# The Catalan Institute of Nanoscience and Nanotechnology

ICN2 Institut Català de Nanociència i Nanotecnologia

EXCELENCIA SEVERO OCHOA

Institució CERCA Centres de Recerca de Catalunya

Generalitat de Catalunya

CSIC Consejo Superior de Investigaciones Científicas

UAB Universitat Autònoma de Barcelona

# ICN2: Introduction

ICN2 Institut Català de Nanociència i Nanotecnologia

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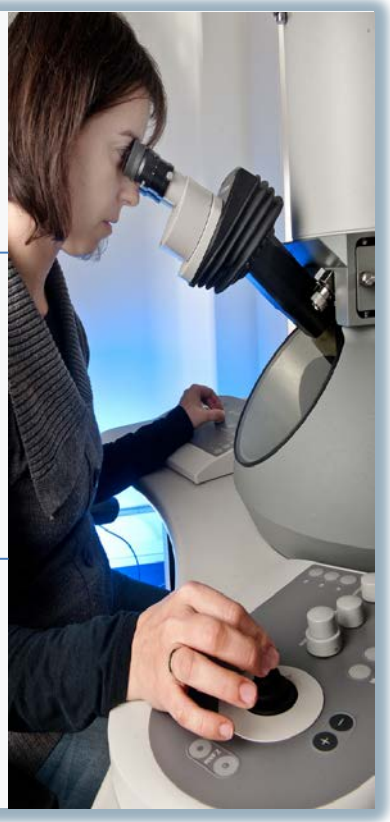
**Vision:**
To become an international centre of reference
in Nanoscience and Nanotechnology, that generates basic knowledge and new technologies.

**Mission in Society:**
To achieve scientific and technological excellence at an international level in nanoscience and nanotechnology, and to facilitate the adoption and integration of nanotechnologies into society and industry.

**Core activities:**
- Frontier Basic and Applied Research in N&N
- Technology Transfer
- Public Outreach



# ICN2: In numbers

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**Annual Budget:** ~11 M€
**Sources:** Patrons: 50%, Competitive Funding: 45%, Tech Transfer (contracts, IP): 5%

**Total staff:** ~ 200
**Demographics:** 45% foreigners, 44% female, 70% are 35 or younger,
**Researchers:** 170 (130 staff + 40 visiting), working language is English
**Research Groups:** 15
**Technical Divisions:** 4
**Distinguished Awards:** 6 ERC (3 current + 3 past); "Severo Ochoa" Award

**Scientific Output:** ~170 indexed publications/year (average IF~6.5)

ICN2 is in the top-ten of all Spanish R&D centres in all measures of excellence,

3rd place in Excellence Rate (% of papers among the 10% most cited in their fields)*

**SCIMAGO Institutions Ranking 2013*

**Total laboratory space:** ~2,000 $m^2$
**Key facilities:** electron microscopes (SEM, S/TEM, TEM), R2R NIL; FIB; XPS;
Nanomoke, wet chemistry labs, access to clean rooms (UAB and CNM)

bnc-b
BARCELONA NANOTECHNOLOGY CLUSTER-BELLATERRA

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Parc de Recerca UAB


ALBA Synchrotron

**A cluster with nearly 750 scientists and technicians in the areas of Materials, Micro and Nanotechnologies**


What can
Nanotechnology offer
to Packaging?

# VISUAL SENSORS FOR FOOD SECURITY

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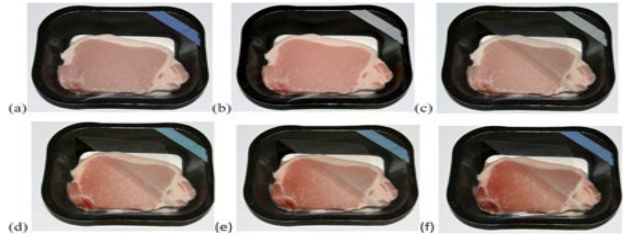
- Products of spoilage
- Pathogens
- Allergens
- Chemical residues

