

# nanoBasque

General overview of the latest  
nanomedicine developments  
in the Basque Country



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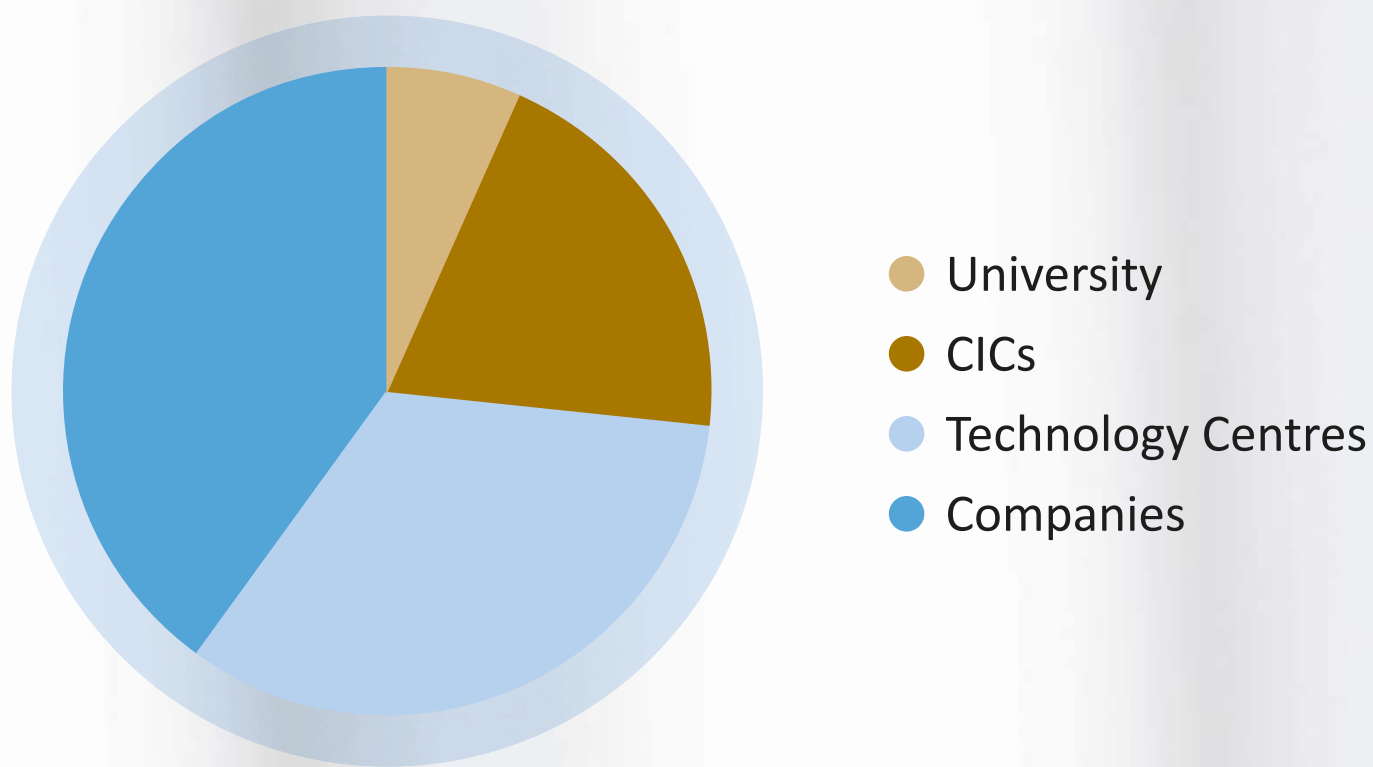
# BASQUE NANOMEDICINE ACTIVITY

## IMPACT OF BASQUE NANOMEDICINE ACTIVIY UNDER FP7

- Direct impact and uptake into FP7 topics and calls
- All NMP calls included a nanomedicine topic
- Nanomedicine under FP7: 85 NMP, 31 Health, 15 ICT

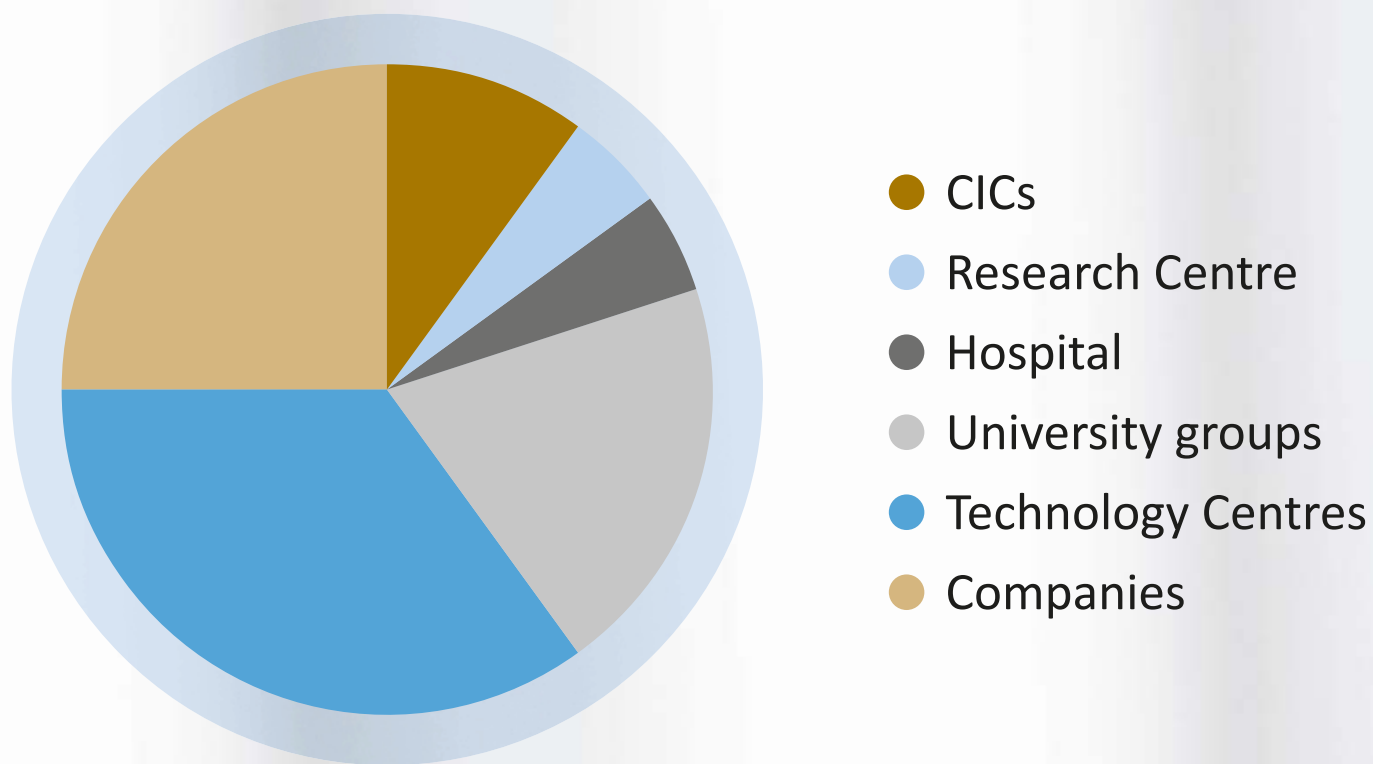
## 15 Basque members in 17 projects under FP7

