# M2 Physics, Engineering and Chemistry for Biology (**PhysEnBio**)

**Target Audience:**
M1 Physics, Applied Physics, Engineering, Physico-Chemistry

école normale supérieure paris—saclay

université PARIS-SACLAY

## INTRODUCTION & OBJECTIVES
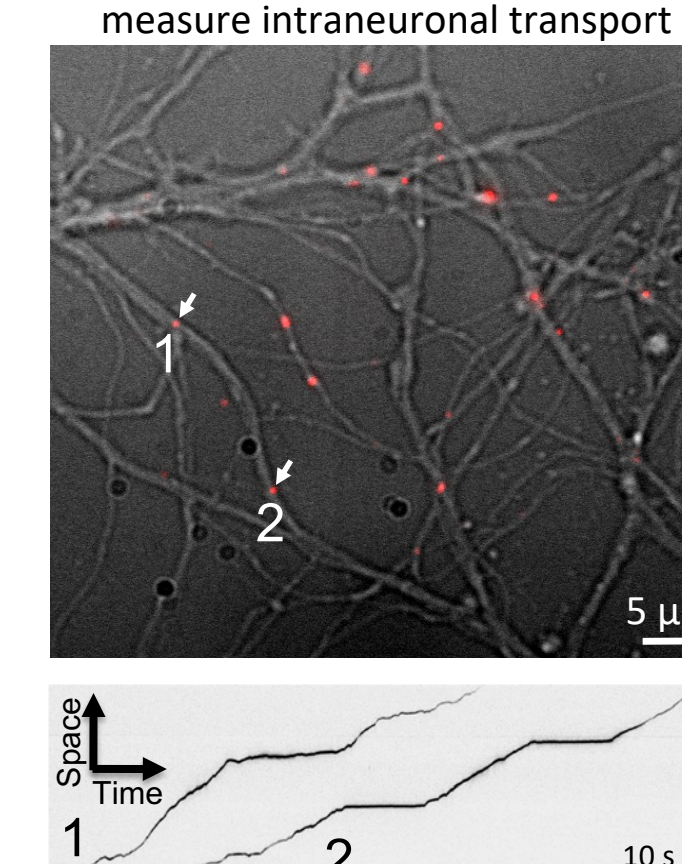
**Objectives:**
- Provide a comprehensive education, bridging the gap between traditional physical sciences and the complexities of biological systems.
- Form students having a background in physics, physico-chemistry, or engineering seeking to delve into biology.



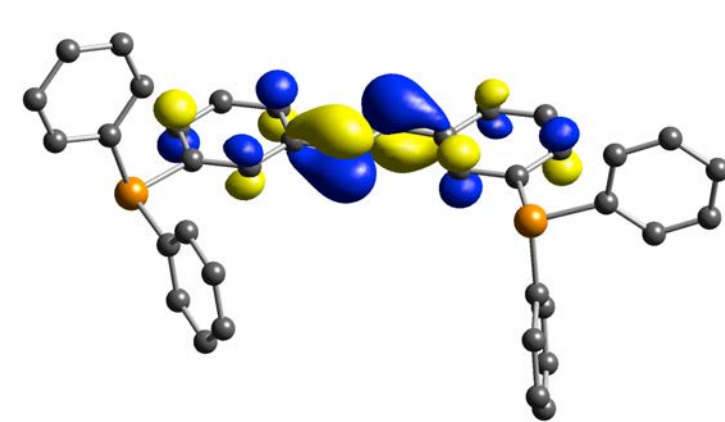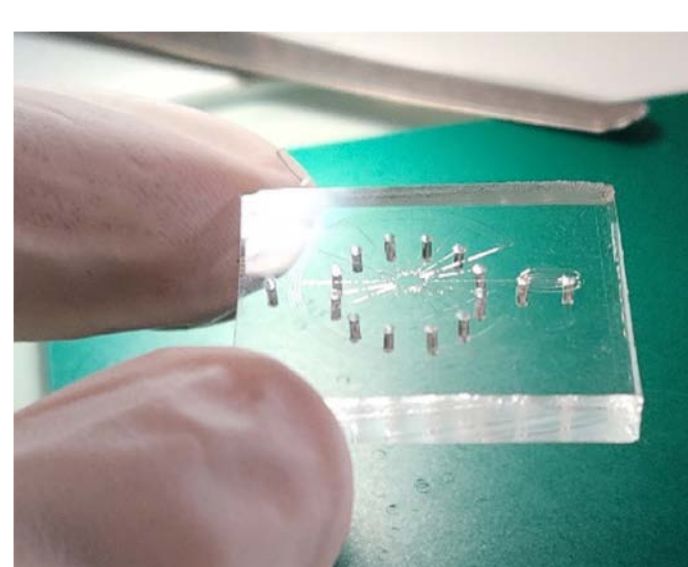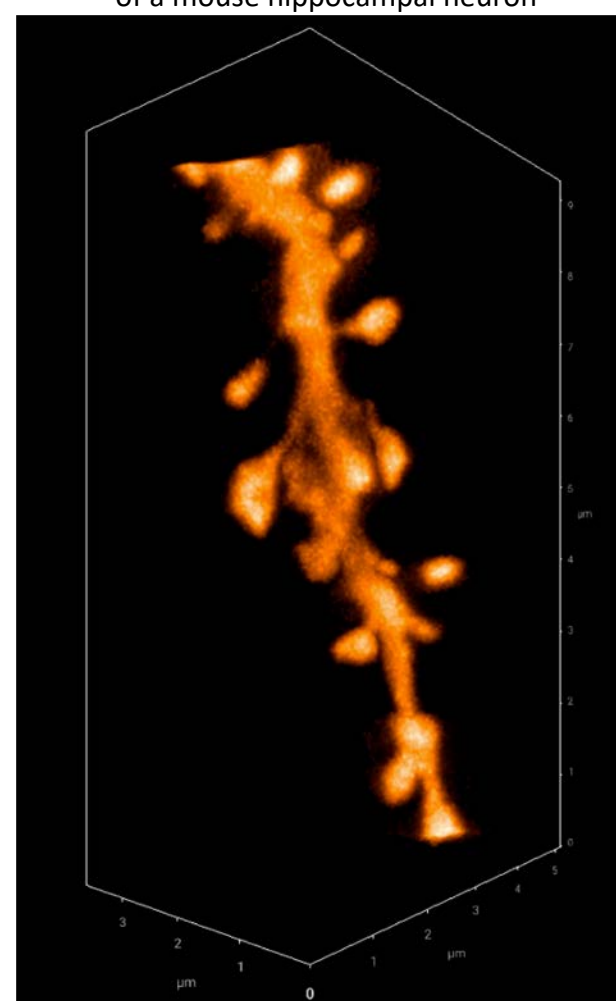3D STED zoom on labeled dendritic spines of a mouse hippocampal neuron



