Àmbit: ***NANOBIOTECHNOLOGY***

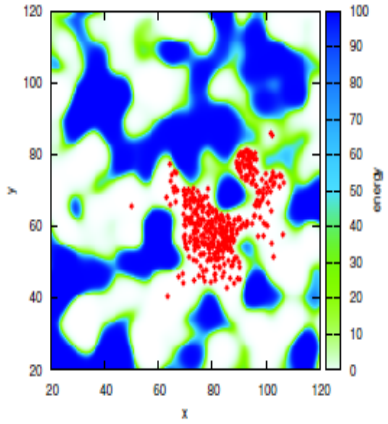
Grup de Física no lineal

- Format el 2001, i finançat en totes les convocatòries SGR des d'aleshores http://www.ecm.ub.edu/nonlinphys/english/index.html
- Orígen: investigadors en física estadística de no equilibri i física no lineal 6 permanents, 1 investigador RyC, 4 postdocs, > 10 predocs

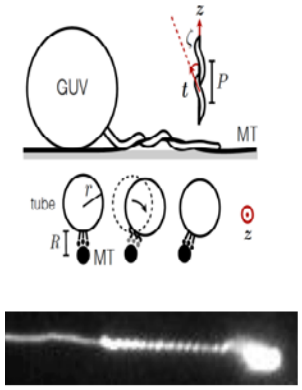
- Temàtiques: problemes de dinàmica no lineal, inestabilitats i formació de patrons en sistemes biològics i en fluids.
- Metodologies: experiments, teoria i simulacions numèriques.

- Finançament: 3 projectes MINECO, 1 Starting Grant de l'ERC (Pietro Tierno), 2 projectes internacionals
- Publicacions 2009-13: Nature Materials, Nature Physics, PNAS, Phys. Rev. Lett., Europhys. Lett., PLoS One, PLoS Comput. Biol., EPJ-E, Soft Matter, Langmuir, J. American Chemical Soc., Small, Advanced Materials, Phys. Rev. E, entre d'altres

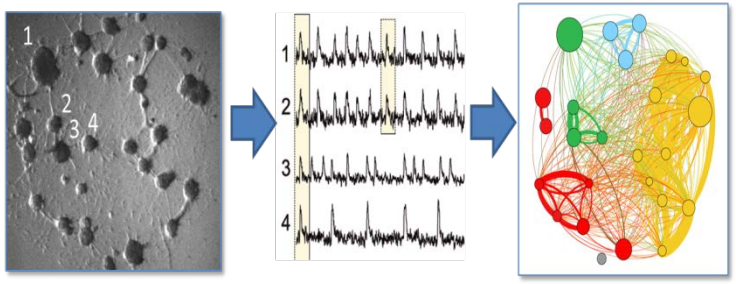
Exemples d'investigacions a escales nanomètriques:



Estudi numèric d'anomalies en el transport i difusió de partícules Brownianes en potencials desordenats: subtransport, subdifusió i superdifusió
José M. Sancho



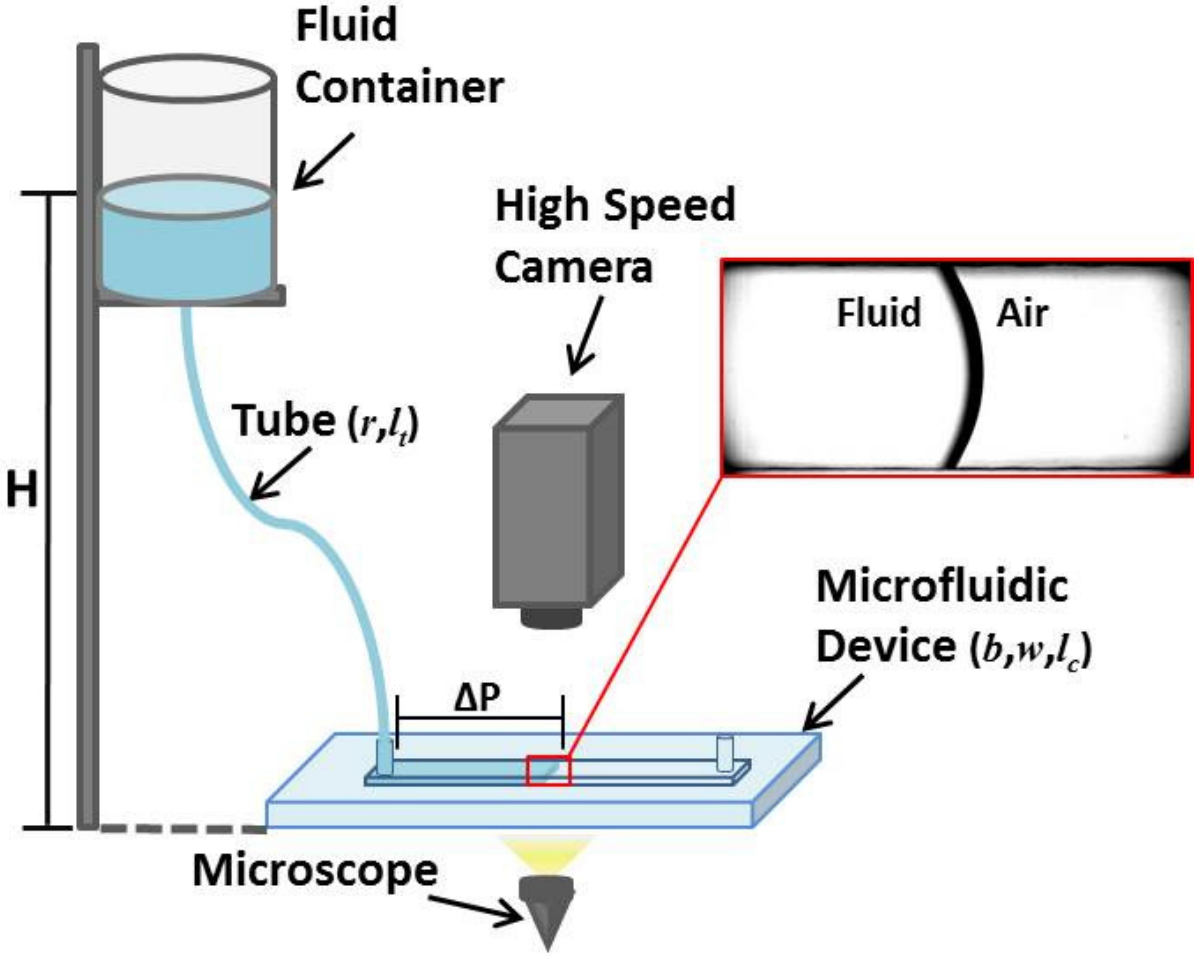
Formació de nanotubs helicoïdals, com a resultat de l'enrotllament de nanotubs de biomembranes al llarg de microtúbuls per part de motors moleculars cooperatius (kinesina KIF1A)
Jaume Casademunt



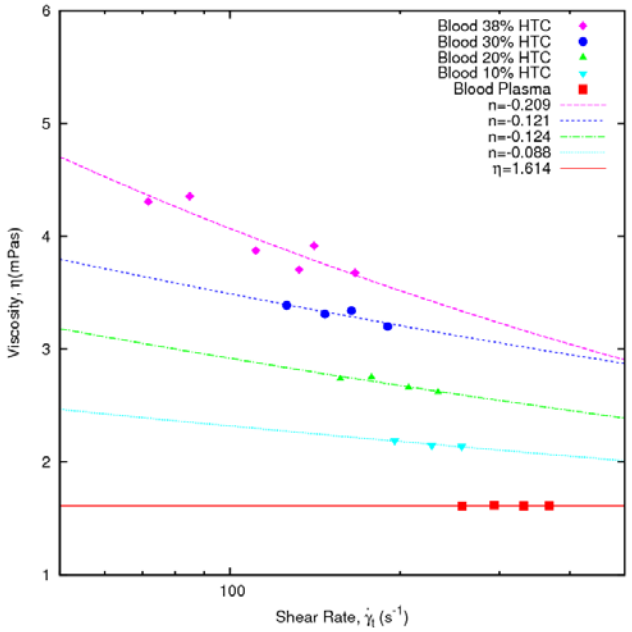
Xarxes neuronals en cultiu. Estudis de resistència a dany mitjançant microcirurgia làser
Jordi Soriano

