, Schmitz D, Ponomarenko A, Jentsch TJ (2015). KCNQ5 K+ channels control hippocampal synaptic inhibition and fast network oscillations. Nature Communications, 6:6254 doi: 10.1038/ncomms7254 (* - equal contribution).*
- *Korotkova T, Fuchs EC, Ponomarenko A, von Engelhardt J, Monyer H (2010). NMDA receptor ablation on parvalbumin-positive interneurons impairs hippocampal synchrony, spatial representation and working memory. Neuron, 68(3):557-69.*

Dmitri RUSAKOV, PhD | University College London, UK

Graduated with a Masters in Physics, Dmitri obtained his PhD in Biophysics / Neurobiology at Bogomoletz Institute of Physiology, NAS, Kiev. He carried out his postdoctoral research in the laboratory of Mike Stewart and Steven Rose (The Open University, UK), and collaboratively with Dimitri Kullmann (University College London). Subsequently, he joined the group of Alan Fine and Tim Bliss (NIMR, Mill Hill, London) where he obtained his first independent post (MRC Career Development Award) in 1999. In 2000, he moved to UCL Queen Square Institute of Neurology to set up a new laboratory, helped by his Wellcome Trust Senior Research Fellowship (2003, renewed in 2008), a Wellcome Trust Principal Fellowship (2013, renewed in 2018), and other major grant awards including an ERC Advanced Grant (2012). Dmitri holds a Personal Chair at UCL, as a Professor of Neuroscience, since 2007. His main research interests focus on synaptic transmission and its use-dependent plasticity, extrasynaptic actions of neurotransmitters, and astroglia-neuron interactions. Dmitri and his group discovered extracellular calcium depletion, electrodiffusion of glutamate, and the role of astroglial signalling in synaptic plasticity. They have been developing novel experimental methods of multiplexed imaging aimed at monitoring synaptic and astroglial function in situ with high spatiotemporal resolution.

Selected publications:

- *Jensen TP, Zheng K, Cole N, Marvin JS, Looger LL, Rusakov DA (2019) Multiplex imaging of quantal glutamate release and presynaptic Ca2+ at multiple synapses in situ. Nature Commun 10: 1414 pp 1-13.*
- *Zheng K, Bard L, Reynolds J, King C, Jensen TP, Gourine AV, Rusakov DA (2015) Time-resolved imaging reveals heterogeneous landscapes of nanomolar Ca2+ in neurons and astroglia. Neuron 88: 277-288.*
- *Henneberger C, Papouin T, Oliet SHR, Rusakov DA (2010) Long-term potentiation depends on release of D-serine from astrocytes. Nature 463: 232-236*
- *Sylantyev S, Savtchenko LP, Niu YP, Ivanov AI, Jensen TP, Kullmann DM, Xiao MY, Rusakov DA (2008) Electric fields due to synaptic currents sharpen excitatory transmission. Science 319: 1845-9.*
- *Rusakov DA, Fine A (2003) Extracellular Ca2+ depletion contributes to fast activity-dependent modulation of synaptic transmission in the brain. Neuron 37: 287-297.*