



Biomedical Research Foundation Academy Athens

George Tsekenis

**Bionanotechnology
& Nanochemistry Laboratory**

The Biomedical Research Foundation of the Academy of Athens (BRFAA) at a glance

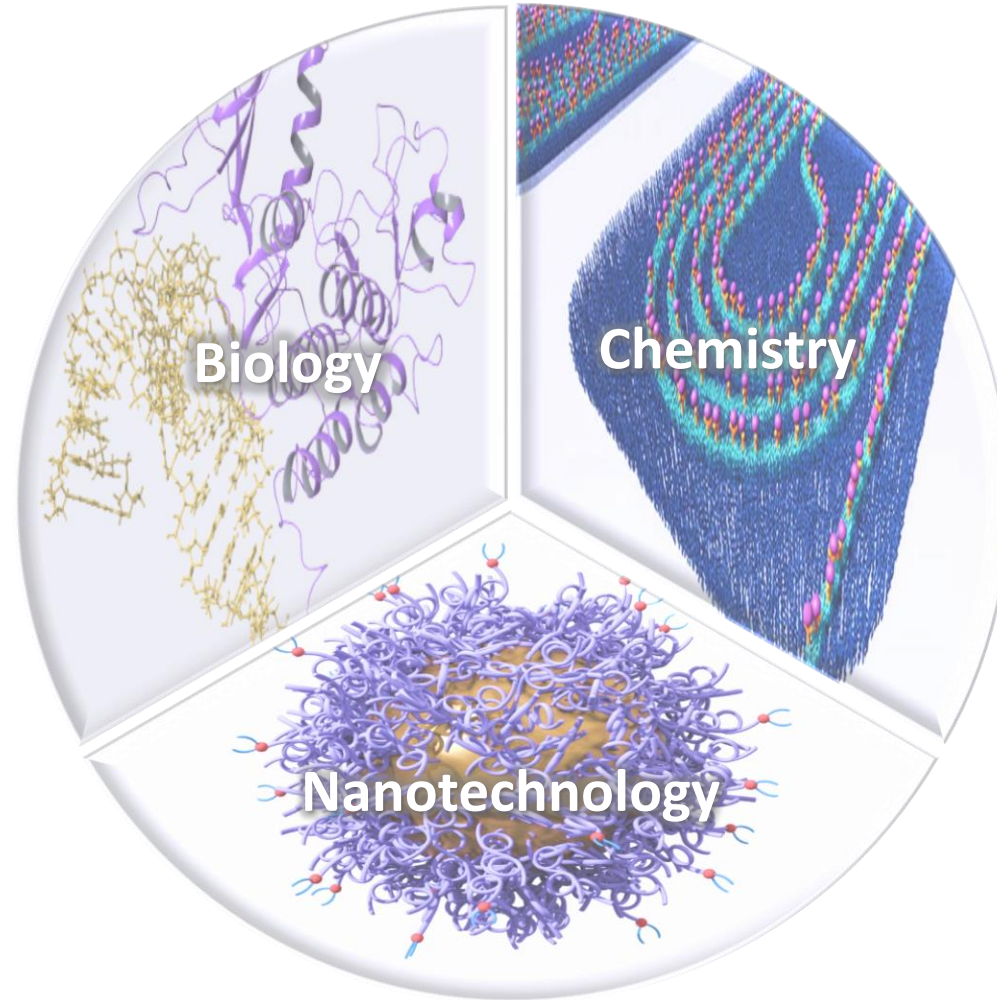


- Newest addition to the Life Sciences Research organizations in Greece (founded in 2004).
- Focus on basic research in life sciences in combination with translational activities and clinical studies.
- Houses:
 - ✓ A **Biobank** for the collection and storage of tissues, fluids and surgical specimens.
 - ✓ The **Greek Translational Medicine** infrastructure (EATRIS-GR) for Phase I clinical trials and drug Bioequivalence studies
 - ✓ The **Greek Genome Center** (Next Generation whole. genome or exome sequencing and RNA sequencing)
- New building under construction to house a Centre dedicated to **Personalized medicine and Nanotechnology**.