A. Hernandez-Machado et al. (2015)

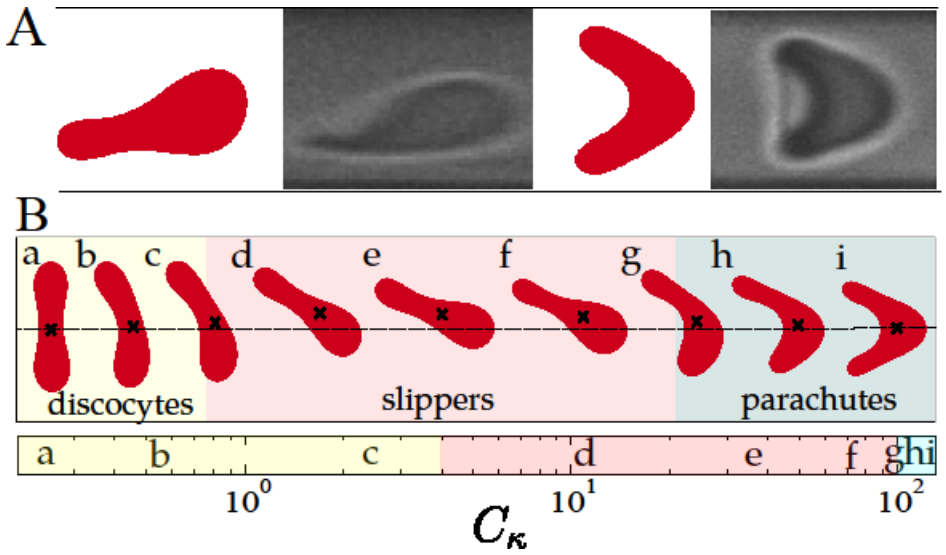
Front Microrheology: Nonlinear Viscosity of Blood



Nonlinear Viscosity



Red blood morphologies

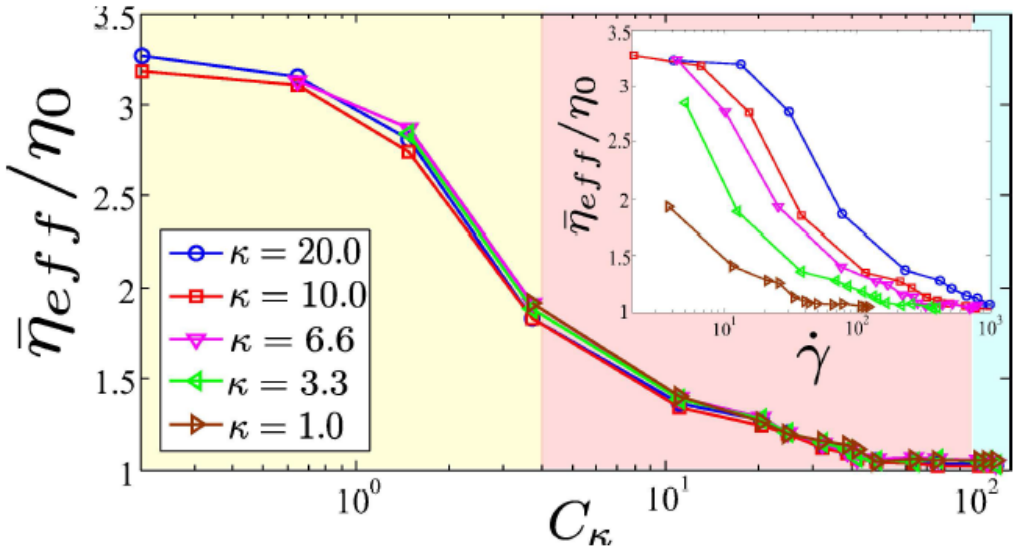


Effective viscosity of Red Blood Cells

$$C_\kappa = \frac{\eta v a^2}{\kappa}\frac{a}{b}$$

Capillary number increases by increasing velocity

$$\eta_{eff} = \frac{f}{12v}b^2$$



Magnetic Soft-Matter Group

Membres del grup

The group focuses on **soft condensed matter** systems with special emphasis on colloidal matter

Members

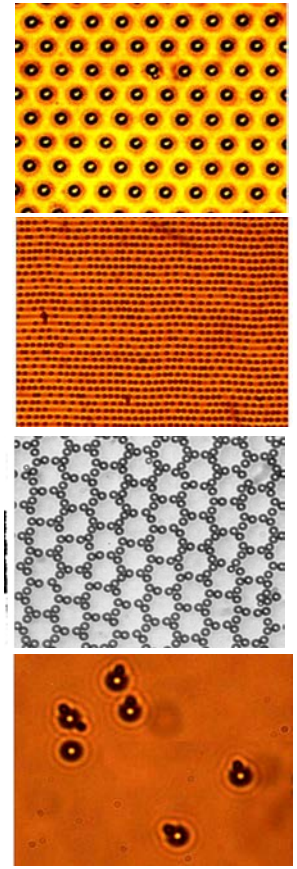
PI: Dr. Pietro tierno (RyC)
Postdocs: Fernando Martinez-Pedreo
Antonio Ortiz-Ambriz
PhDs: Ricard Alert Zenon
Johannes Loehr

Techniques and infrastructurs

-Optical microscopy
(brighfield, fluorescent, polarization etc....)
-Laser systems
(optical tweezers, SLM, AOD etc...)
-Magnetic field manipulations
(Magnetic coils,power amplifiers, etc..)
-2 laboratories, Dept. ECM

Research lines

-Transport and assembly of colloids via external fields
- Synthesis and characterization of magnetic colloids
- Self-assembly processes
-Propulsion in micro and nanoscale systems
-Thin magnetic films
- Nanotribology
-Microfluidics
-Critical phenomena
-Field-Induced Phase Transitions
-Frustrated magnetic systems
-Hydrodynamics



Financial support

erc
European Commission
AGAUR Agència de Gestió d'Ajuts Universitaris i de Recerca
GOBIERNO DE ESPAÑA MINISTERIO DE ECONOMIA Y COMPETITIVIDAD

Conformational diseases group

Research Group Introduction

The group of Conformational Diseases from University of Barcelona focuses its research in the **screening of new potential drugs for the treatment and prevention of conformational diseases.**

In the last years our research group has developed ***new fast, simple, and inexpensive methods to screen potential amyloid aggregation inhibitors.***

The objectives of research are:

- Providing the screening service of drugs and other substances of interest to pharmaceutical, food and livestock industries and international research groups.
- Discovering, research and develop substances to treat neurodegenerative diseases and conformational diseases.
- Development of new screening methods to check anti-aggregation drugs.

Conformational diseases, linked to protein aggregation into amyloid conformations
Alzheimer disease (AD)
Parkinson disease (PD)
Huntington disease (HD)
Frontotemporal dementia (FTD)
Amyotrophic lateral sclerosis (ALS)
Human transmissible sporadic encephalopathies (TSEs)
Light-chain (AL) amyloidosis
Type II diabetes

Team

- Dr. Raimon Sabaté (Principal investigator)
- Dra. Alba Espargaró (Researcher)

Industrial Sectors

Pharmaceutical / Healthcare

Biotechnology / Human and Animal Functional Food

Services offered

Screening of drug candidates, complementing the classical approach with physical results such as binding analysis and X-Ray diffraction.