- 16 NMP; 1 HEALTH
- 5 coordinated from Basque Country
- 12 Million € EC contribution



## Basque members at national nanomedicine platform (NANOMED SPAIN)

- 20 Basque members at NanoMed Spain







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CIC nanoGUNE, the Basque Nanoscience Cooperative Research centre, was inaugurated in 2009 with the mission to perform world-class nanoscience research for the competitive growth of the Basque Country.  
[www.nanogune.eu](http://www.nanogune.eu)





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## **NANOMEDICINE RELATED ACTIVITY**









### **Mechanomedicine:**

-  Study of mechanical forces in human pathologies, viral, and bacterial infections
-  Mechanopharmacology

### **Drug delivery:**

-  Design of nanoparticles and nanostructures for drug delivery
-  Development of nanomagnetic devices for remote manipulation

## **MAIN INFRASTRUCTURES**

-  Atomic-Force Spectroscopy
-  Magnetic Tweezers
-  High-Performance Liquid Chromatography + Mass Spectrometry
-  Environmental SEM
-  SQUID magnetometer
-  Cell-Culture Laboratory
-  Infrared spectromicroscopy
-  Electrospinning

## **CONTACT PERSON**

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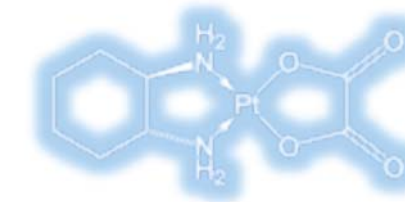
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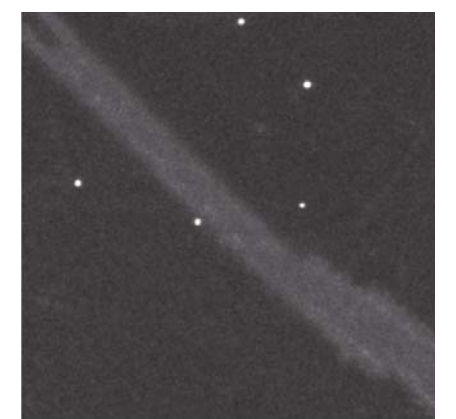
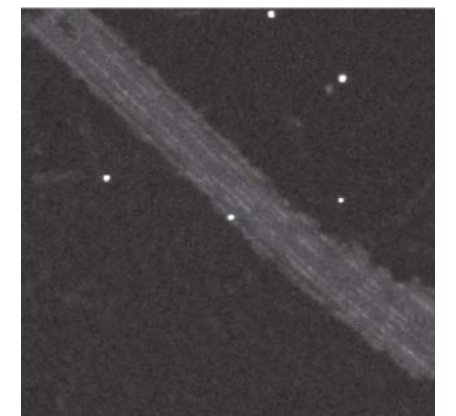
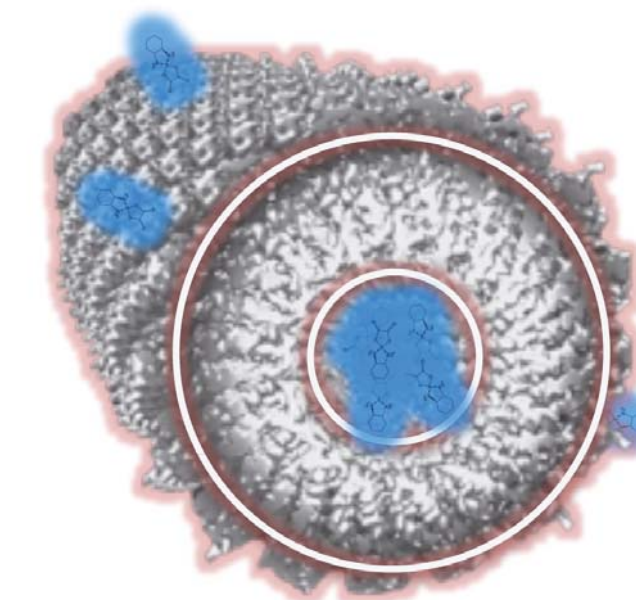
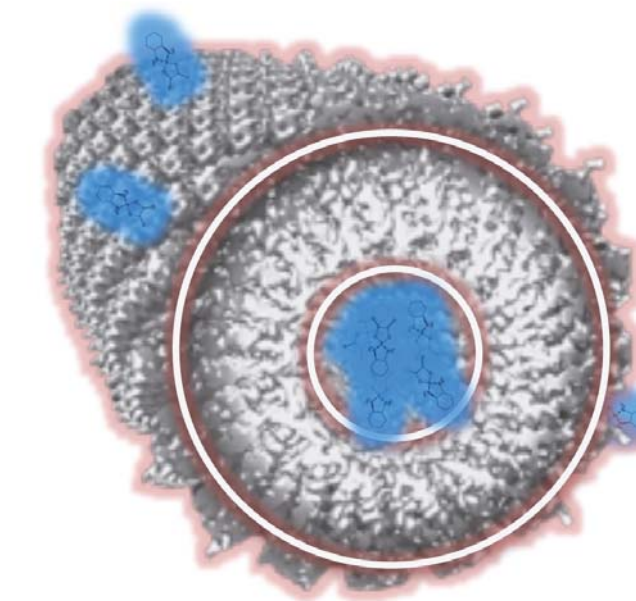
## SELF-ASSEMBLY GROUP