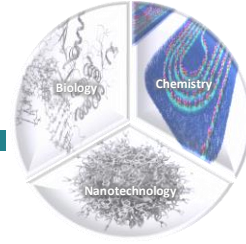


OUR LAB

BIONANOTECHNOLOGY & NANOCHEMISTRY



Functionalization chemistries

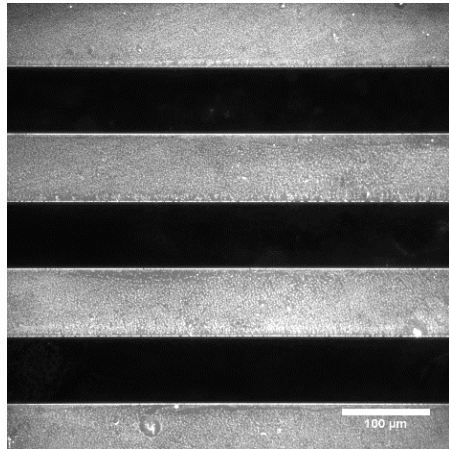
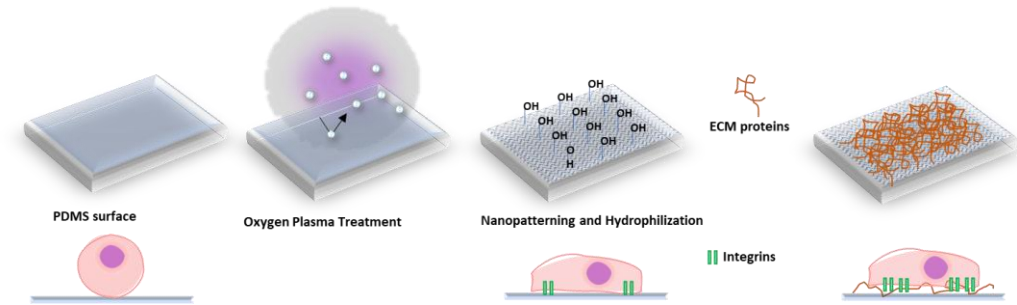


➤ Material-selective nano-coatings for biosensors

Development of photonic biosensor for the detection of cancer biomarkers in blood

- ✓ Selective functionalization of SiN waveguides only allows for significant signal enhancement.

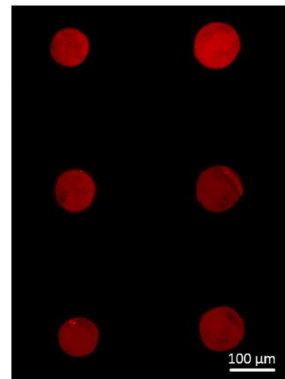
➤ Cell culturing on chemically modified and structures substrates



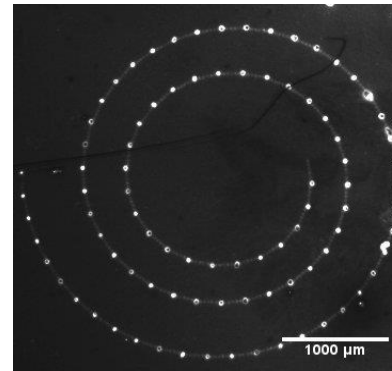
Functionalized surfaces incubated with fluorescently-tagged antibody.

<https://doi.org/10.3390/s21062230>

➤ Click chemistry-based hydrogels and polymer brushes

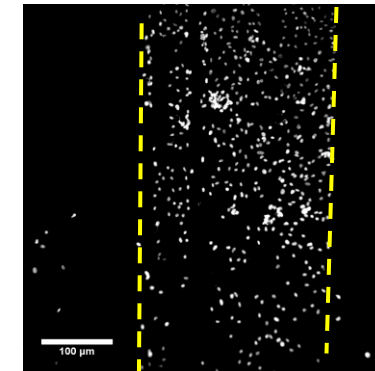


Aptamers spotted with the use of thiol-ene reactions

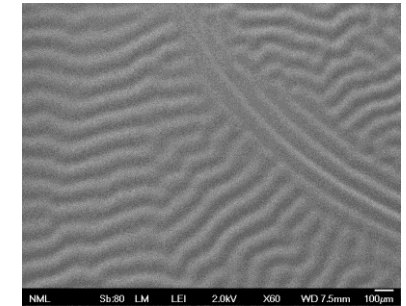


Photoinduced hydrogel formation incorporating fluorescently-tagged IgGs

<https://doi.org/10.1021/acs.langmuir.6b02860>



DAPI stained MDA-MB-231

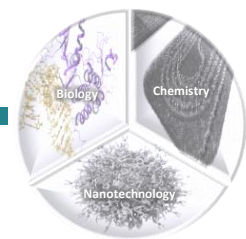


PDMS treated with sulfuric acid

Investigation into the effect of:

