

Cellular and molecular regulation of synaptic transmission (Oheim/Ropert group)

Keywords: cortical development, silent synapses, exocytosis, sensory cortex, evanescent wave microscopy, semiconductor nanocrystals, FRET

Introduction

Our group is one of four within the Laboratory of Neurophysiology and New Microscopies (INSERM U603 – CNRS FRE2500) and currently comprises 2 CNRS researchers with different backgrounds (see below), 3 postdoctoral researchers, 2 graduate students and between 2 and 4 undergraduate students. Nicole ROPERT is a biologist with a strong expertise in neurotransmission in the central nervous system of adult and newborn mammals and has used patch clamp techniques in slice preparations. Martin OHEIM is biophysicist with training in the field of exocytosis, using Evanescent Wave microscopy, Ca²⁺ imaging and amperometric recording in isolated neuroendocrine cells.

Scientific Projects

We have ongoing projects in biology, in physics, and several projects at the interface of physics and biology. Our projects are the following:

- (i) development of NanoFRET sensors of ion concentration, based upon semiconductor nanocrystal donors and organic acceptor indicator dyes;
- (ii) development of all-optical-imaging and micromanipulation techniques (photoconversion, uncaging, force transduction) on a nanoscale
- (iii) development of ultrasensitive tools for quantitative evanescent-field imaging
- (iv) to characterize the functional changes that occur at identified synapses during development, and to demonstrate their importance for the formation of a cortical sensory map;
- (v) to study the mechanisms and triggering of astroglial release of neuroactive substances.

Selected publications

Becherer, U., T. Moser, W. Stühmer, M. Oheim (2003). "Ca²⁺ regulates exocytosis at the level of single vesicles." *Nature Neurosci.* 6(8): 846-853

Schapper F, Goncalves JT, Oheim, M. Fluorescence imaging with two-photon evanescent wave excitation. *Eur Biophys J.* 2003 Nov;32(7):635-43.

Oheim, M. & Schapper F. Non-linear evanescent-field imaging. *J. Phys.D: Appl. Phys.* 2005. 38: R1-R13

Research grants

ACI 'jeune chercheur', 2001 (French ministry of research and technology, MNRET)

AC 'dynamique et réactivité des assemblages cellulaires', 2003 (MNRET & CNRS)

ACI 'nanosciences', 2004 (MNRET)

AMIGO (Max-Planck Society/INSERM), 2005

ANR 'neuroscience', 2005 (GIP-ANR, under negotiation)