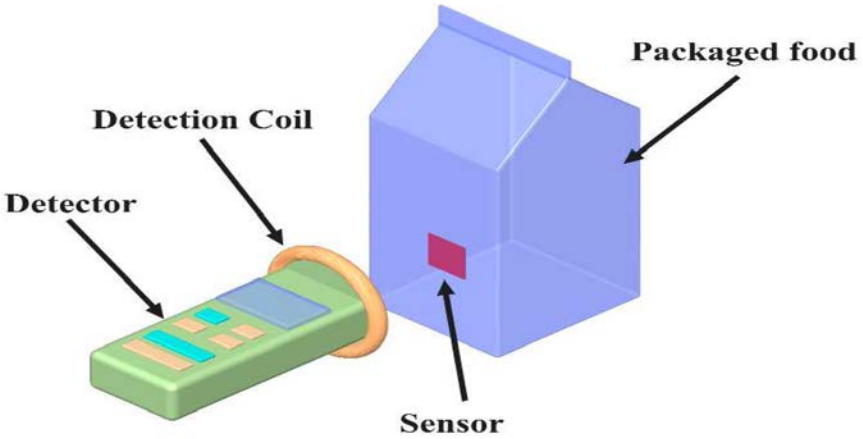






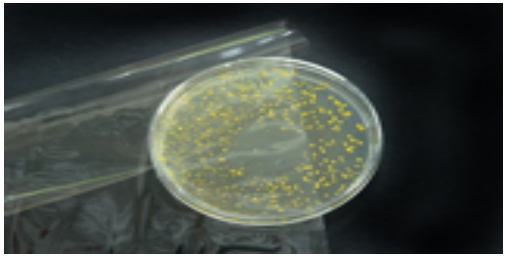

# QUANTITATIVE MEASUREMENTS IN THE FOOD CHAIN

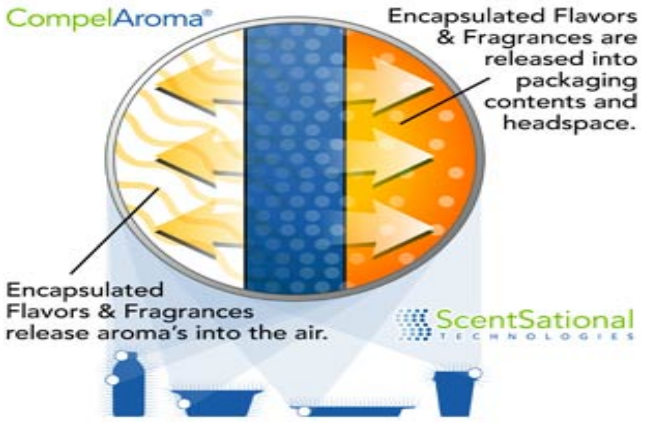
- Final products
- Intermediate food ingredients
- Warehouses and cold stc



# ACTIVE PACKAGING

- Antimicrobials
- Flavours
- Fragrances
- Enviromental modifiers:
  - pH,
  - oxygen,
  - etc.





# HIGHLY SPECIALISED SURFACES

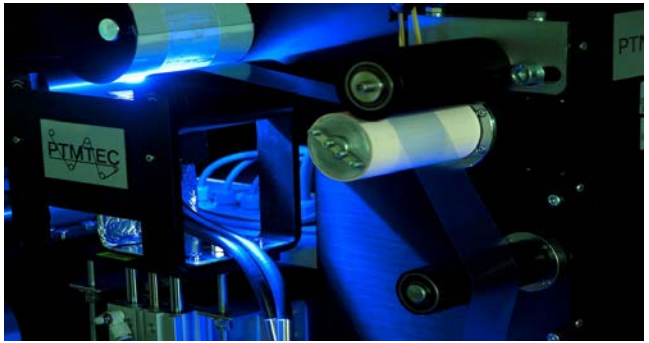
- Super hydrophobic / hydrophilic
  - Non wetting
  - Non sticking
  - Non fogging /misting

- Nanoimprints for security / authenticity

- Colour from surface structure

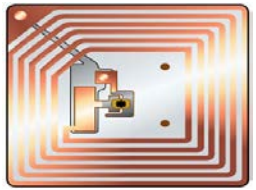
(no inks)