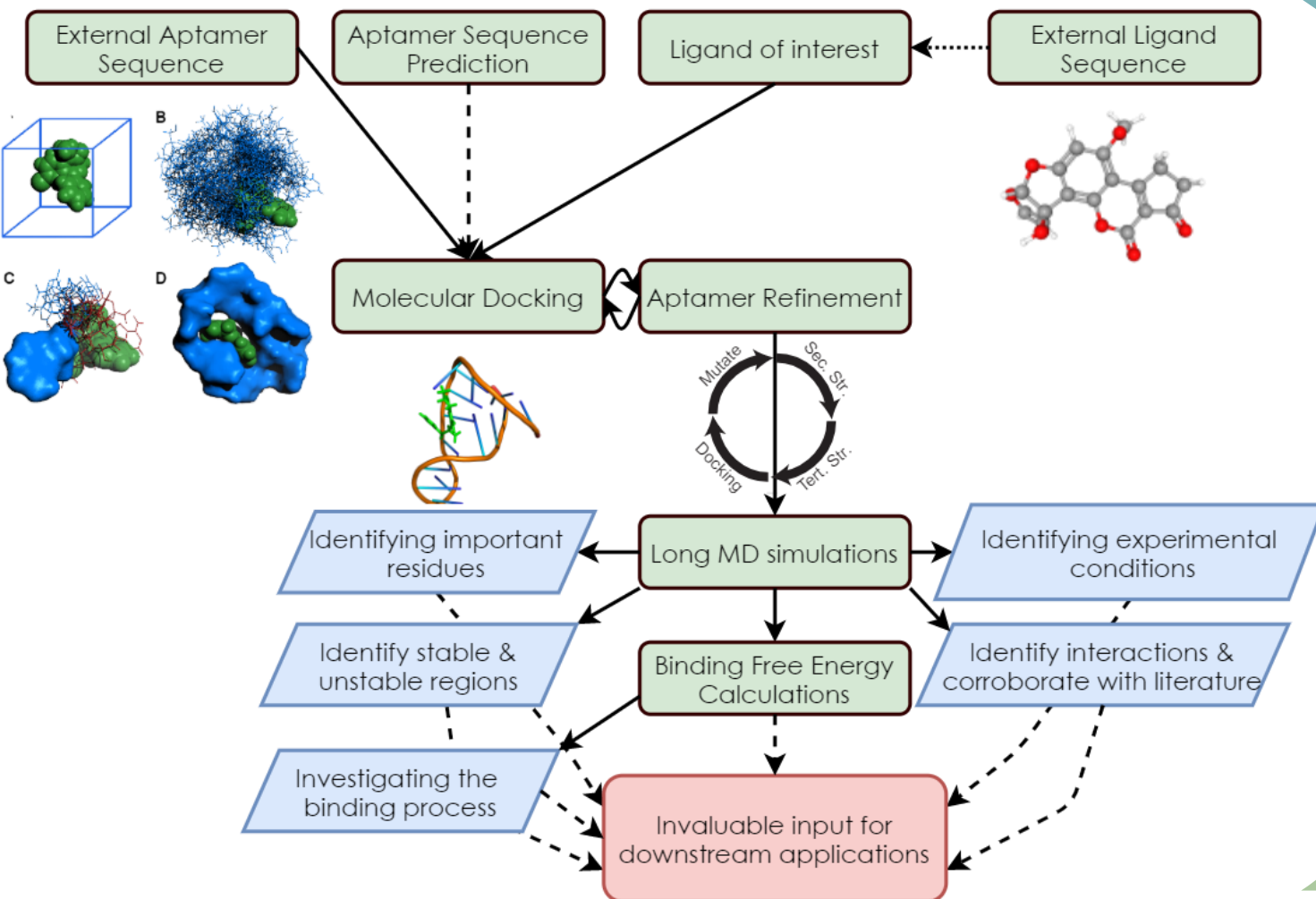
- ✓ Surface roughness
- ✓ Stiffness
- ✓ Chemistry