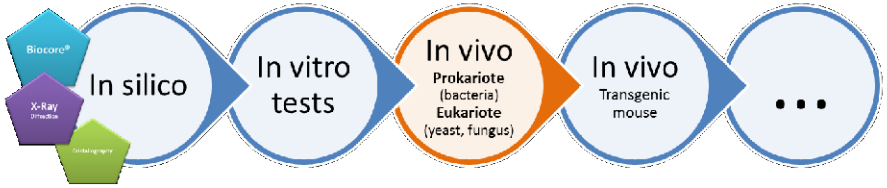
- Rational design of anti-amyloid compounds and early stage drug discovery.
- Screening and isolation for new anti-amyloid drugs: In-silico, in-vitro and in-vivo detection.
- Target identification and determining the mechanism of action.
- Drug delivery. Nano-particles (Liposomes and microencapsulation)

Results are complemented with a complete analysis of the inhibitor-protein complex, determining the binding constants (Biacore®) and the putative interaction mechanisms (by crystallography and X-ray diffraction if is required).

Reliable and Economic in vivo results in just 2 weeks.

Using both prokaryote and eukaryote models (bacteria or yeast and fungus), that allow to obtain reliable results saving time and money compared to in-vivo in transgenic studies.

Our exclusive methods allow our clients to obtain results in less than two weeks and reduce the number of the potential drugs to be tested in transgenic animals.



Activity of Research and More Relevant Related Publications

The research profile of the group, essentially focused on the study of amyloid aggregation and conformational diseases, stands out for over 60 publications in the last years.

- Pérez-Areales FJ, et al. ***Shogaol****-huprine hybrids: Dual antioxidant and anticholinesterase agents with β-amyloid and tau anti-aggregating properties.* Bioorg Med Chem. 2014 Oct 1;22(19):5298-307.
- Di Pietro O, et. al. ***Tetrahydrobenzo[h][1,6]naphthyridine-6-chlorotacrine hybrids as a new family of anti-****Alzheimer agents targeting β-amyloid, tau, and cholinesterase pathologies.* Eur J Med Chem. 2014 Sep 12;84:107-17.
- Viayna E, et. al. ***Synthesis and multi-target biological profiling of a novel family of rhein derivatives as disease-modifying anti-Alzheimer agents.*** J Med Chem. 2014, Mar 27;57(6):2549-67.
- Villar-Piqué A, et. al. ***Screening for Amyloid Aggregation: In-Silico, In-Vitro and In-Vivo Detection.*** Curr Protein Pept Sci. 2014, Feb 20.
- Viayna E, et. al. ***Dual inhibitors of β-amyloid aggregation and acetylcholinesterase as multi-target anti-Alzheimer drug candidates.*** Curr Top Med Chem. 2013;13(15):1820-42.
- Espargaró A, et. al. ***Thioflavin-S staining coupled to flow cytometry. A screening tool to detect in vivo protein aggregation.*** Mol Biosyst. 2012 Nov;8(11):2839-44.
- Villar-Piqué A, et. al. ***Using bacterial inclusion bodies to screen for amyloid aggregation inhibitors.*** Microb Cell Fact. 2012;11:55.
- Tribouillard-Tanvier D, et. al. ***Protein folding activity of ribosomal RNA is a selective target of two unrelated antiprion drugs.*** PLoS One. 2008 May 14;3(5):e2174.

Transfer activities

In the last 3 years, the research group has maintained close collaboration with different national and international research groups in the isolation and design of new anti-amyloid drugs. This intensive research has recently attracted the attention of several international companies such as NeuroScios (NEU), Siena Biotech (SIE) or Rare Partners.

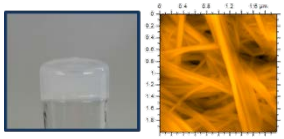
Location

University of Barcelona. Department of Physical Chemistry,

Sistemes Supramoleculars en Nanobiomedicina

Objectius: Drug delivery/Nanosensors

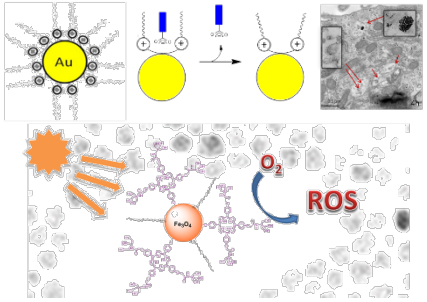
- Vehicles per teràpia i PDT
- Etiquetatge extracel·lular
- Sensors intracel·lulars
- "Molecular walkers"
- Estudis d'interacció "host-guest"
- Dissolució o superfície



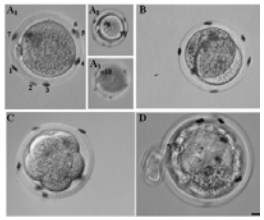
J. Mater. Chem. B, 2014, **2**, 5419–5429

Metodologia: Nanomaterials Híbrids

- Síntesi i "self-assembly"
  - Molècules funcionals
  - AuNPs
  - IONPs
  - SAMs
    - Dissolució
    - "Pen lithography"



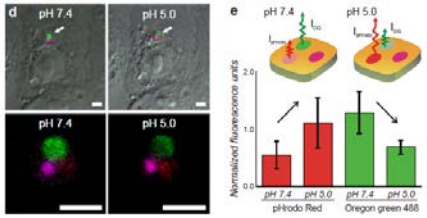
Langmuir, 2012, **28**, 2368–2381
J. Colloid Interface Sci., 2016, **462**, 154–165



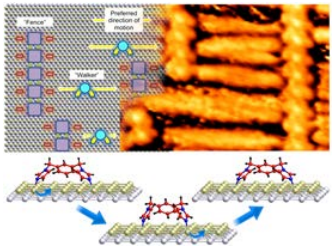
Bioconjug. Chem., 2012, **23**, 2392–2402

Caracterització: Dissolució/Superfícies

- RMN, IR, UV-vis
- XPS, TGA
- TEM, STM, AFM
- Microscòpia òptica de fluorescència
- Goniometria (angle de contacte)



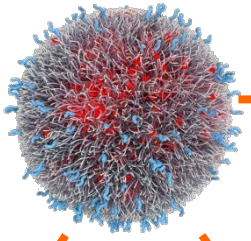
Adv. Mater., 2015, DOI: 10.1002/adma.201504164



Angew. Chemie Int. Ed., 2015, **54**, 7101–7105

Internalització de nanovesícules i nanopartícules

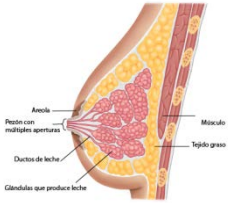
Morfologia, agregació i aglomeració en medis fisiològics.
Protein corona

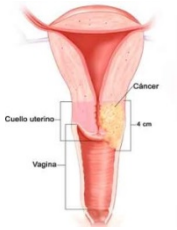


Interferències amb els assajos cel·lulars clàssics?