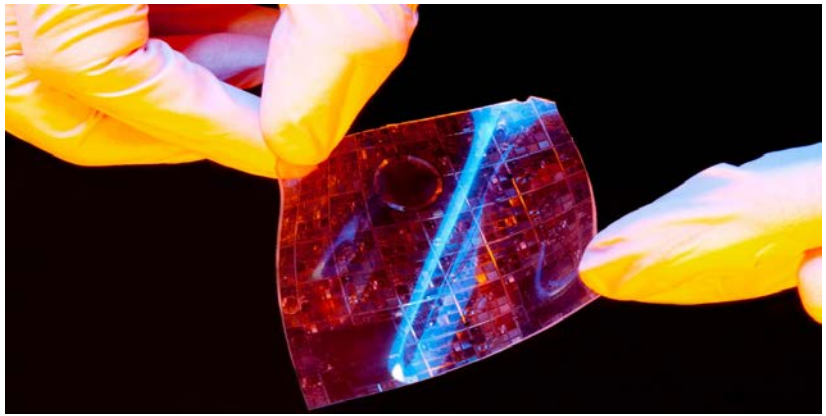
  - Butterfly wing effects



# INTEGRATED ELECTRONICS

- Conductive inks
- Self-powering pressure and temperature sensors
- Flexible photovoltaics





# Overview of ICN2 Groups relevant to Biosensors B30 …

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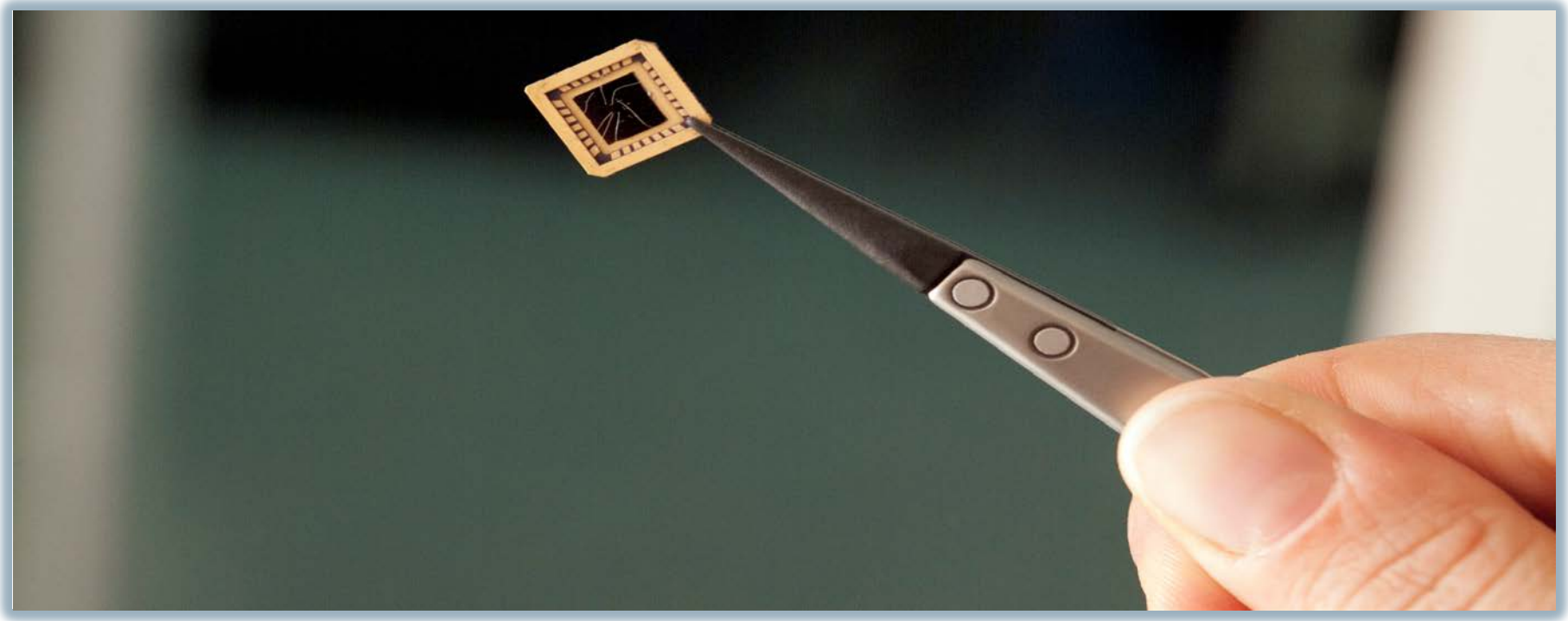