Biomolecular interactions – Assay development and optimization



Pipeline for MD and docking simulations

COC1=C2C3=C(C(=O)..OC5C4(C=CO5)O



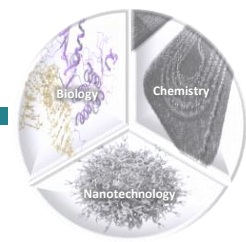
Design a putative aptamer sequence *de novo*.

Optimization of aptamer sequences using iterative optimization *in silico*.

MD simulations to extract key information pertaining to **downstream applications**.

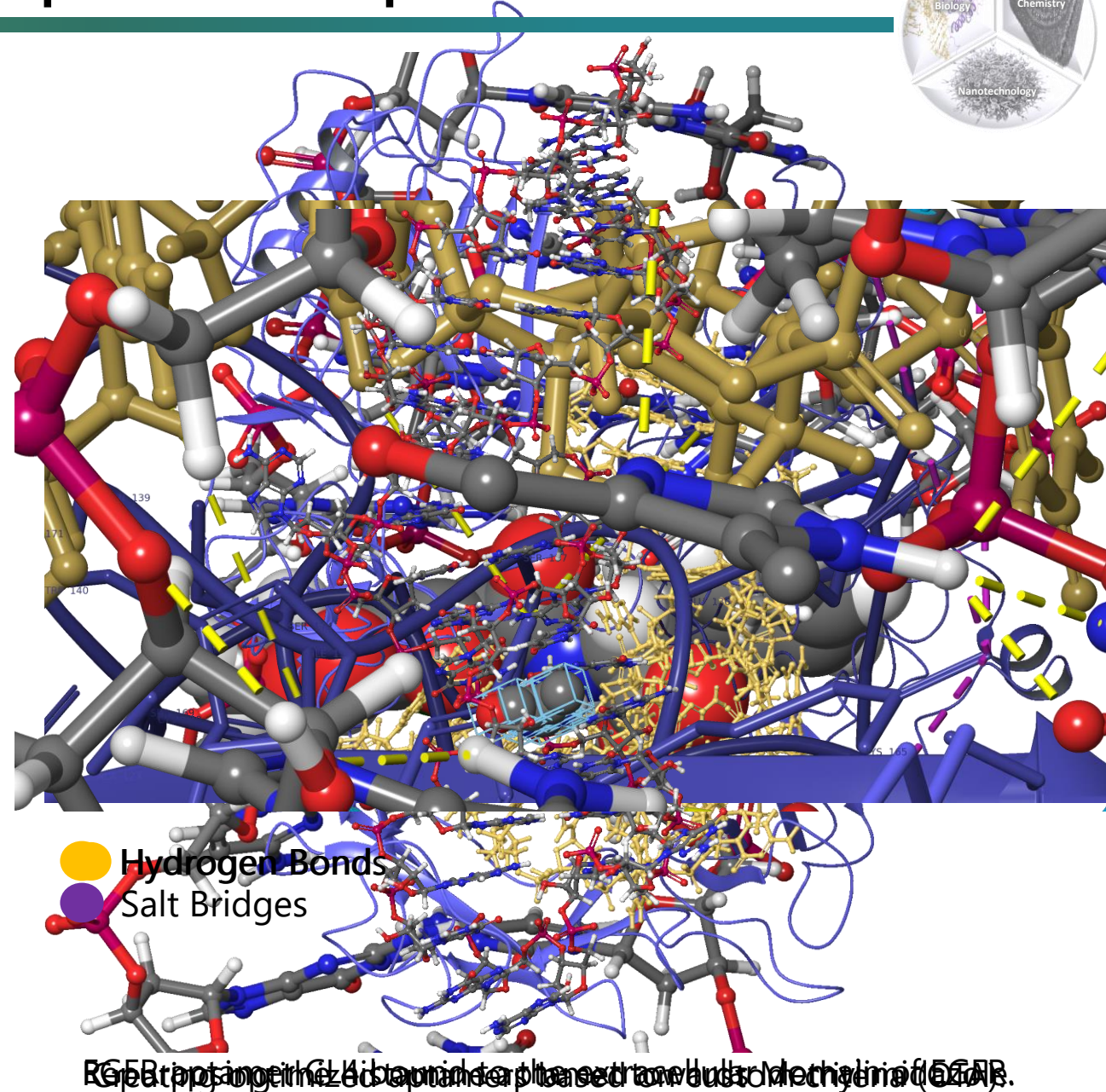
Patent application to be submitted.