Aplicacions biomèdiques

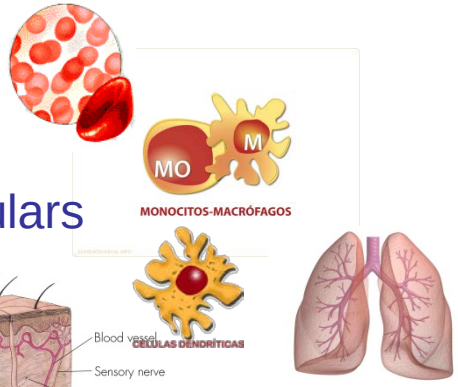
- Línees cel·lulars

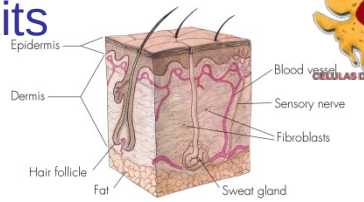




Efectes tòxics

- Línees cel·lulars
- Teixits





- Citotoxicitat (MTT, NRU, LDH), apoptosi, cicle cel·lular, mediadors inflamació (ELISA) y expressió de molècules de superfície (citometria).
- Genotoxicitat (Comet assay).
- Alteracions morfològiques: microscòpia òptica, TEM.
- Avaluació de l'estrès oxidatiu.
- Alteracions proteiques: coagulació, SDS-PAGE

UNIVERSITAT DE BARCELONA

Genómica, proteòmica i metabolisme vegetal

INSTITUT DE NANOCIÈNCIA I NANOTECNOLOGIA

MOLÈCULES:
ALCALOIDES i altres metabòlits secundaris
Col·laboracions:
UKZN (Sudàfrica), UDEA, UNICAUCA, (Colombia), UCR, CIPRONA (Costa Rica), UNAM (Mèxic), UFES, UFRGS, UFRN (Brasil), USJ (Argentina), ESPOCH (Equador) etc

ACTIVITATS BIO/FARMACOLÒGIQUES:
Inhibició AChE (Alzheimer), Antriprotozoaris (malaria, leishmania, tripanosomiasis, trichomonas), Apoptosi
Col·laboracions: STI (Suïssa), UFRGS (Brasil), PU (Rep. Checa), McMU (Canadà), NCI (USA)

ALTRES TEMES:
DOCKING
AChEI, GSK-3β
Col.laboracions:
UB, UFES (Brasil)

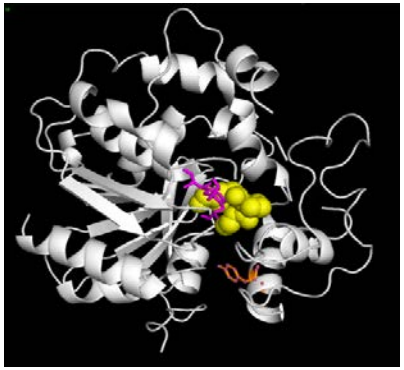
CARACTERITZACIÓ ESTRUCTURAL DE MOLÈCULES ORGÀNIQUES D'ORIGEN VEGETAL

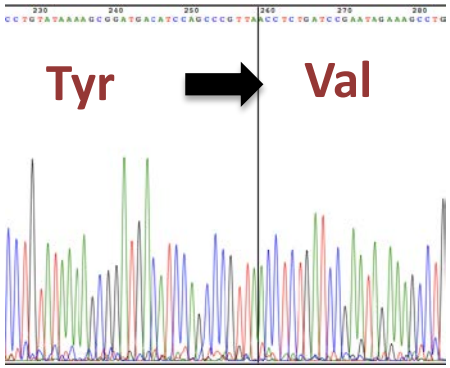
TÈCNIQUES MÉS EMPRADES:
GC-MS; LC-SPE-RMN; RMN (1D i 2D), MS, HRMS, CD, αD, IR, UV, raigs X
Col·laboracions: UFES (Brasil)

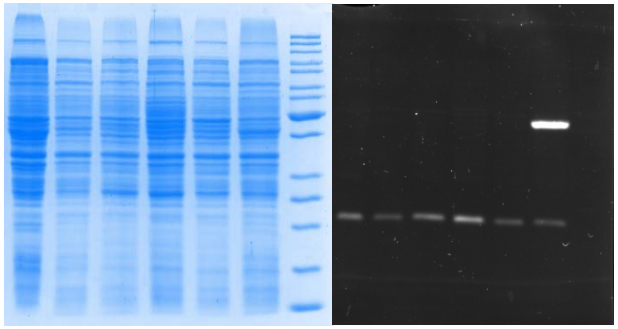
ALTRES TÈCNIQUES:
Micropropagació (*in vitro*) de plantes (bulboses) en risc d'extinció
Col·laboracions: ABI (Bulgaria)

GRUP 2014SGR928 - Jaume Bastida, Francesc Viladomat, Antoni Fernández, Laura Torras

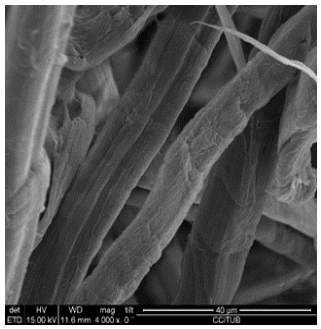
Aïllament, clonació i millora d'enzims microbians per a les indústries farmacèutica o paperera



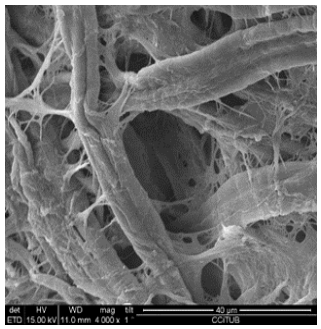




Personal: F. I. Javier Pastor, Pilar Diaz, Josefina Martínez, Susana Valenzuela



Control cel·lulosa

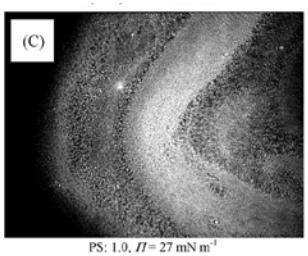


cel·lulosa + Cel6D

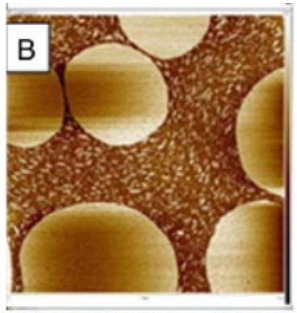
Know How **en:**

- Estudis amb microorganismes
- Manipulació de l'ADN
- Enginyeria de proteïnes
- Valorització de la biomassa
- Biocatàlisi aplicada a química fina
- Biotecnologia paperera
- Producció de biocombustibles

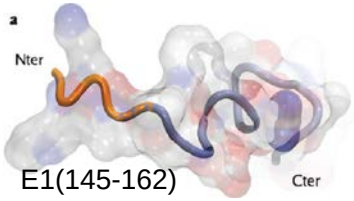
Biointerfícies



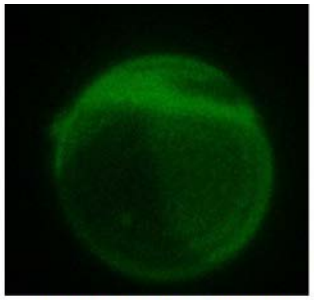
PS: 1.0, Π= 27 mN m^{-1}



DPPC/DPPG (2:1)+ E1P8 5%

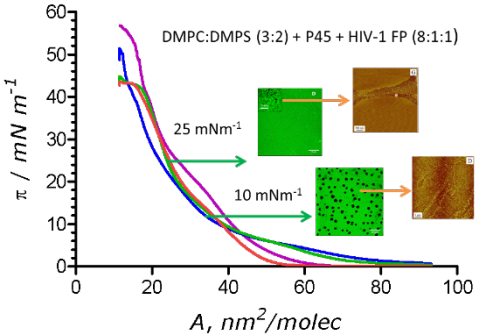


E1(145-162)


DOPC/DOPS (3:2)/SM/Chol 20/40/40

(2014 *SGR 216: Péptids i proteïnes: aspectes fisicoquímics*)
Contacte: Montserrat Pujol (mopujol@ub.edu)

Projecte actiu: *Estudio de interacción de péptidos sintèticos del virus GBV-C con capacidad de inhibición del PF HIV-1 en sistemes péptido/péptido y lípido/péptido a escala nanométrica*



Tècniques: Obtenció i caracterització de monocapes de Langmuir i Langmuir-Blodgett. Obtenció i caracterització de liposomes gegants (GUVs), Potencial de superfície, Espectroscòpia de fluorescència, microscòpia d'angle de Brewster (BAM), microscòpia de forces atòmiques (AFM), microscòpia de fluorescència (FM), calorimetria diferencial (DSC).