Alexander Bittner, self-assembly group leader  
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### Drug delivery from a plant virus nanotube



- Immersion in oxaliplatin and dialysis
- Slow Effusion drug delivery over some days



TRL: 1  
Time to market: long



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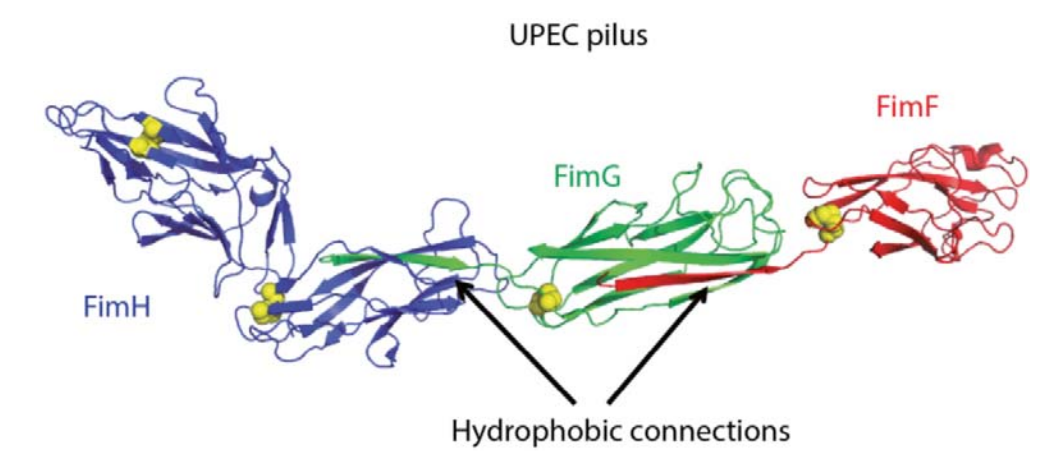
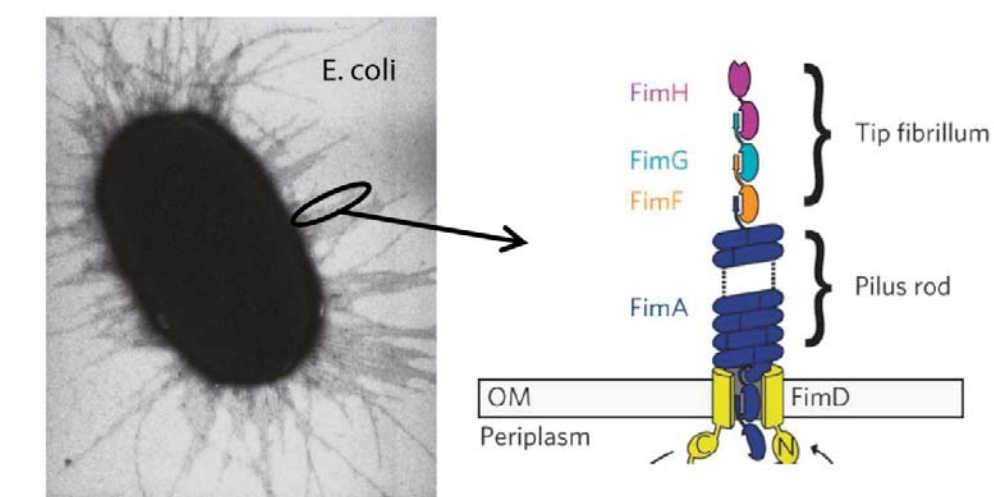
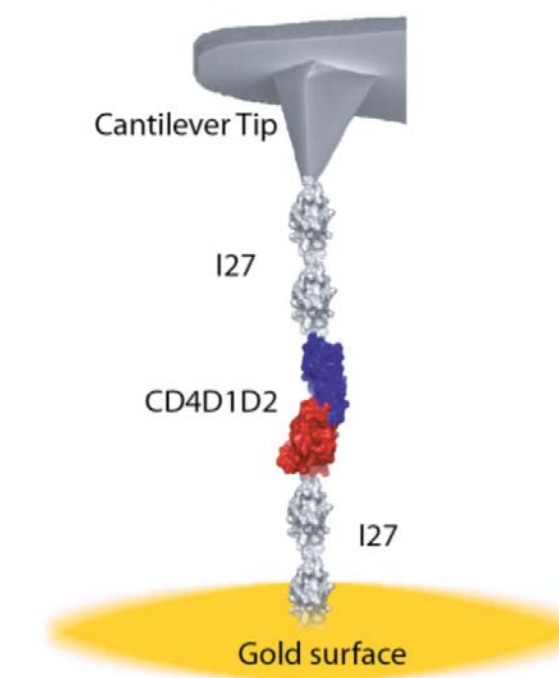
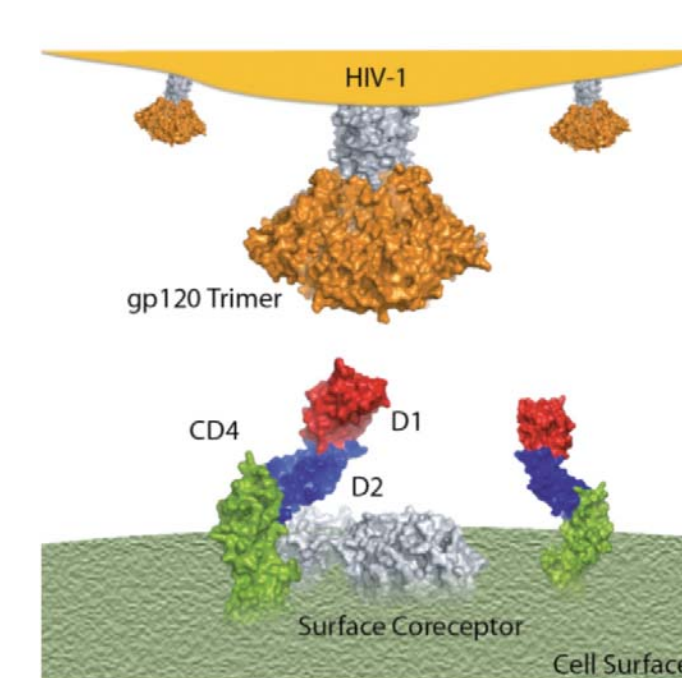
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## NANOBIOMECHANICS GROUP