Biomolecular interactions – Assay development and optimization

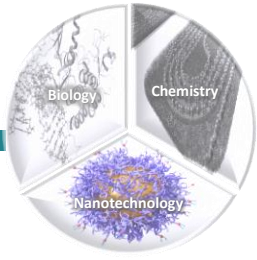


- Branching out from small molecules to proteins.
- *In silico* identification of aptamers for small molecules either through mutation of existing ones or *de novo*.
- Optimization of aptamer sequences for downstream applications (enhanced selectivity, specificity, avidity).

- ✓ **Biosensors**
- ✓ **Targeted drug delivery**
- ✓ **Theranostics**

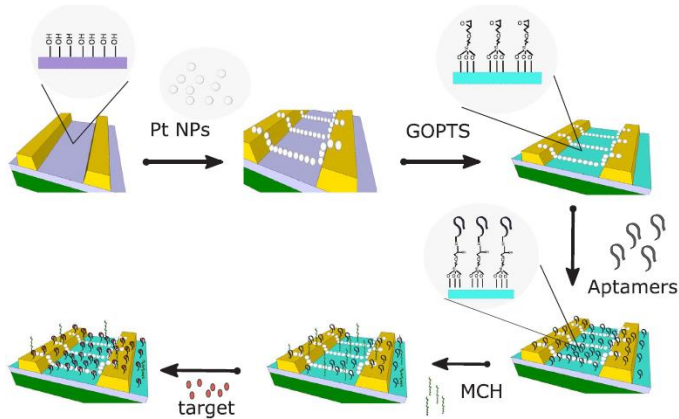


Nanotechnology - Applications



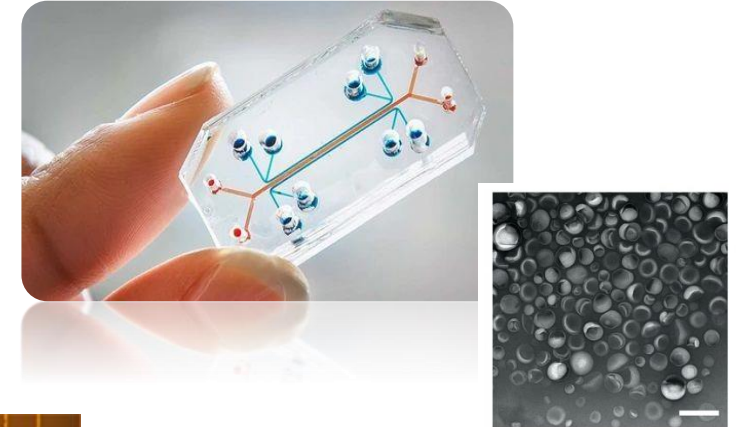
➤ Assay integration for biosensor development

Impedimetric aptasensor for the detection of pesticides based on microwires formed by platinum nanoparticles