Equips en el seu laboratori: Balances de Langmuir amb dipper, potencial de superfície i *microBAM*. Espectrefluorímetres, (*binding, quenching, anisotropia, FRET, potencial de membrana etc*.), aparell d'ultrasons en sec, struder i ministruder per a obtenir liposomes (MLVs, SUVs, LUVs).

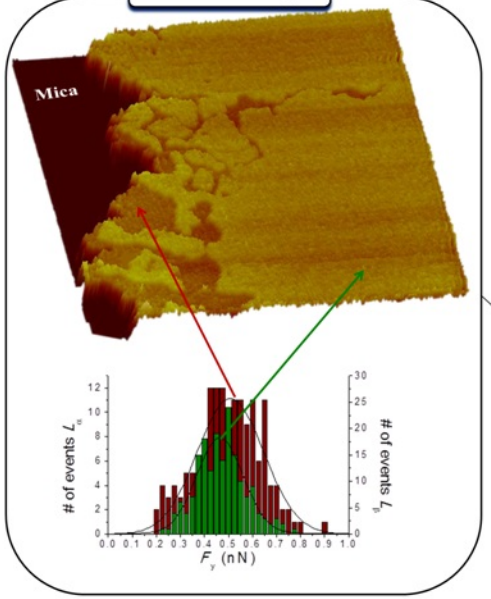
Publicacions recents: J Miñones Jr et al. *Langmuir,* DOI: 10.1021/acslangmuir.sb00712 R. Galatola et al. *BBA* **1848** (2015) 392–407.. Alba Ortiz et al. *Colloids and Surfaces A: Physicochem. Eng. Aspects* **480** (2015) 184–190 Domènech, O. Et al. *BBA-Biomembranes* (2014) **1838**:1274-1280. Ramona Galatola et al. *European Journal of Medicinal Chemistry*. (2014) **86**: 589-604. M. Alay et al. *Colloids and Surfaces B: Biointerfaces.* (2013) **105:** 7-13.

Nanoestructura de Biomembranes

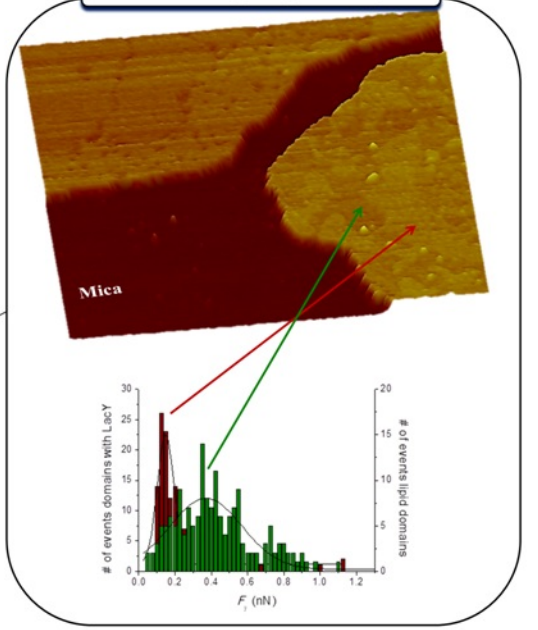
UNIVERSITAT DE BARCELONA

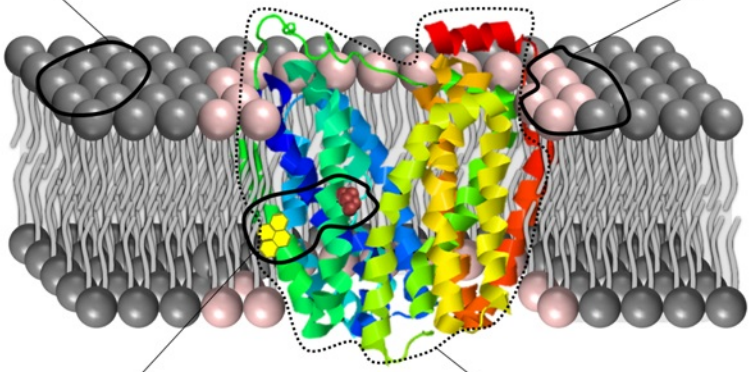
INSTITUT DE NANOCIÈNCIA I NANOTECNOLOGIA

Nanomechanics of lipids

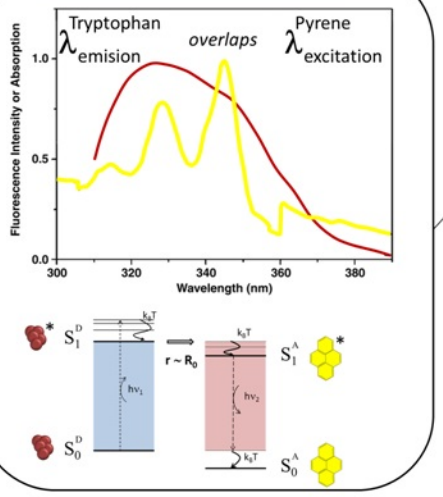


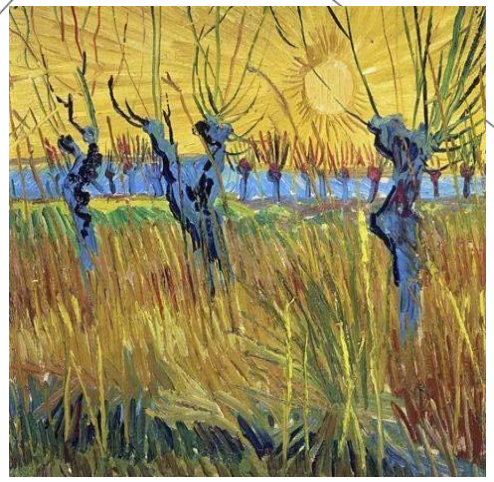
Nanomechanics of lipids in presence of protein



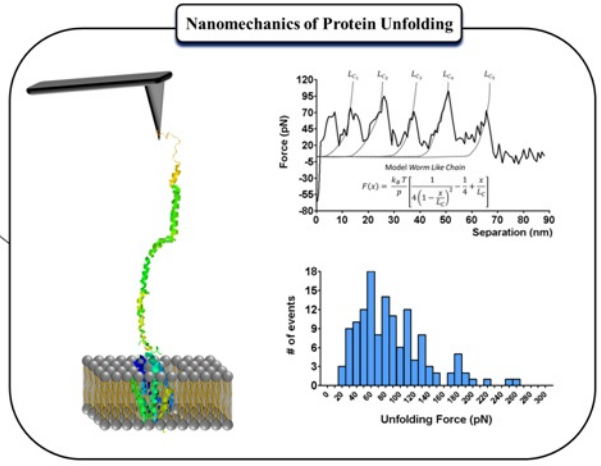


Fluoresence Ressonance Energy Transfer





Nanomechanics of Protein Unfolding

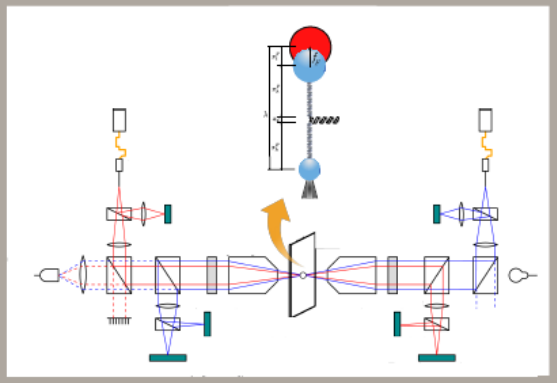


Small BioSystems Lab

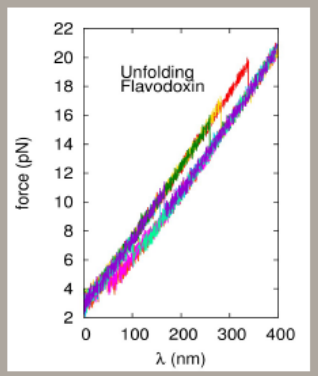
IP: F. Ritort

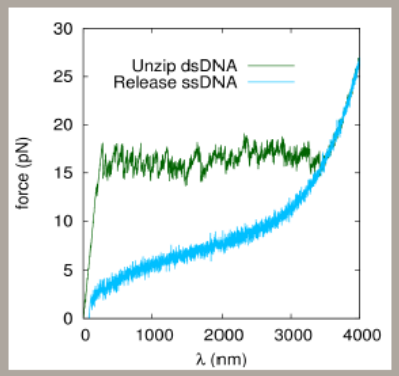
Utilitzant les **pinces òptiques** podem estudiar:

