

*nano*SCIENCES  
FONDATION



# Life science at the limits of microelectronics

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# Nanobiosciences in Grenoble

## Structure-function relationships in macromolecules

proteins  
polysaccharides  
molecular assembly

IBS  
CERMAV  
INAC DCM

## Application of nanotechnologies to life sciences

biosensors  
microarrays  
control of the cell microenvironment  
biophysics studies  
medical imaging

DCM INAC  
LSP GIN IAB  
IRTSV LSP LMGP  
LETI

## Theoretical physics applied to biology or medicine

protein structure  
biomechanics  
signal and image processing.

IBS  
LSP IAB  
TIMC

# Life science at the limits of microelectronics

## Selection criteria

Involvement of **microelectronics or photonics**

Relevance for the **life sciences**

Scientific excellence

Collaborative project and interest for the community

**2 chairs of excellence, 4 projects, 3 PhD grants**

**Neuroscience**

**Lab on chip**

# Neuroscience projects

## 2 Chairs of excellence

**Donald Martin** : "Biomimetic Artificial Membrane Systems for Generating Electrochemical Energy"

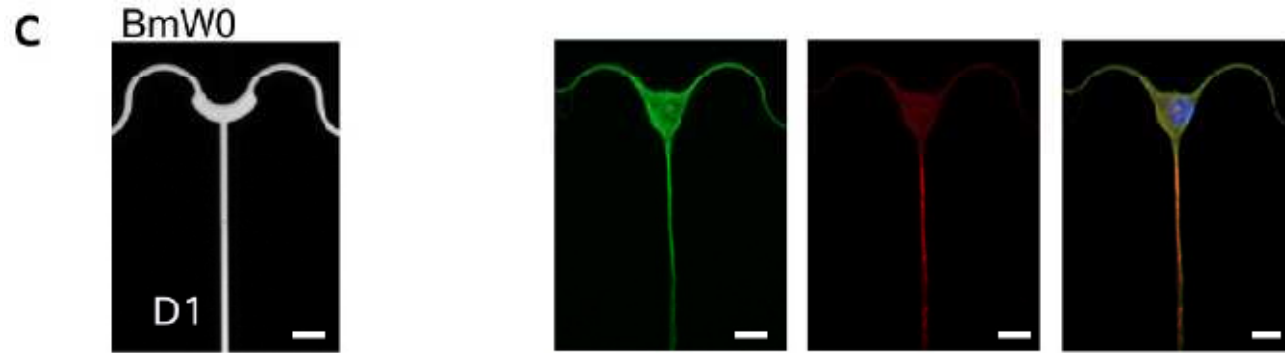
**Tetiana Aksenova** : "Implantable computer-brain interfaces"