Raúl Perez Jimenez, nanobiomechanics group leader  
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### Understanding Viral and Baceterial Infections using Atomic Force Microscopy





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## NANOMAGNETISM GROUP

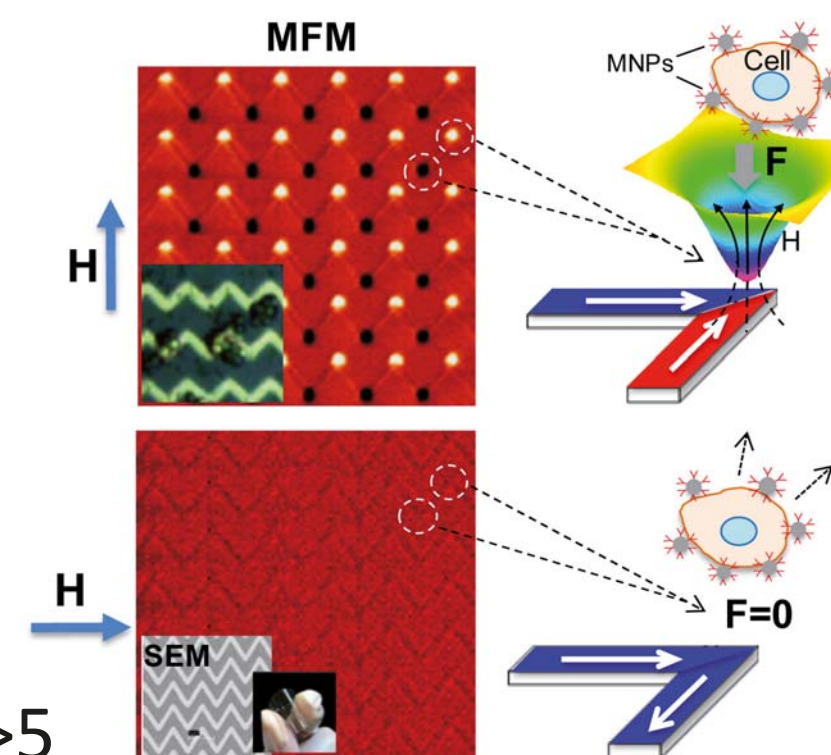
Paolo Vavassori, nanomagnetism group co-leader  
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### Nano-magnetic devices for remote manipulation of biomolecules and cells

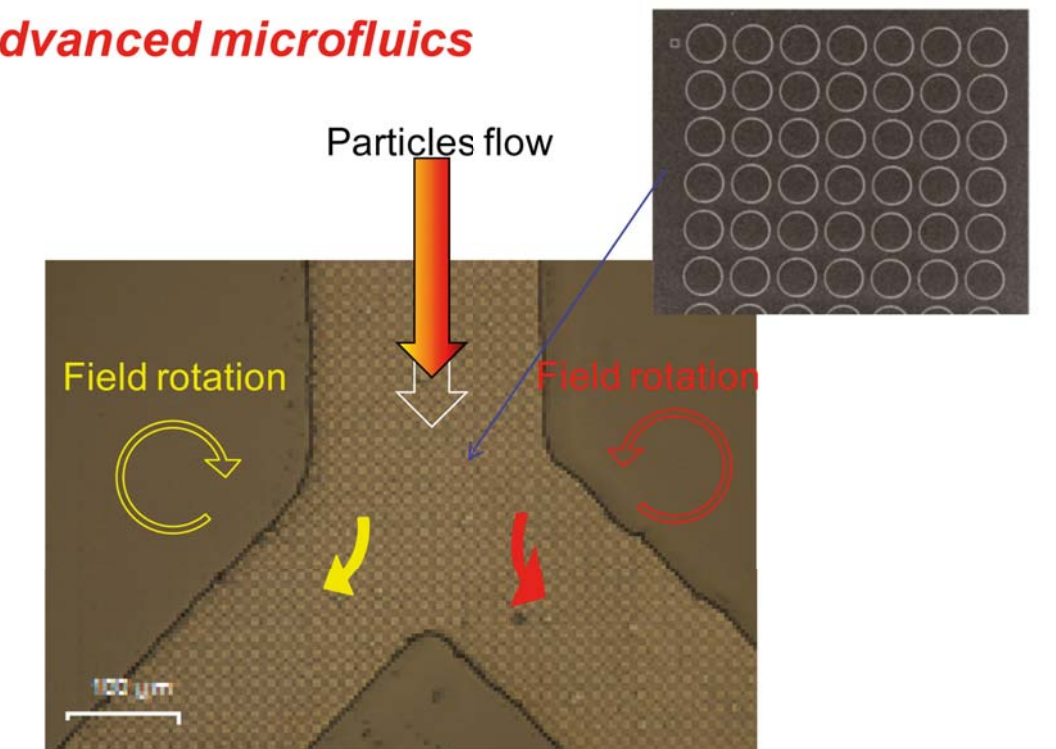
Novel device concept for a 2-dimensional remote manipulation of magnetic beads along any arbitrary pathway on a chip surface. We realized test devices that proved the remote manipulation of individual and multiple magnetic nano-particles on a chip surface.

Applications: lab on a chip, magnetic templates for tissues regeneration, in-flow sorting of biomolecules, and biodetection.

Magnetic template for tissue regeneration



Advanced microfluidics



Magnetically activated deviation of particles flow

TRL: 3

Time to market: 3-5 / >5





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Biomaterialetako Ikerkuntza Kooperatiboko Zentroa  
Centro de Investigación Cooperativa en Biomateriales

CIC biomaGUNE Centre for  
Cooperative Research in biomaterials  
is a non-profit research organization  
created to promote scientific  
research and technological  
innovation at the highest levels  
in the Basque Country following  
the BIOBASQUE policy in order to  
create a new business sector based  
on biosciences.