# Nanobioelectronics and Biosensors Group

*ICREA Professor Arben Merkoçi*

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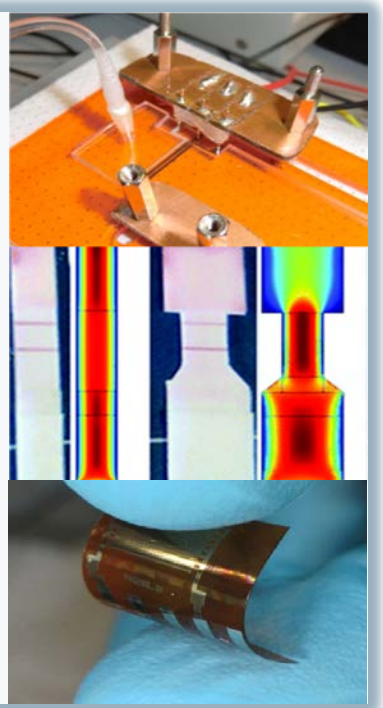
**Design and Fabrication of nanomaterial-based sensors and biosensors for diverse areas of life**

**Focus areas**

- Nanomicrofluidics, Nanochannels and Nanomotors
- Catalytic/carrier nanomaterials
- Paper nanobiosensors
- Graphene and related materials for sensing applications
- Sensors for Health, Environment, and Safety & Security

**Expertise**

Nanobiosensing Technology; Analytical Chemistry; Electrochemistry; Microprinting; Lab-on-a-Chip Technology; Ink-Jet Printing; Screen Printing; Lateral Flow Technology



**SENSORS**

# nanoB2A Group

*Professor Laura M. Lechuga (CSIC)*

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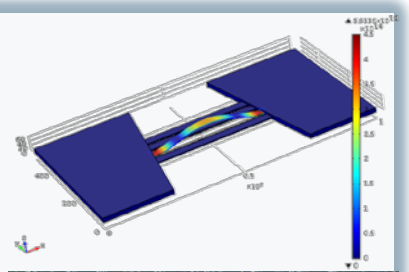
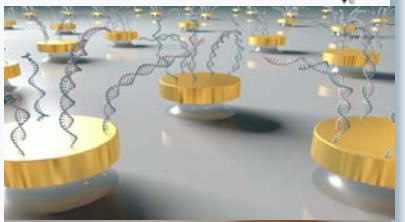
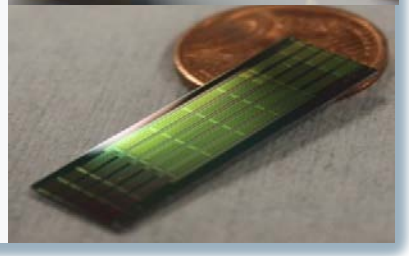
**Design, fabrication and clinical applications of nanobiosensor devices and lab-on-chip platforms; and technology transfer into commercial products**

**Focus areas**

- Plasmonic and Nanoplasmonic Biosensors
- Silicon nanophotonics Biosensors
- MEMs based-opto-nanomechanical Biosensors
- Biomimetic nano-optomechanical sensors
- Lab-on-chip integration
- Biofunctionalisation of surfaces
- Clinical and Environmental Applications







**Expertise:** Plasmonics; Integrated Optics and Optoelectronics; Surface Biofunctionalisation; Immunochemistry; Genomics; Bio-analytical Applications; Miniaturisation; and Microelectronics Integration

