SCUOLA NORMALE SUPERIORE

The end-of-the first year exam

Roberta Mezzena

17/10/2019

National Enterprise for nanoScience and nanoTechnology

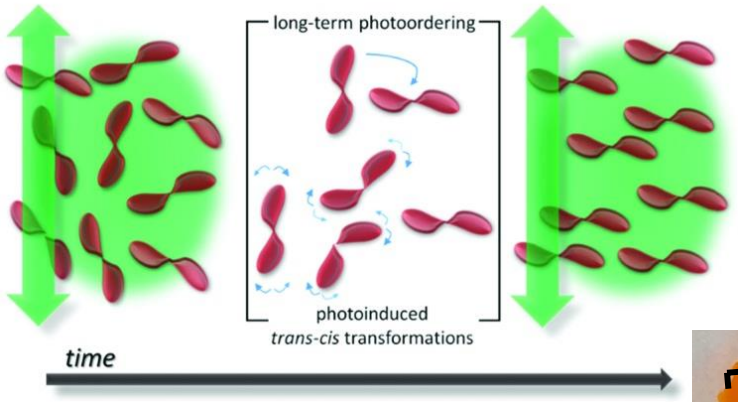
NEST

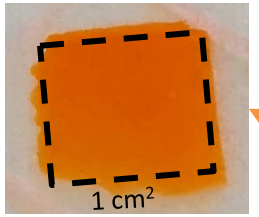
Exams

Courses	State	Hours
• Introductory Quantum Physics G. C. La Rocca, S. Luin	✓	40
• Fundamentals of Biophysics at the Nanoscale S. Luin, R. Nifosì, F. Cardarelli	✓	50
• Biophysical Principles of Neuroscience G. M. Ratto	planning	40

Stages

xPRINT lab





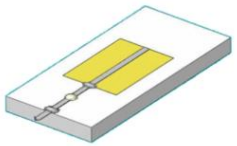
Photoresponsive 3D printed material

Printed film doped with a nonlinear pyrazoline derivative chromophore (PY-pCN). Excitation laser light is the template for molecular ordering leading to optical anisotropy and driving the system into two defined states used for the switch construction.

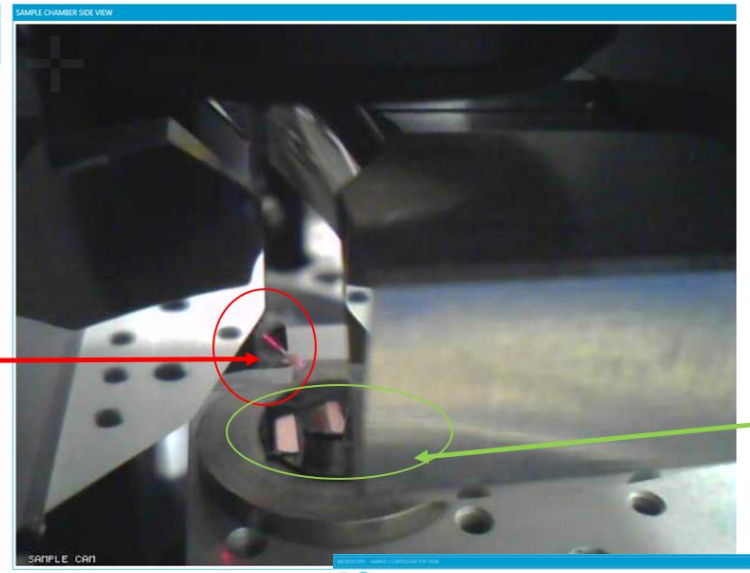
Szukalski et al., 2019

Terahertz near-field microscopy lab

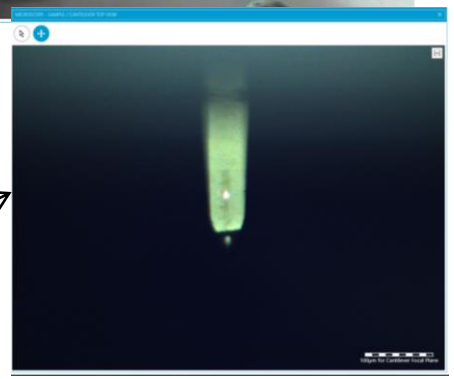
Sample positioning and approach with the detail of the tip with deflection of the laser spot that allows to follow the tip oscillation.