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## **NANOMEDICINE RELATED ACTIVITY**

- Biofunctional Nanomaterials
- Biosurfaces
- Molecular Imaging

## **MAIN INFRASTRUCTURES**

- Radiochemistry
- MRI
- Nuclear Imaging
- Image Analytics
- Animal Facility
- NMR
- Electron Microscopy
- Mass Spectrometry
- Surface analysis and fabrication
- Colloidal Nanofabrication
- Optical Spectroscopy

## **CONTACT PERSON**

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## Uptake, biological fate, and toxicity of metal oxide nanoparticles

Studies of the uptake, biological fate, and toxicity of several metal oxide nanoparticles (NPs), such as  $\text{Al}_2\text{O}_3$ ,  $\text{TiO}_2$ ,  $\text{CeO}_{2-x}$ , and  $\text{ZnO}$  NPs undertaken in the European Project “Health Impact of Engineered Metal and Metal Oxide Nanoparticles: Response, Bioimaging and Distribution at Cellular and Body Level” are reviewed here. Metal oxide NPs are radiolabeled by direct proton bombardment of commercially available NPs or enriched during synthesis with  $^{18}\text{O}$  to generate  $^{18}\text{F}$  after-proton bombardment. Size, degree of aggregation, and zeta potential of the metal oxide NPs are studied in the presence of proteins and cell media. NP uptake and intracellular fate are followed by ion beam microscopy (IBM), transmission electron microscopy, confocal Raman microscopy and confocal laser scanning microscopy. IBM allows for the quantification of the intracellular dose of NPs. Cell viability studies and the immune response are studied “in vitro” in primary alveoli, and immortalized cell lines. Biodistribution studies in rodents are performed with positron emission tomography following different exposure routes: intravenous, oral, topical, and inhalation using radiolabelled NPs. Activity per organ is quantified for the different uptake routes and with the time.

**TRL: 3**

**Time to market:** long



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### **<sup>68</sup>Ga-Labeled Gold Glyconanoparticles for Exploring Blood–Brain Barrier Permeability: Preparation, Biodistribution Studies, and Improved Brain Uptake via Neuropeptide Conjugation**

Synthesis of novel water-soluble and biocompatible glucose-coated gold nanoparticles (GNPs) carrying BBB-permeable neuropeptides and a chelator of the positron emitter <sup>68</sup>Ga as a PET reporter for in vivo tracking biodistribution. The small GNPs (2 nm) are stabilized and solubilized by a glucose conjugate. A NOTA ligand is the chelating agent for the <sup>68</sup>Ga, and two related opioid peptides are used as targeting ligands for improving BBB crossing.

The radioactive labeling of the GNPs is completed in 30 min at 70 °C followed by purification via centrifugal filtration. As a proof of principle, a biodistribution study in rats is performed for the different <sup>68</sup>Ga-GNPs. The accumulation of radioactivity in different organs after intravenous administration is measured by whole body PET imaging and gamma counter measurements of selected organs. The biodistribution of the <sup>68</sup>Ga-GNPs varies depending on the ligands, as GNPs with the same gold core size show different distribution profiles. One of the targeted <sup>68</sup>Ga-GNPs improves BBB crossing near 3-fold ( $0.020 \pm 0.0050\%$  ID/g) compared to nontargeted GNPs ( $0.0073 \pm 0.0024\%$  ID/g) as measured by dissection and tissue counting.

**TRL: 3**

**Time to market:** long





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**POLYMAT**

Basque Center for  
Macromolecular Design and Engineering

POLYMAT, University of the  
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Synthetic polymers are found in such a large variety of products that have shaped modern life. In the future, polymers will continue substituting other materials in established applications and will play a major role in the development of the technologies needed to address some of the 21st Century challenges such as energy, health care and sustainability. POLYMAT is devoted to use-inspired fundamental research on synthesis, assembly and processing of polymers that in concert with theory and simulation enable addressing to these challenges.

[www.polymat.eu](http://www.polymat.eu)

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## NANOBIOSEPARATIONS GROUP

## NANOMEDICINE RELATED ACTIVITY

- DNA-gated nanoparticles for drug delivery and controlled release
- DNA-modified polymeric interfaces for disease detection platforms

## MAIN INFRASTRUCTURES

- Surface-sensitive techniques (SPR, DPI, QCM-D)
- Polymer processing and characterization

## CONTACT PERSON

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### DNA-aptamer gated nanoparticles and membranes for controlled delivery and drug release

Mesoporous nanoparticles and nanoporous membranes are loaded with cargo molecules (such as drugs) and then capped with DNA-aptamers. Upon interacting with the cognate target, the DNA-aptamer changes conformation giving rise to an opening of the pores and subsequent release of the cargo. Proof of concept has been succeeded with cancer cells but applications might also be in smart bioseparations.

**TRL:**

**Time to market:** short/medium/long >5





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### DNA-modified polymeric interfaces for disease detection platforms

Interfaces are created through DNA-aptamers being grafted on polymeric thin films via suitable surface modification. Such interfaces can be used either as selective thin films on sensors or as membranes in purification technology. Applications under preliminary study range from detection of markers for diseases to tissue engineering.

TRL: 2

Time to market: short/medium/long >5



## BIONANOPARTICLES GROUP

### NANOMEDICINE RELATED ACTIVITY

- Synthesis and characterization of hard, hybrid, and soft nanoparticles for bio-applications
- Colloidal and polymeric characterizations of bionanoparticles
- Modeling the heterogeneous polymerization processes to produce hard, hybrid, and soft nanoparticles for bio-applications
- *In vitro* preliminary bio-applications using hard, hybrid, and soft bionanoparticles

### CONTACT PERSON

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### MAIN INFRASTRUCTURES

800 m<sup>2</sup> of new labs and offices with state-of-the-art equipment for controlled synthesis (computer controlled reactors, RC1 calorimeter reactor, high throughput reactor system) and characterization (<sup>1</sup>H and <sup>13</sup>C NMRs, AFM, TEM, SEM, FTIR, DSC, GPC, DLS, MALS, CHDF, DCP, MALDI-TOF, tensiometer, contact angle, rheometer) of polymer materials. Also, free access to all the infrastructures of the General Research Services of the UPV/EHU.