## 2 projects

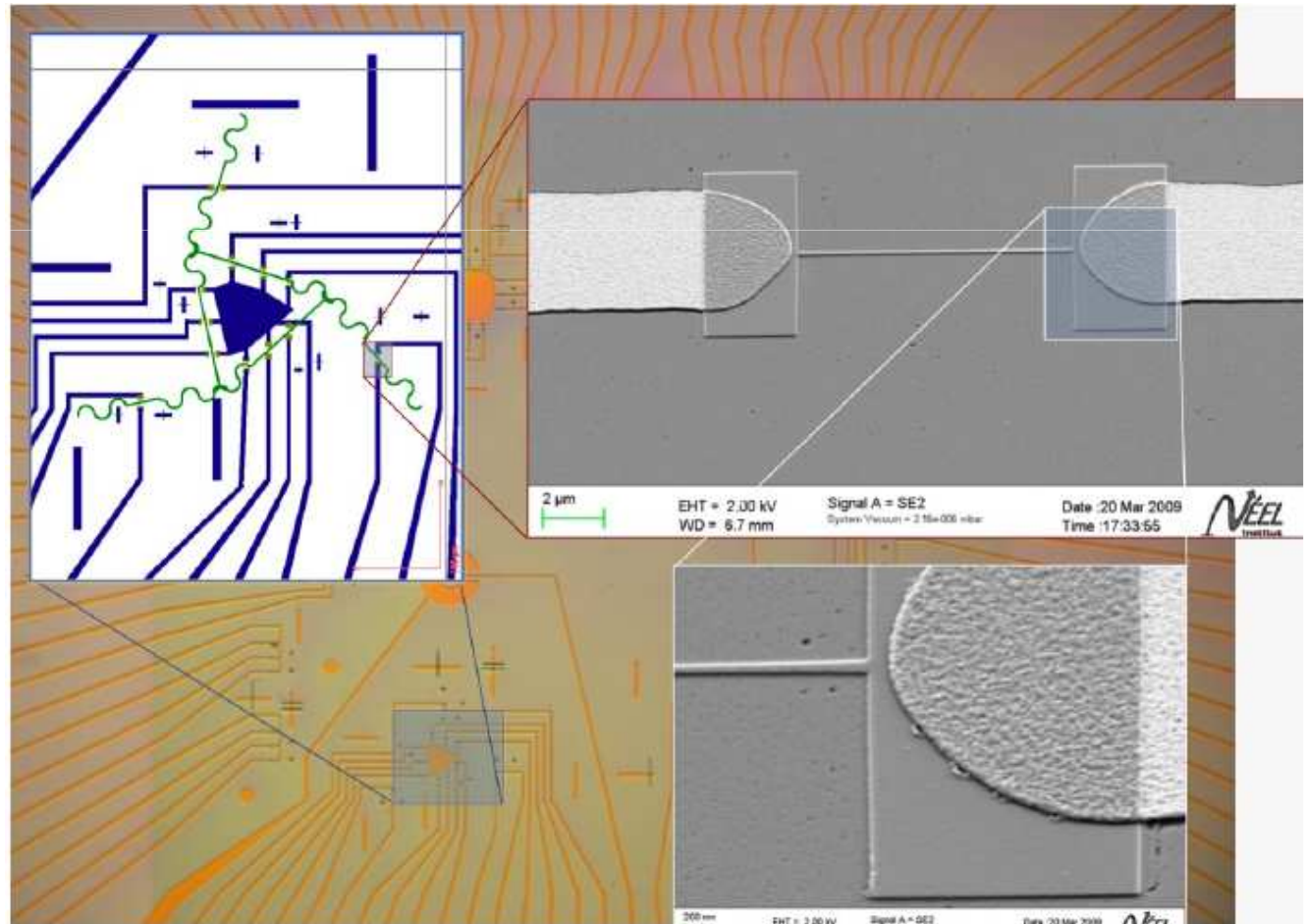
**Catherine Villard**: "Coupling of neurons with patterned functionalized surfaces and stimulation/recording with silicon nano Field Effect Transistors."

**Julien Douady** : "Dendritic potentials imaging by second harmonic generation."

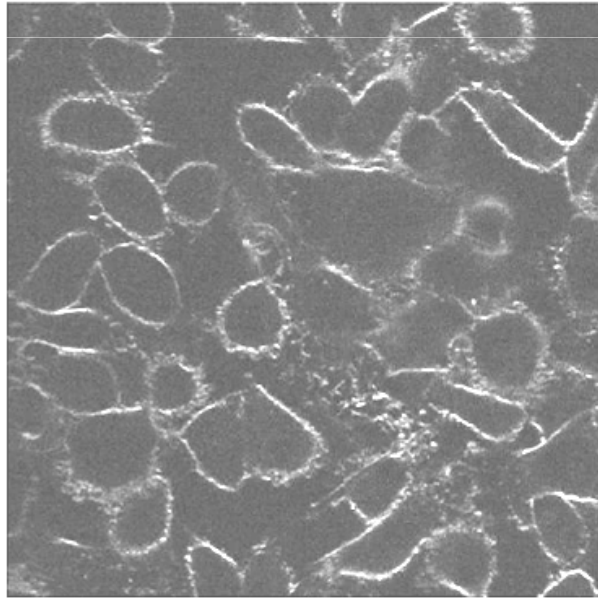
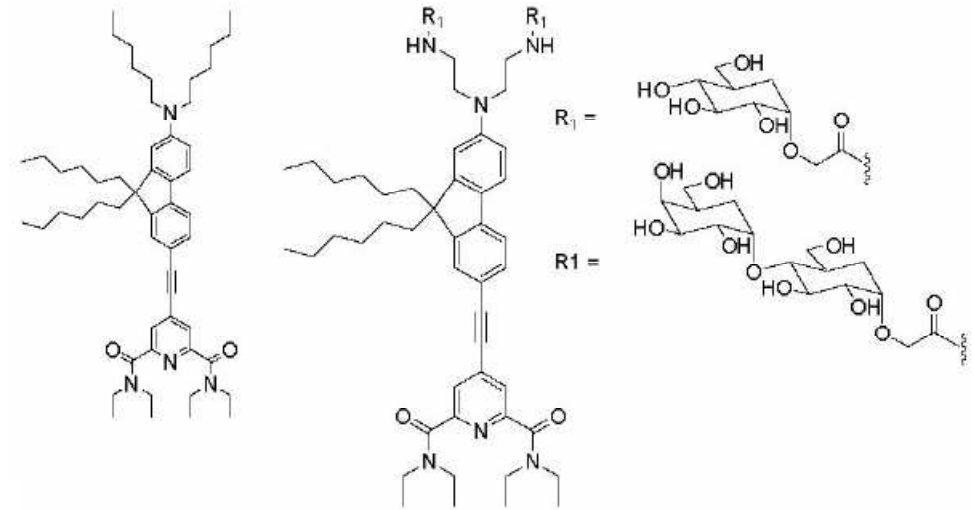
Patterned surface to orient neuron axon : 90% success