**SENSORS**

# NANO$^{up}$ Group
*ICREA Professor Daniel Maspoch*

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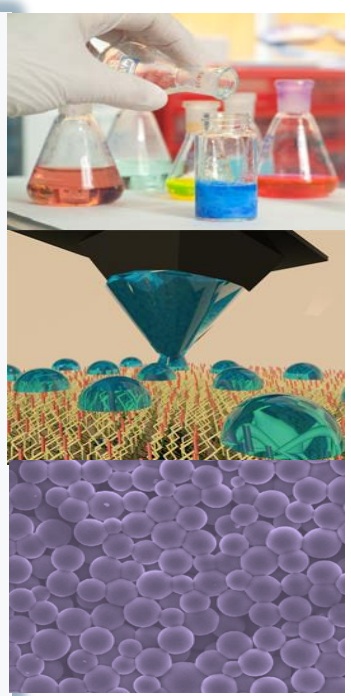
**Focus areas**
- Synthesis of new organic and supramolecular superstructures, including Metal-Organic Frameworks (MOFs)
- Femtoscale chemistry via tip-based Nanolithography
- Discovery and development of new techniques for the fabrication of novel nanomaterials

**Services offered:**
Micro- and Nanoencapsulation of active ingredients for commercial products, and consulting on industrial scale-up

**Commercial endeavours based on Micro- and Nanoencapsulation:**
- Laundry detergents and softeners with long-lasting scent (non-disclosed company)
- Antifungal paints (Chemipol)
- Slow-release disinfectants and antiseptics (non-disclosed company)



**ACTIVE PACKAGING**

# Nanostructured Functional Materials

*CSIC Research Scientist Daniel Ruiz*

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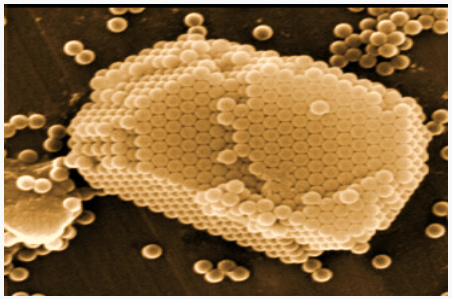
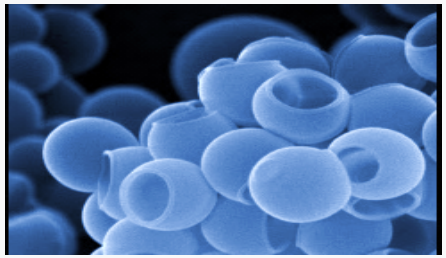
**Focus areas:**

- Smart devices and molecular memories
- Theranostics
- Functional surfaces for improved performance





**Services**

- Micro- and Nanoencapsulation of active ingredients
- Synthesis of polymeric nanoparticles
- Characterisation of nanomaterials and surfaces
- Microscopy (Optical, Electron and Atomic Force)

**Commercial endeavours** HIGHLY SPECIALISED SURFACES

Micro- and Nanoencapsulation of photo/thermochromics, fragrances, bioactive systems, self-healing materials, etc.

**HIGHLY SPECIALISED SURFACES**

# Nanofabrication Division

*Dr Nikos Kehagias*

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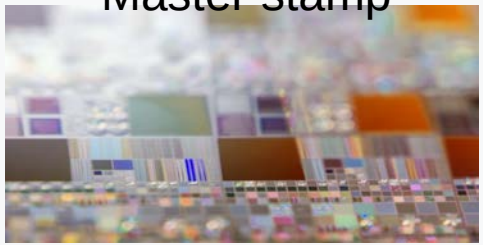
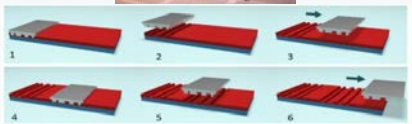
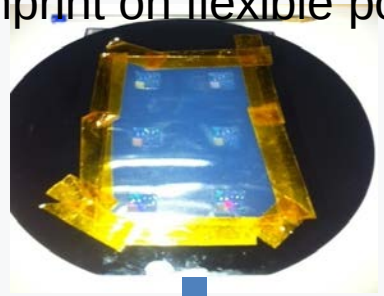
Master stamp