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### Design of Cationic Nanogels for Targeted Intracellular Codelivery of Doxorubicin and siRNA to Overcome Drug Resistance in Breast Cancer

Drug resistance to chemotherapy is believed to cause failure in over 90% of patients with metastatic cancers. Therefore, to overcome multidrug resistant (MDR) in breast cancer, the main objective of this project is the synchronous targeted codelivery of doxorubicin (Dox) as a chemotherapeutic anticancer drug together with a specific small interfering RNA (siRNA) for knocking down a Dox resistance gene, using a folate-conjugated cationic nanogel able to degrade intracellularly.

This project is carried out in collaboration with the group of Prof. Molly Stevens at Imperial College London, and the final stages of this project will be carried out at BioDonostia Health Research Institute and Glaxo Smith Kline (GSK) in order to validate and assess the clinical translation of the product.

**TRL 3:** experimental proof of concept

**TRL 4:** technology validated in lab

**Time to market:** long >5



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## SCIENCE AND ENGINEERING OF POLYMERIC BIOMATERIALS GROUP

### NANOMEDICINE RELATED ACTIVITY

- Novel bioresorbable polymer systems for tissue engineering
- Polymer scaffolds and medical devices with biologically active molecules
- Synthesis, characterization and conformation of polymeric biomaterials

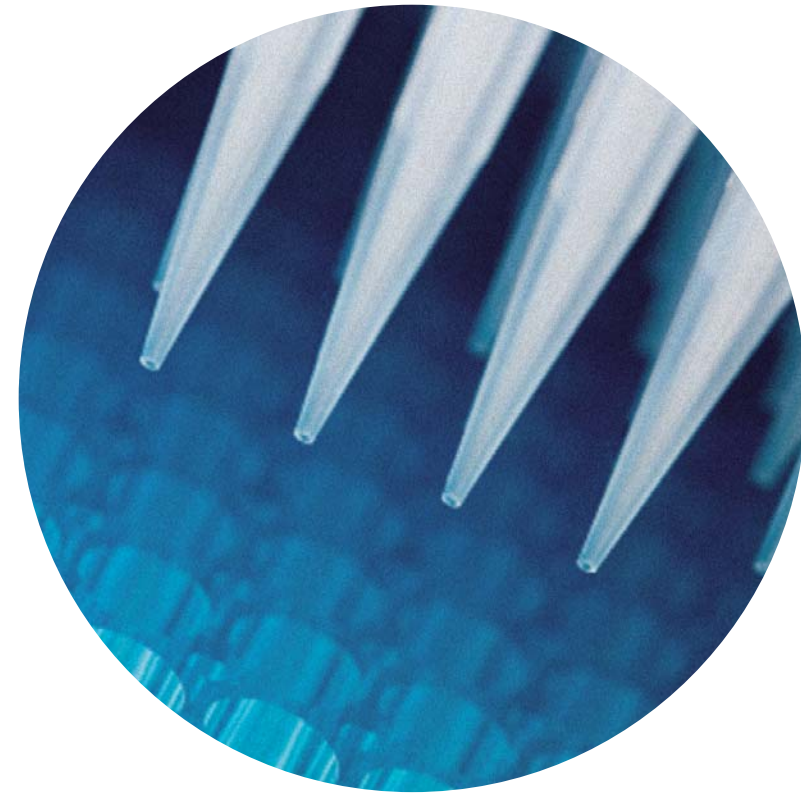
### MAIN INFRASTRUCTURES

- Laboratory of polymer synthesis
- Laboratory of polymer processing and Surface functionalization. Clean Room conditions
- Laboratory of physico-chemical characterization of biomaterials
- Mechanical testing equipment

### CONTACT PERSON

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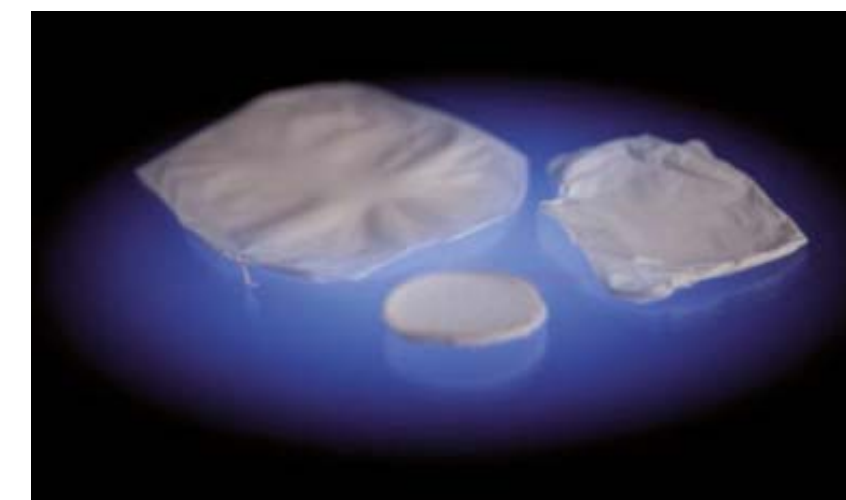


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### Novel bioresorbable polymer systems for regenerative medicine

Bioresorbable polymers with thermoplastic elastomer (TPE) behavior are highly valued for several regenerative medicine applications, e. g. cartilage, vascular vessels, urology... Polylactide/polylactone copolymers with tuned properties and no crystallization capability are synthesized, characterized and manufactured in different shapes for medical implant applications. Polymers may be loaded with biologically active molecules and inorganic nanoparticles (bioglass, hidroxiapatite...) with several biomedical purposes.