AFM probe holder



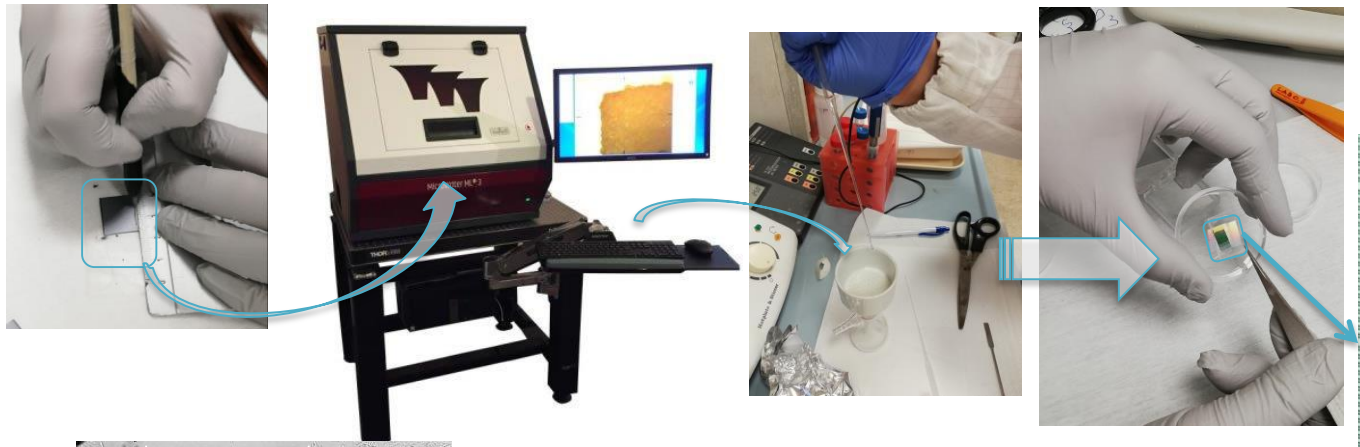
Sample

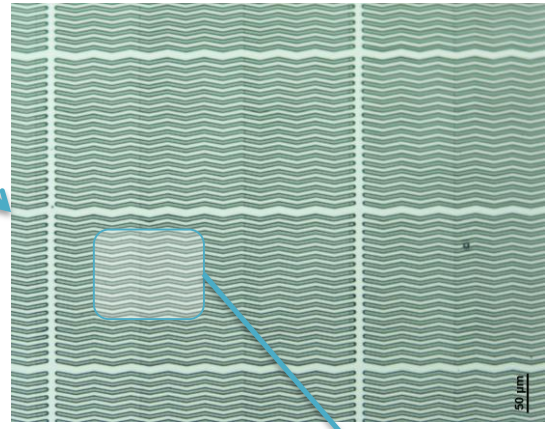


Tip image with deflection laser spot

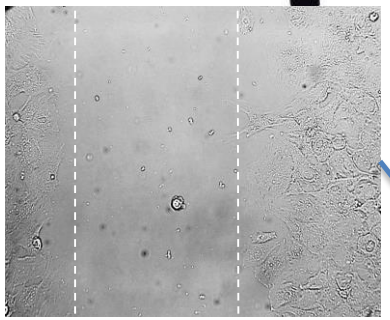
Project: so far

Manufacturing steps of microstructured biocompatible films





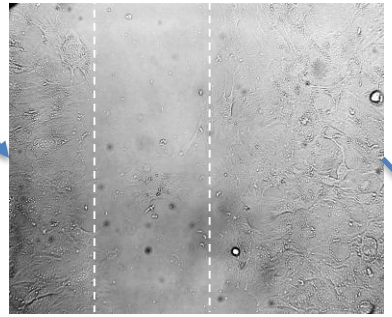
Two days time-lapse experiments with fibroblast cells