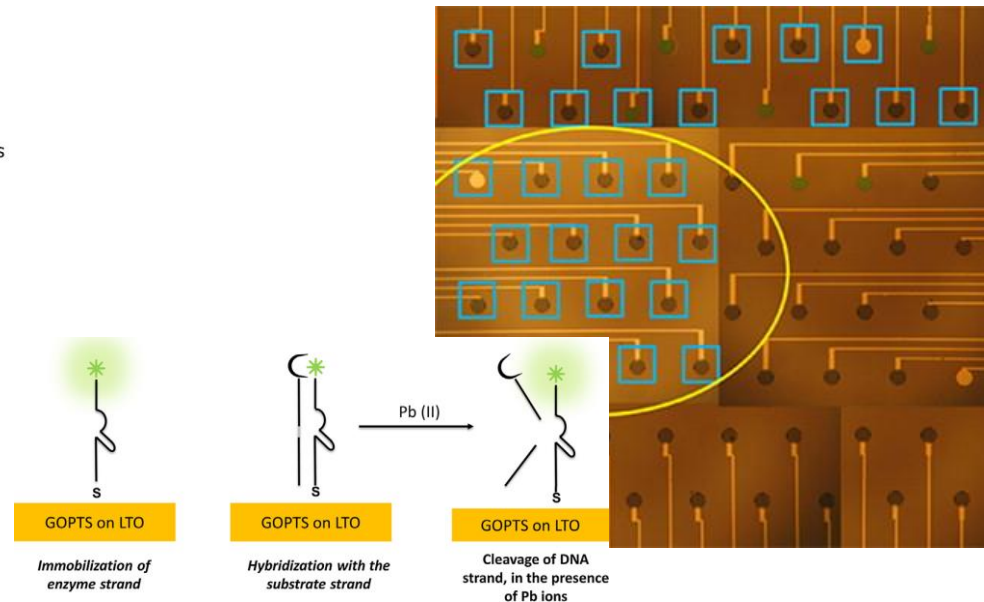


<https://doi.org/10.1016/j.bios.2017.10.034>

➤ Nanoparticle synthesis

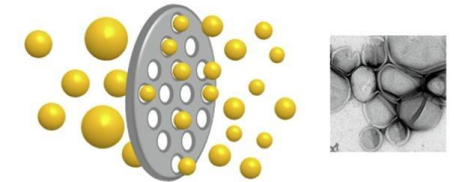


Heavy metal ion sensing with a capacitive micromechanical DNAzyme array sensor



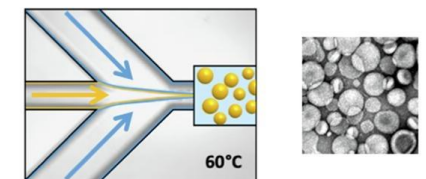
<https://doi.org/10.1016/j.snb.2014.10.093>

Thin-film method

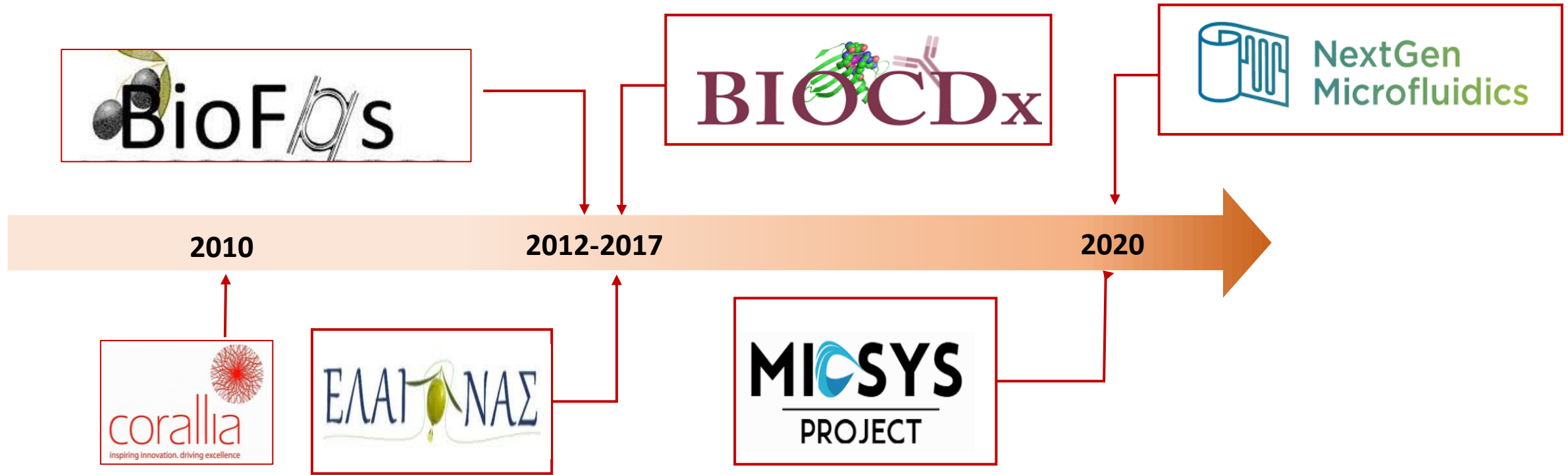
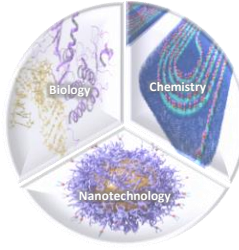