TRL: 2

Time to market: short/medium/long >5

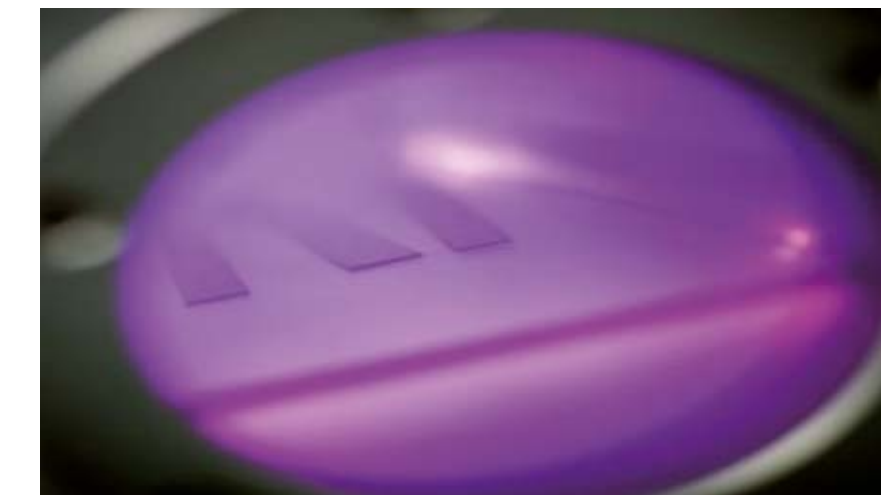


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**Bioresorbable polymer scaffolds functionalized with a model protein for local delivery of antibiotics and immuno-supressive molecules**

Polymer scaffolds loaded with antibiotic and immunosuppressive molecules are obtained by novel techniques such as electro-spinning and 3D printing and activated by plasma. A model protein is grafted through a crosslinker upon the surface. Specific interactions and miscibility are key issues for controlled delivery profiles.



**TRL: 2**

**Time to market:** short/medium/long >5



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NanoBioCel

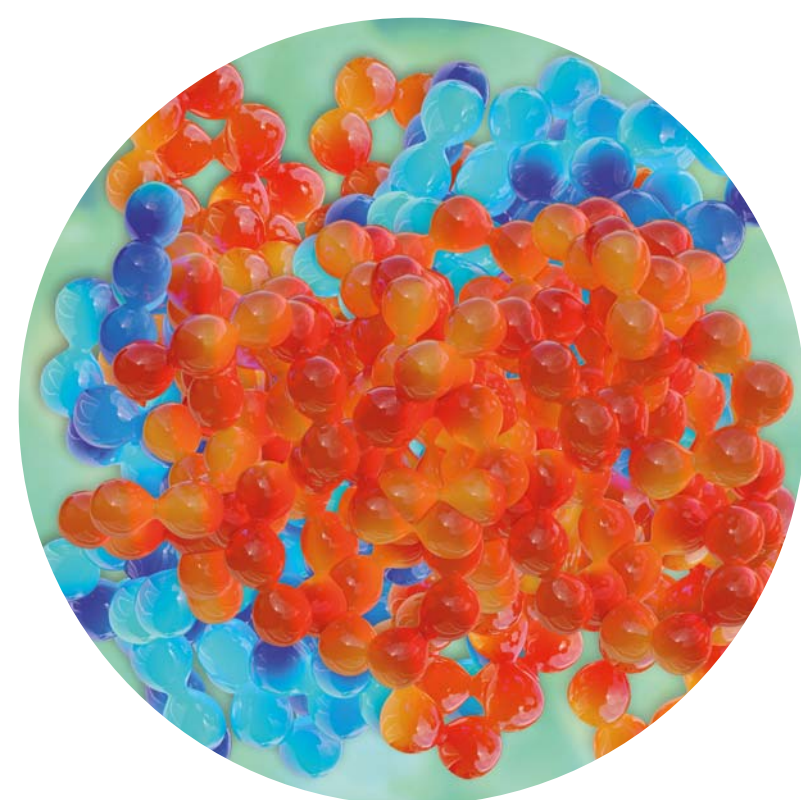
Micro and Nano technologies,  
Biomaterials and Cells Research Group

Micro and nano technologies,  
biomaterials and cells research group.

Since 2001, the research group from the Pharmacy and Pharmaceutical Science's Department has been recognized as a University of the Basque Country UPV/EHU Consolidated group by the Basque Government. The principal investigator is Dr Jose Luis Pedraz. It is remarkable the implication in relevant research projects on the field of pharmaceutical technology, cellular therapy, characterization of biomaterials and specially on the development of new sustained and controlled delivery systems for drugs, peptides, proteins, DNA and cells.

[www.ehu.es/es/web/nanobiocel/home](http://www.ehu.es/es/web/nanobiocel/home)





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NanoBioCel

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## NANOMEDICINE RELATED ACTIVITY

- Microencapsulation of alive cells. Design and optimization of polymeric systems for immobilization of cells with therapeutic activity
- Micro and nano-particles as vaccine administration systems of peptides and proteins
- Non viral vectors for gene therapy purposes; design and optimization of non-viral vectors based on lipidic and polymeric nanoparticles
- Development of modified release formulation based on new polymers to obtain a sustained release profile of drugs
- Nanocarriers for pulmonar administration: design, optimization and characterization of vehicles in the nanometric range

## CONTACT PERSON

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## MAIN INFRASTRUCTURES

HPLC with UV-visible; fluorescent and electrochemical detector; HPLC-MS, HPLC-MS/MS; GC-MS; Spray-Dryer; Tableting machine; Particle size analyzer for liquid suspensions (Coulter, nano-sizer) and solid phase (Helos sympatec); Image acquiring microscope; coating pan; single step mixer-granulation-dryer; capsule filler; extruder-spheroniser; dissolution rate/disintegration rate determination equipments; tablet hardness testing; Climatic chambers, Jet cutt for microcapsules elaboration.