**AO-TPFM for closed-loop correction in fixed brain slices.** 2D maximal intensity projection of a stack of images in cortical brain slices of GAD-GFP mice. Left: without adaptive optics correction. Right: with adaptive optics correction. The depths of the cells are color-coded. Inserts: original Z-stacks (S. Imperato & A. Fragola, ESPCI - L. Bourdieu, IBENS - F. Harms, Imagine Optic)

Fluorescent nanodiamonds to measure intraneuronal transport

**Highlights:**
- **Multidisciplinary Foundation:** Gain essential biology knowledge to complement your existing scientific background.
- **Physics and Engineering Integration:** Explore diverse methods and models from physics, engineering and chemistry for a comprehensive understanding of biological systems.
- **Hands-On Experience:** Emphasis on practical learning with a range of experimental teaching.
- **Language of Instruction:** English, fostering an international learning environment.

**Opportunities:**
Upon completion, you'll possess foundational biology skills and practical experience, preparing you for careers in research and applied research at the biology interface.
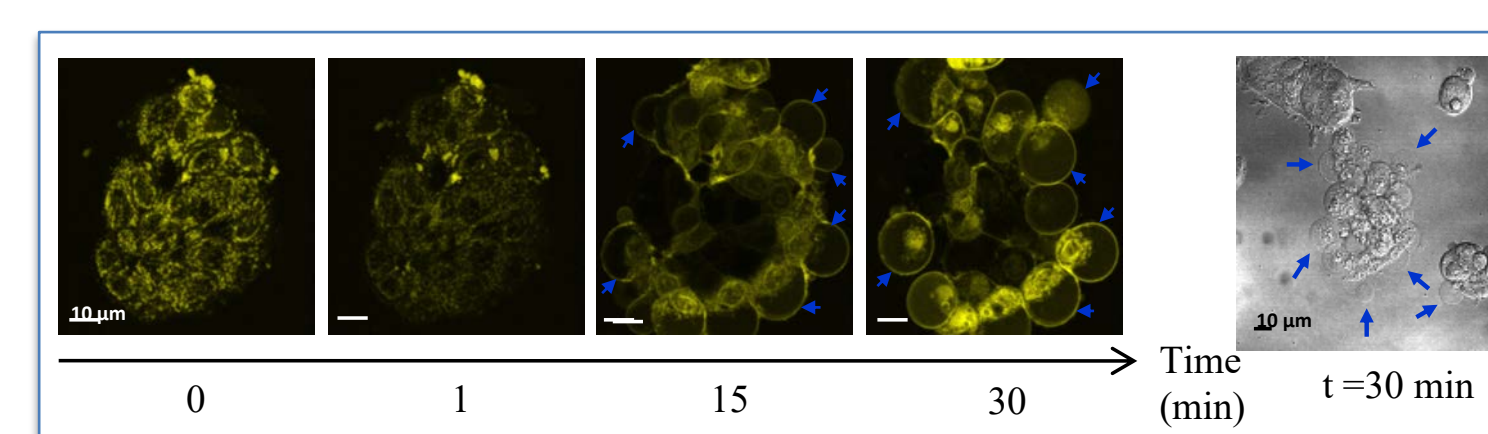


Triggering cell death of MCF7 cells by two-photon excitation (860 nm) of a 2-P absorbing photo-sensitizer (blue arrows designate membrane blebbing, a hallmark of apoptosis)

## Program Structure

### Core courses

*Mandatory:*
- Fundamentals in Biology
- Laboratory Practical Unit

*5 among 6:*
- Light-Matter Interaction from molecules to solids
- Biomolecular photonics
- Advanced Microscopy
- Cell biochips - from single cell to organ on chip
- Soft Condensed Matter
- Fundamentals in Chemistry

### 4-6 months internship

### Options *5 among:*
- Advanced Python for Big Data Exploration and Visualisation
- Ion Channel Recording and nanopore technology
- Quantum Sensing
- Laser and nonlinear optics
- Image Analysis for Biology
- Modeling structure and dynamics of biomolecules
- Microfluidics – Biosensors – Biodevices : fundamentals & applications
- Nanophotonics
- Tissues and Bioengineering (workshop with EDs)

## Partner Laboratories at Université Paris-Saclay

ISMO

LBPA
LABORATOIRE DE BIOLOGIE ET DE PHARMACOLOGIE APPLIQUÉE

LuMIn
Lumière, Matière et Interfaces

I2BC

INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech

LABORATOIRE CHARLES FABRY

LPS ORSAY

SATIE

PPSM

IDA Institut d'Alembert