At time 0 the wound is open

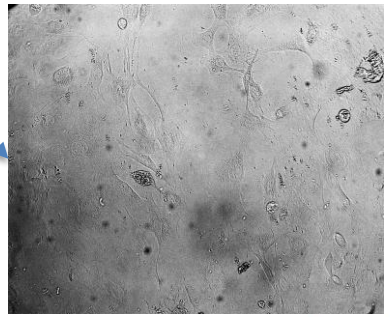
0-24h

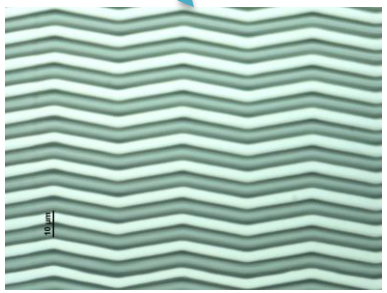
At 24 hours the wound is closing

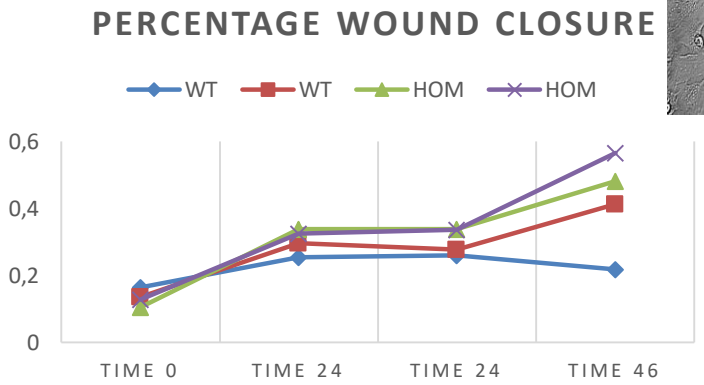


24-48h

At 48 hours the wound is closed







Preliminary data

Project : perspectives

GALC gene **mutation** → GALC depletion ↔ Autophagy ↔ NBR1*

GALC depletion → ↑ Psychosine

↑ Psychosine → Disrupted raft architecture → **De-myelination & Neurons death**

↑ Psychosine → OLGs and SCs death → **De-myelination & Neurons death**

↑ Psychosine → Inflammation → **De-myelination & Neurons death**

↑ Psychosine → ↓ PKC

↓ PKC → Cytoskeletal rearrangments

↓ PKC → Neurite outgrowth

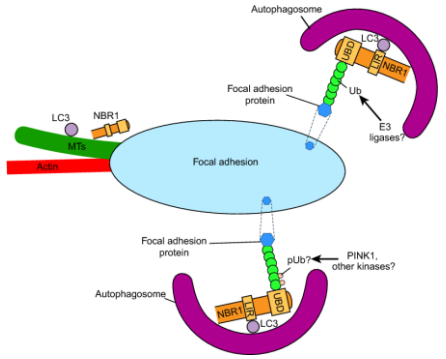
GALC depletion → ↑ p62 → P62 aggregates (neurons) → **Autophagic dysregulation**

GALC depletion → ↑ LC3II → ↓ Autophagosome assembly → **Autophagic dysregulation**

GALC depletion → ↓ ATG16L1 → ↓ Autophagosome assembly → **Autophagic dysregulation**

Heckman and Plummer 2013

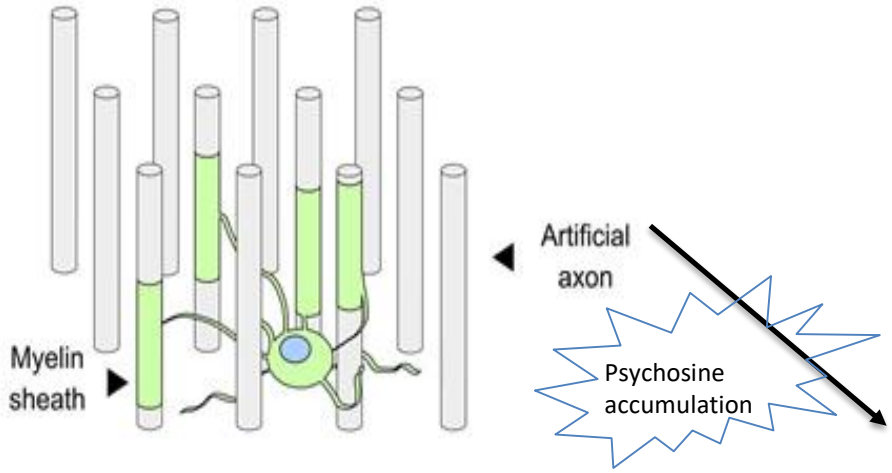
NBR1* → Mechanotransduction



*(autophagy cargo receptor neighbor of BRCA1) **key mediator of autophagy-dependent FA remodeling**

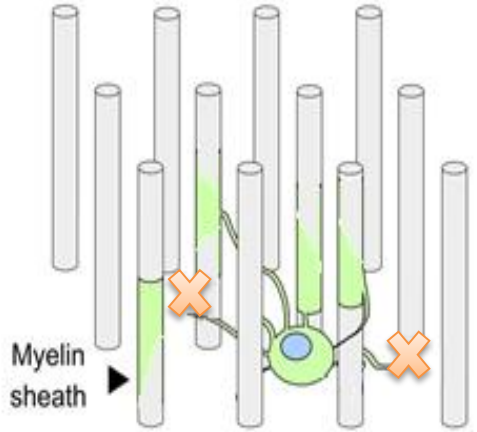
Kenific et al. 2016

Project: the idea

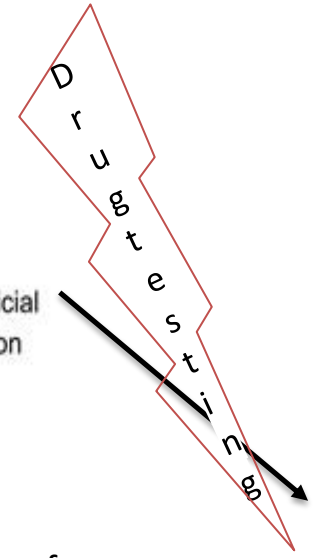


To mimic the extracellular environment and axons in such a way as to observe the behavior of the glia, such as the oligodendrocytes (OGDs) that can extend their processes to many different axons forming a leaflet of 1 µm thickof myelin sheath around each axon for several adjacent axons

Neurodegeneration



A mutated OGD or an administration of psychosine causes a degeneration of the myelin with consequent neurodegeneration. In the model this causes an inability of glial processes to coat the pillars or in the regression of processes.



The treatment of cells with different drugs concurrently or not with GALC enzyme will allow us to observe if and how the restoration of astrocytic processes occurs, which are the best times and administrations, in vitro.