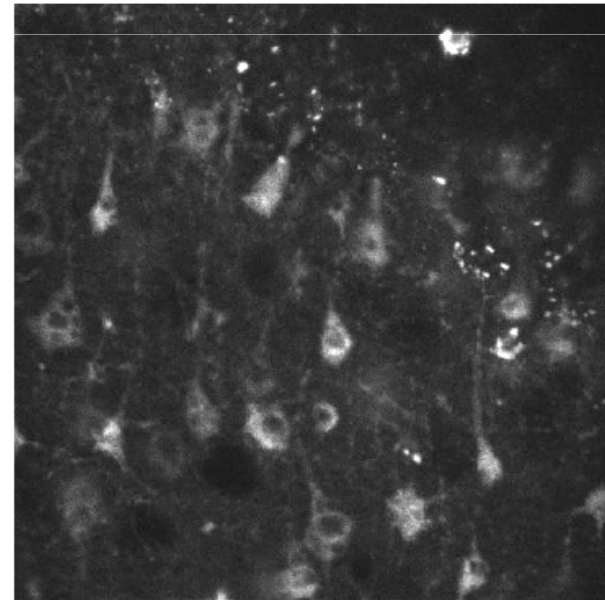
NeuroFET chip to probe simple neuron networks



New dyes developed for Second Harmonic Generation Microscopy to monitor transmembrane voltage change in neurons



HEK cells



Pyramidal cells

## Lab-on-Chip projects

### 2 Projets :

**Michel Vivaudou and Benjamin Cross** : “Nanodroplet chip for a controlled assembly of lipid layers and electrical detection of single-protein activity”

**Martial Balland** : “Contribution of 3D micro environnement to cell adhesion”

### 2 PhD grants :

**WANG Xu** : "New nanometric bio-sensors from carbon nanotubes"

**BOMBERA Radoslaw**: “Development of biochips dedicated to blood cell characterization”

## Support to (bio)technological platforms

**Nanobio facilities** in Grenoble :

Quartz microbalance (molecular interaction facility)

Transient spectroscopy

Mass spectrometry (chemical synthesis facility)

AFM scanner

dual AFM-fluorescence microscopy (cell imaging facility)

**CIME-PTA**

Fluorescence reader

Support to initial setting and running costs

## Added value of the Nanoscience Foundation

Lab on chip → expected

Neurosciences ↔ increased visibility of the GIN

Importance of theoretical physics and mathematics

New collaborations

## Future developments

Neurosciences and Lab on Chip projects

Define the subject of an excellence chair

Synergy with the team “**Nanomaterials, nanoassembly and nanostructuring**” on molecular assembly at material surfaces

**JAIN Purvi:** Antibody phage display in materials sciences : new nano-probes and linkers for nano-objects.

## Relation with the industry

### Existing industrial partnerships :

Biomerieux, ST Microelectronics, Becton Dickinson, Protein Expert ...

### Start-up incubators

### Partnerships to be developed :

Bioprofile, Thornier ...