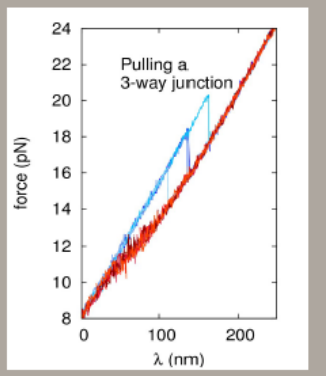
Pinces òptiques



Termodinàmica de proteïnes, d'ADN i de RNA

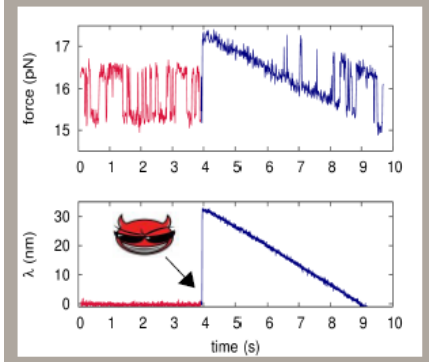




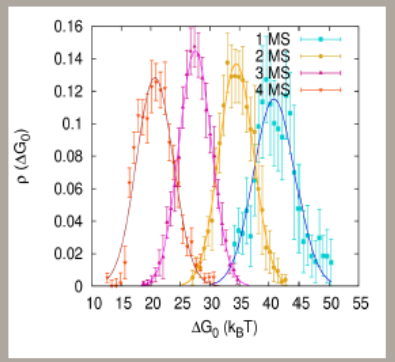


Termodinàmica de la informació

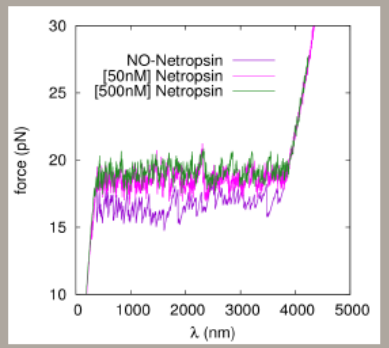
Dimoni de Maxwell



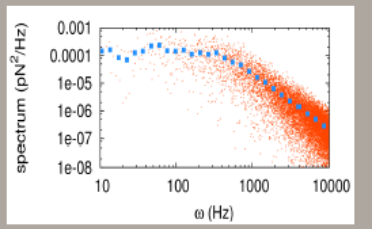
Heterogeneïtat



Interacció lligant-ADN



Cel·lular



Fisiologia dels aneurismes d'aorta en malalties Genètiques del teixit conjuntiu: síndrome de Marfan (IDIBAPS)


Gustavo Egea


Thayna Meirelles

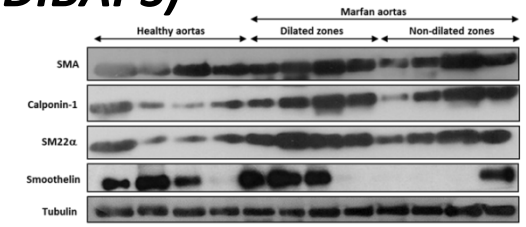

Darya Gorbenko

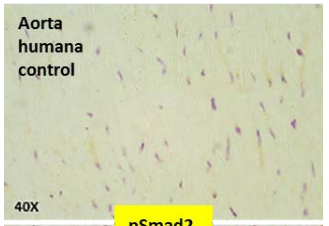

Júlia López


Annemie Siegert

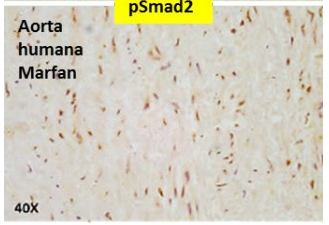

Carla Serra


Laura Barbera

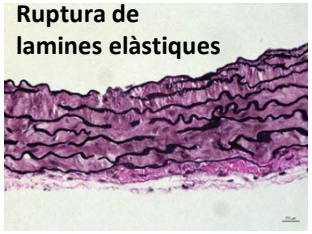


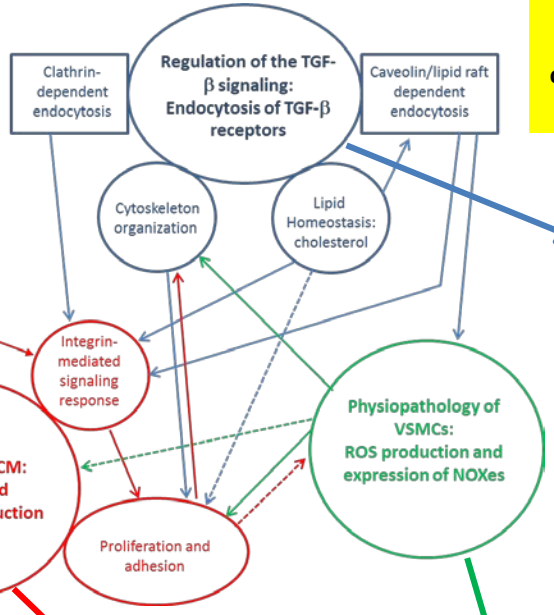


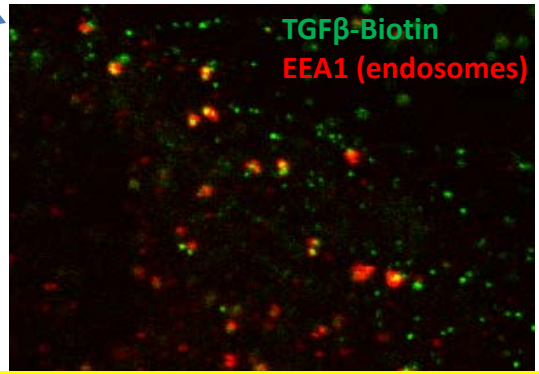
pSmad2



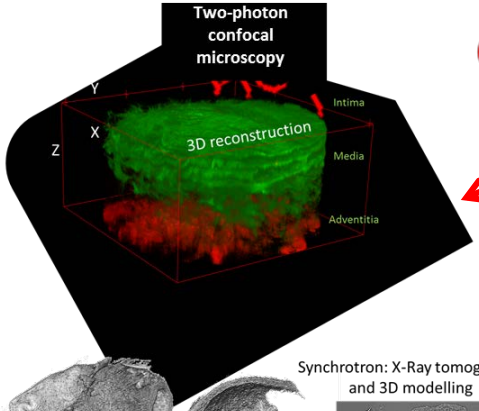
Cell signaling and differentiation of vascular smooth muscle cells