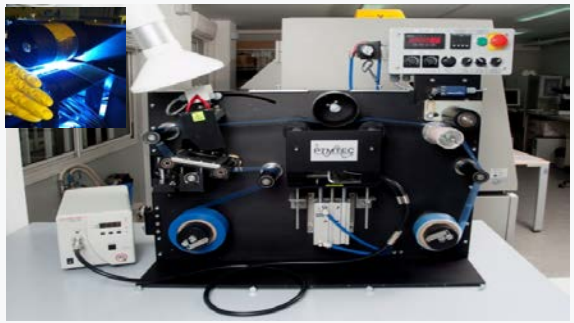
Step and stamp/Upscale



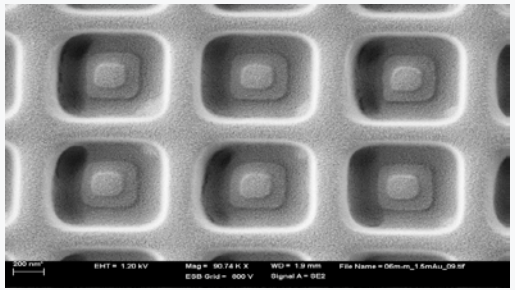
Imprint on flexible polymer



Working-stamp generation



R2R imprint



Imprinted structures

**Printing speed:** 0.5 to 1 m/min **Resolution:** < 50 nm @ 0.6 m/min

# Laboratory of Nanostructured Materials for Photovoltaic Energy

*Dr Monica Lira-Cantu*

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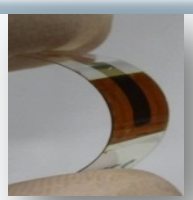
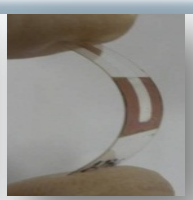
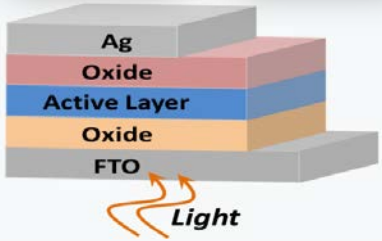
**Synthesis of photoactive nanomaterials, and design, fabrication and testing of photovoltaic cells**








## Focus areas

- New solar-cell concepts and device design
- Nanostructured materials for next-generation solar cells *(dye sensitized, hybrid and small-molecule organic solar cells)*
- All-solution processable devices
- Optical and electrical characterisation
- Outdoor and accelerated stability analyses of solar cells
- Stability studies following ISOS protocols

**FLEXIBLE PHOTOVOLTAICS**

## Expertise

Organic and Inorganic Synthesis; Electrochemistry; Photochemistry; Nanofabrication; Solar Cell Testing;

# Oxide Nanoelectronics Group

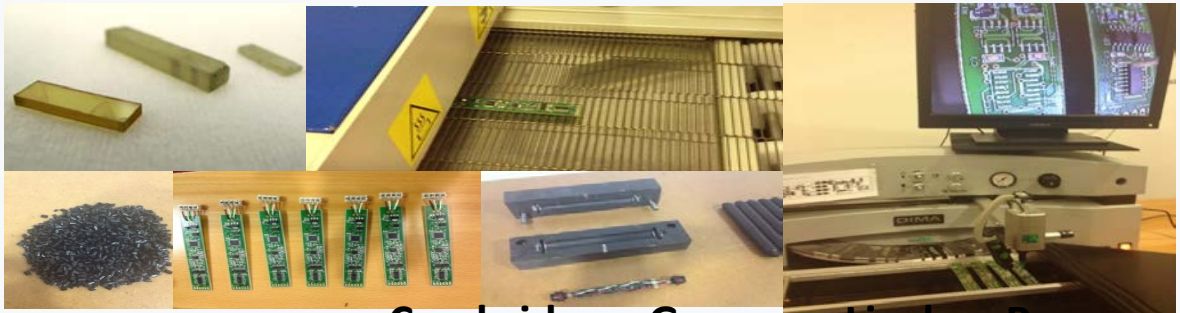
*ICREA Research Professor Gustau Catalán*

*Advisory board of IGSresearch since 2012*

**Electromechanical device design, characterization and fabrication**

Our collaboration with the device company IGS allows turning ideas for electromechanical devices into functional prototypes enclosed in market-ready packaging, in months-time-frame

https://www.youtube.com/watch?v=LGNEDZeH3cs&feature=youtu.be

**Cambridge – Geneve – Licoln – Prague – Barcelona**

# THANK YOU

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