Manufacturing parameters:
Extrusion membrane pore size

Microfluidic system



Manufacturing parameters:
Viscosity, Total Flow Rate (TFR), Flow Rate Ratio (FRR)

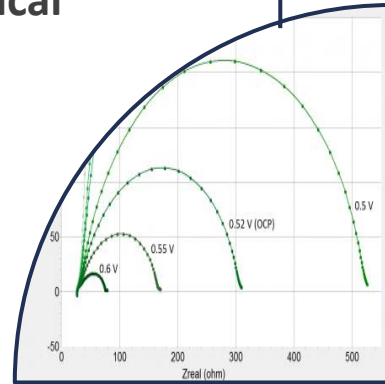


- 11 EC and Nationally funded projects in the past 10 years
- Currently numbers 8 members (3 Master's & 3 PhD students, 1 Postdoc)



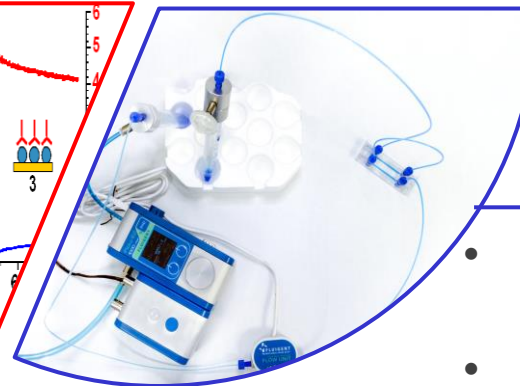
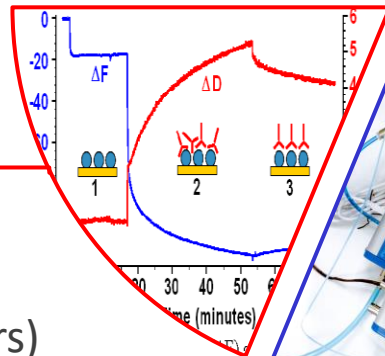
Potentiostat/Galvanostat

- Suite of **electrochemical measurements** and **characterization** techniques.
- **EIS** board



eQCM-D

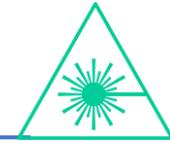
- Study of **interfacial phenomena** (sensors, supported lipid bilayers)
- Sensor integration and optimization.



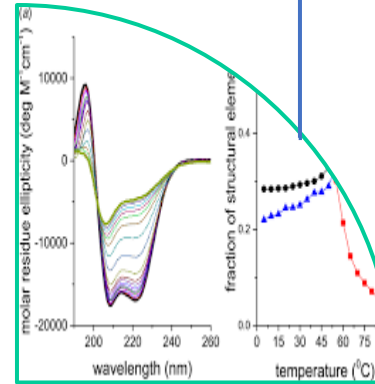
Microfluidic control

- **Flow injection analysis** for sensing applications
- **Nanoparticle synthesis**

Spectrophotometers



1. **Circular Dichroism**
 2. **Multimode 96 well plate reader**
- Study of biomolecular interactions
 - Assay development and optimization



Bionanotechnology and Nanochemistry Lab's team (most of them at least)



Collaborators



I. Zergioti
K. Kordatos
E. Skotadis
D. Tsoukalas



V. Tsikourkitoudi
G.A. Sotiriou



A. Economou



C. Charalambous
Z. Cournia
A. Klinakis
A. Papadimitropoulou



A. Tserepi
V. Tsouti
S. Chartzandroulis



M. Kanidi
M. Kandyla

Z. Chakim
L. Gkionis
D. Karadimas
N. Kalavros
N. Melios
A. Rapisis
T. Protopapadaki
D. Soulis



THANK YOU