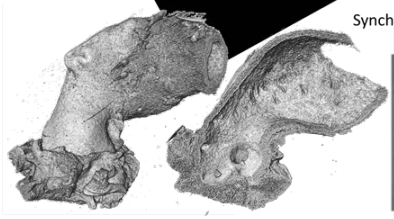




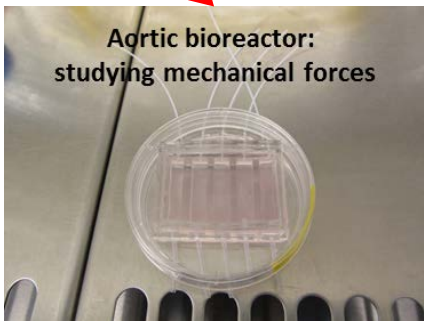


Membrane trafficking of TGF-β-TGF-β receptors

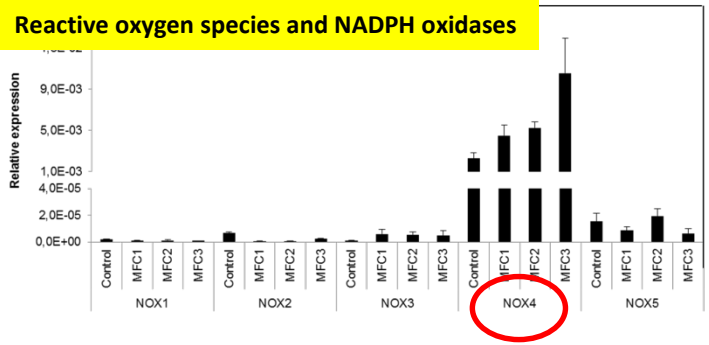




3D modeling of injuried aortic tissue architecture



Reactive oxygen species and NADPH oxidases

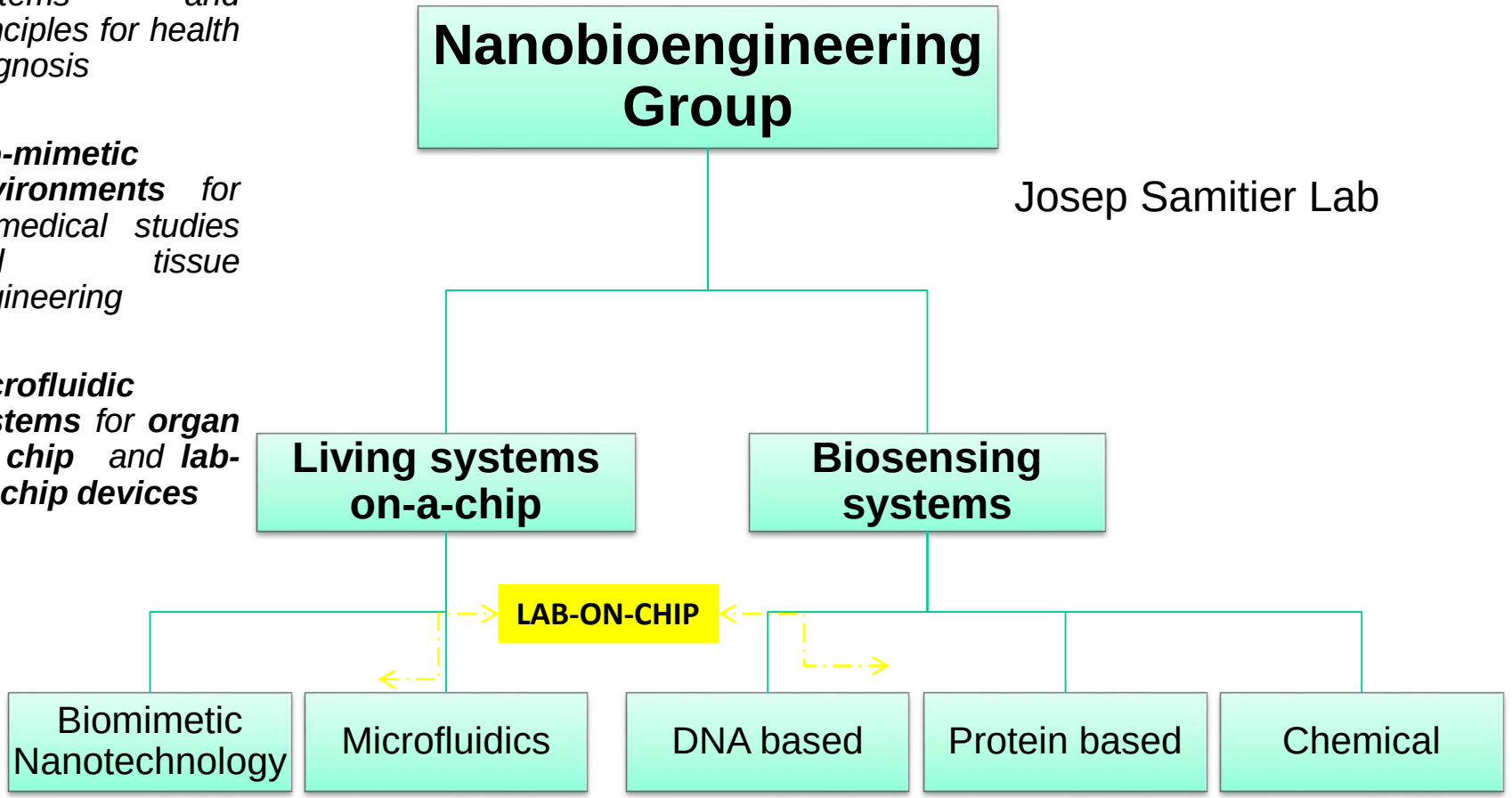


Research lines

OBJECTIVES: UNDERSTAND AND CONTROL THE PHENOMENA INVOLVED ON CELLULAR AND MOLECULAR MANIPULATION BY DEVELOPING INSTRUMENTATION BASED ON MICROSYSTEMS AND NANOFABRICATION TECHNIQUES.

IMPROVE BIOLOGICAL INFORMATION DETECTION AT MOLECULAR LEVEL FOR BIOMEDICAL APPLICATIONS.

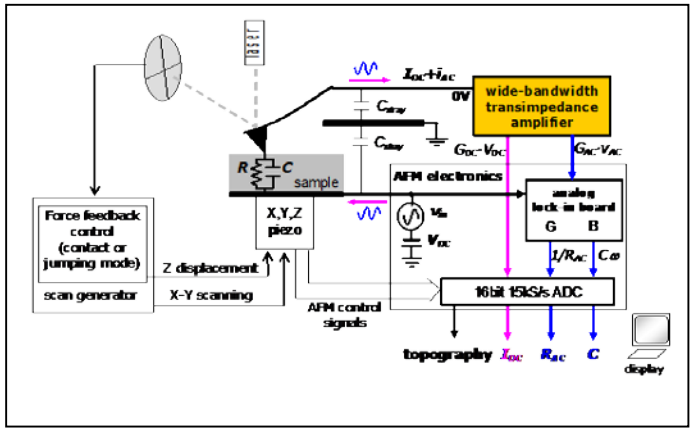
1. *New **biosensors** systems and principles for health diagnosis*
2. ***Bio-mimetic environments** for biomedical studies and tissue engineering*
3. ***Microfluidic systems** for **organ on chip** and **lab-on-chip devices***



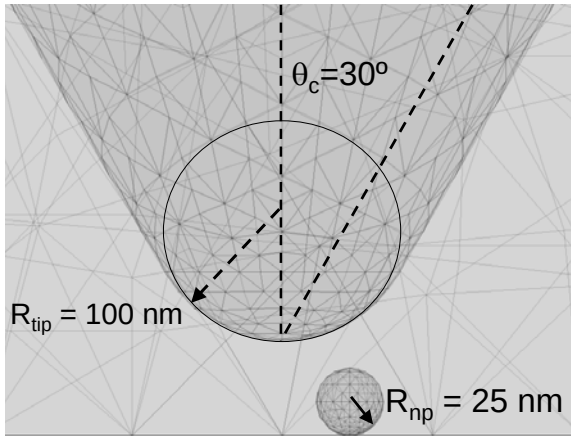
RESEARCH FOCUS OF THE NANOBIOELEC GROUP

(i) Development of experimental set ups based on Atomic Force Microscopy and of Theoretical models to measure the **electrical properties of biological samples at the nanoscale** (e.g. biomolecules, viruses and single cells)

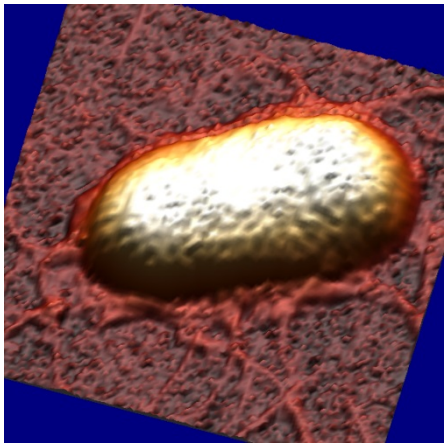
(ii) To use the developed technologies to assist in the development of new label free biological characterization methods and of new hybrid bioelectronic devices.



Instrumentation development



Theoretical modeling

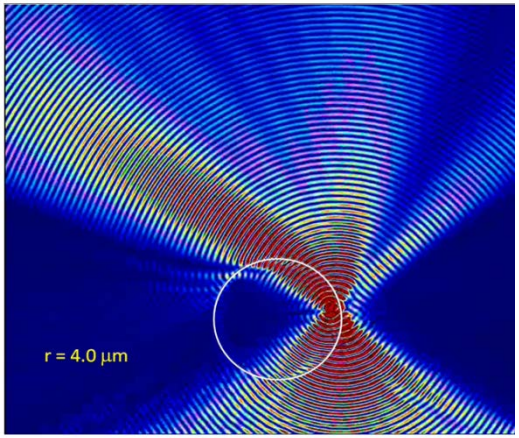


Bioapplications

Optical Traping Lab

Biopt Optical Trapping Lab
Grup de Biofotònica

IMPETUX
The Force of Light

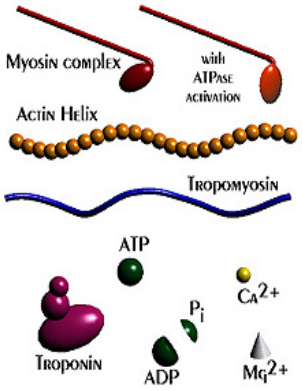


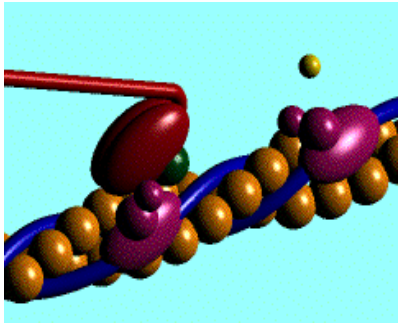
Optical tweezers *exert forces due to the momentum change of photons interacting with the sample*

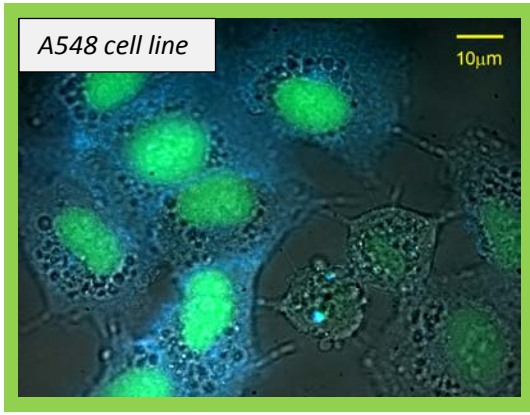
Facilities and techniques:

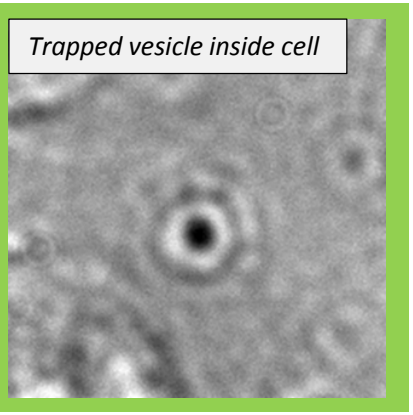
- *Bright-field, phase contrast, epi-fluorescence and DIC microscopy*
- *Optical tweezers setups for the manipulation of microscopic samples*
- *Force measurement systems*
- *Spatial light modulators and digital holography for wavefront shaping*
- *Acousto-optic devices for beam deflection*
- *Imaging: EMCCD ultrasensitive, fast cameras*
- *Sub-nm tracking of cellular components*
- *Cell culture lab (incubator, laminar flow cabinet, cryostorage, centrifuge, autoclave): cell lines NG108, PC12, CHO, A549, tobacco cells*

Force measurement technology patented and commercialized by the spinoff IMPETUX









Optical Trapping Lab – Grup de Biofotònica

http://biopt.ub.edu

UNIVERSITAT DE BARCELONA

Biopt

Estela Martín-Badosa

Mario Montes-Usategui

IMPETUX

The Force of Light

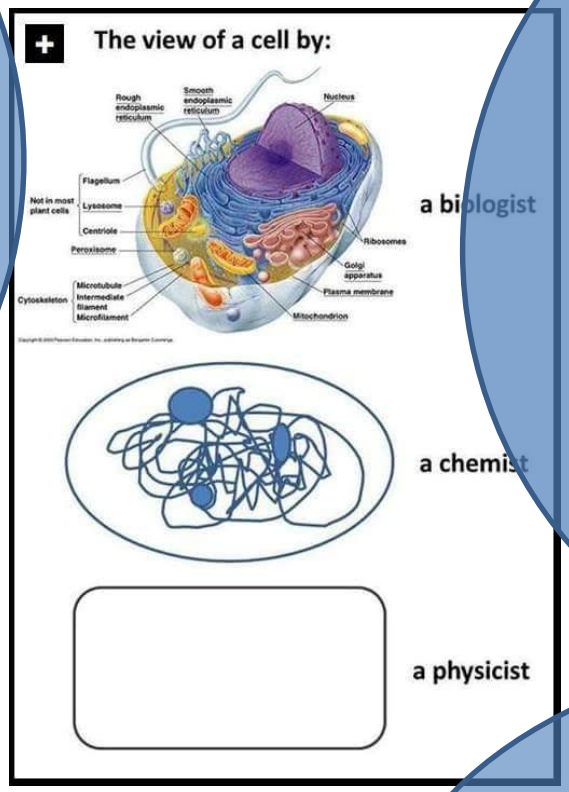
Frederic Català

Raúl Bola

Arnau Farré

Ferran Marsà

- Magnetic field manipulators
- Impressió amb làser (LIFT)
- Ablació amb làser
- Tractaments superficials
- Force measurement systems
- Spatial light modulators and digital holography for wave front shaping



- Optical Tweezers
- Force measurement systems
- TEM
- NMR, IR,UV-Vis
- GC-MS
- LC-SPE-NMR
- CD
- XPS, TGA
- TEM, STM, AFM
- Goniometria
- µBAM
- Espectrofluorimetria

- Manipulació de l'ADN
- Enginyeria de Proteïnes
- Estudis amb microorganismes
- Valoració de la biomassa
- Biocatàlisi aplicada a la Q.F.
- Biotecnologia paperera
- Producció de biocombustibles
- Sub-nm tracking of cellular components