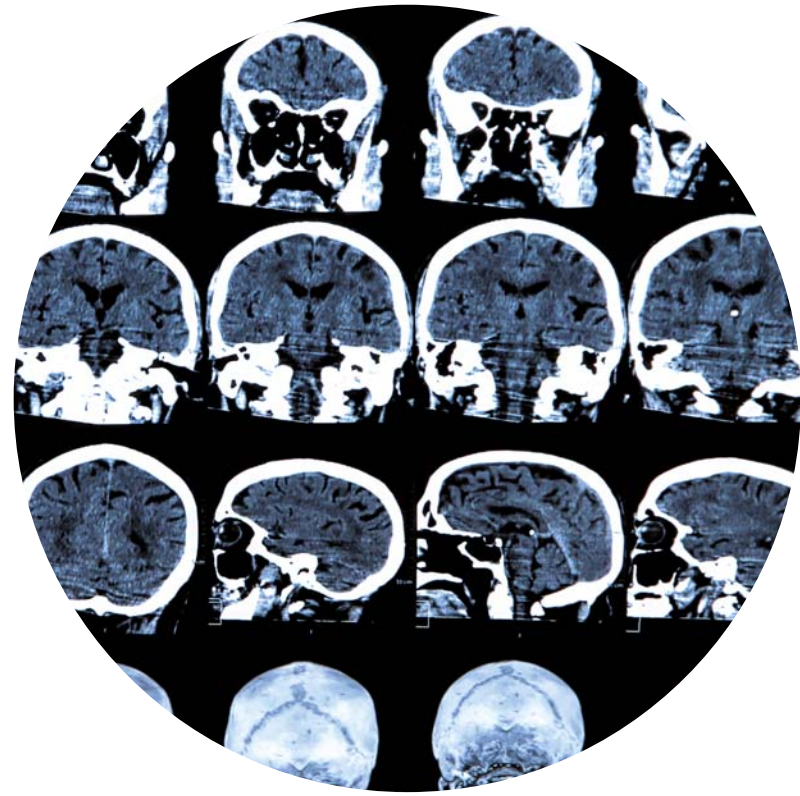
## Treatment of retina neurodegenerative diseases through gene therapy using non viral vectors

Niosomes represent a recent promising approach for gene delivery purposes. We elaborated a novel niosome formulation based on cationic lipid, combined with squalene and polysorbate 80 to evaluate the transfection efficiency in rat retinas. Niosomes prepared by the solvent emulsification-evaporation technique were mixed with the pCMSEGFP plasmid to form lipoplexes which were characterized in terms of morphology, size, surface charge, and DNA condensation, protection and release. The efficacy of the most promising formulation was evaluated in rat eyes by monitoring the expression of the EGFP after intravitreal and subretinal injections. Lipoplexes successfully transfected HEK-293 and specially ARPE-19 cells, without affecting the viability. Whereas lipoplexes entered mainly retinal cells by clathrin-mediated endocytosis, HEK-293 cells showed a higher caveolae-dependent entry. After ocular administration, the expression of EGFP was detected in different cells of the retina depending on the administration route. This novel niosome formulation represents a promising approach to deliver genetic material into the retina to treat inherited retinal diseases.

**TRL 4:** technology validated in lab  
**Time to market:** medium- 3 a 5 years

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### Alzheimer treatment through revascularization of cerebral cortex

With this development attempts to develop a novel nanotechnology-based strategy to deliver vascular endothelial growth factor (VEGF) to the brain, as a possible therapeutic approach for AD. VEGF-NS were able to improve behavioral deficits, decrease A $\beta$  deposits and promote angiogenesis, as well as reduce neuronal loss and cerebrovascular abnormalities. Furthermore, their ability to protect neuronal cultures against neuroinflammation induced by LPS provides new insight for future therapeutic approaches in other neurodegenerative disorders. We also confirmed that encapsulated VEGF secreting cells also stimulated angiogenesis in the cerebral cortex and hippocampal dentate gyrus. In addition, we found that VEGF-microcapsule treatment was associated with a depressed expression and activity of acetylcholinesterase in the hippocampus of A $\beta$ PP/PS1 mice, a similar pattern as first-line medications for the treatment of AD. We conclude that stereologically-implanted VEGF-microcapsules exert an acute and long-standing neurotrophic effects, and could be utilized to improve potential therapies to control the progression of AD.

**TRL 4:** technology validated in lab

**Time to market:** medium- 3 a 5 years



A close-up photograph of a laboratory experiment. A glass pipette is tilted, dispensing a drop of red liquid into a petri dish. Several other petri dishes containing red liquid are visible in the background, which is softly blurred. The lighting is bright and clinical.

3

Health  
Research  
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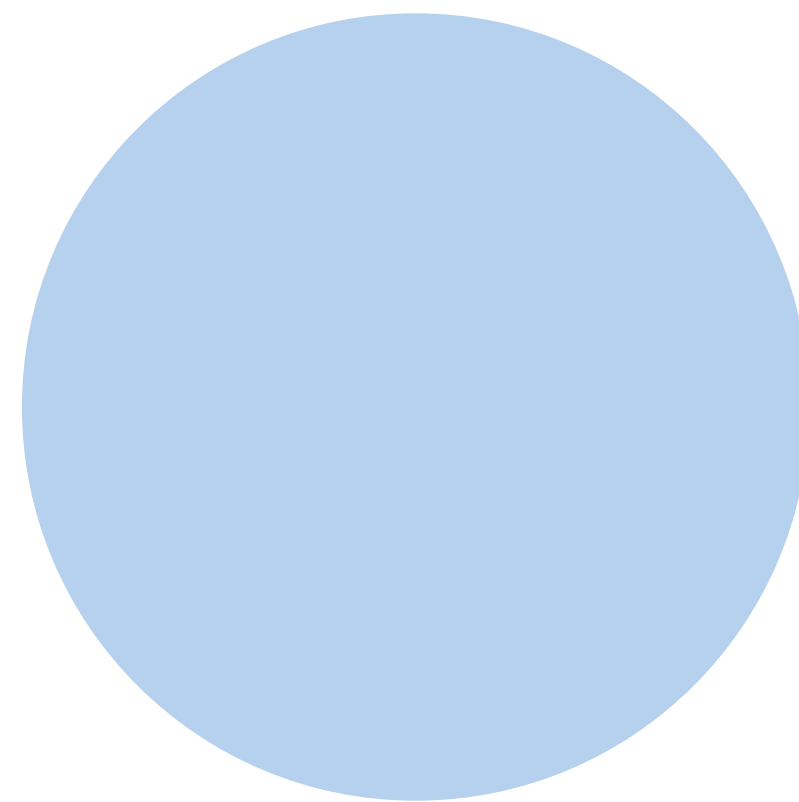
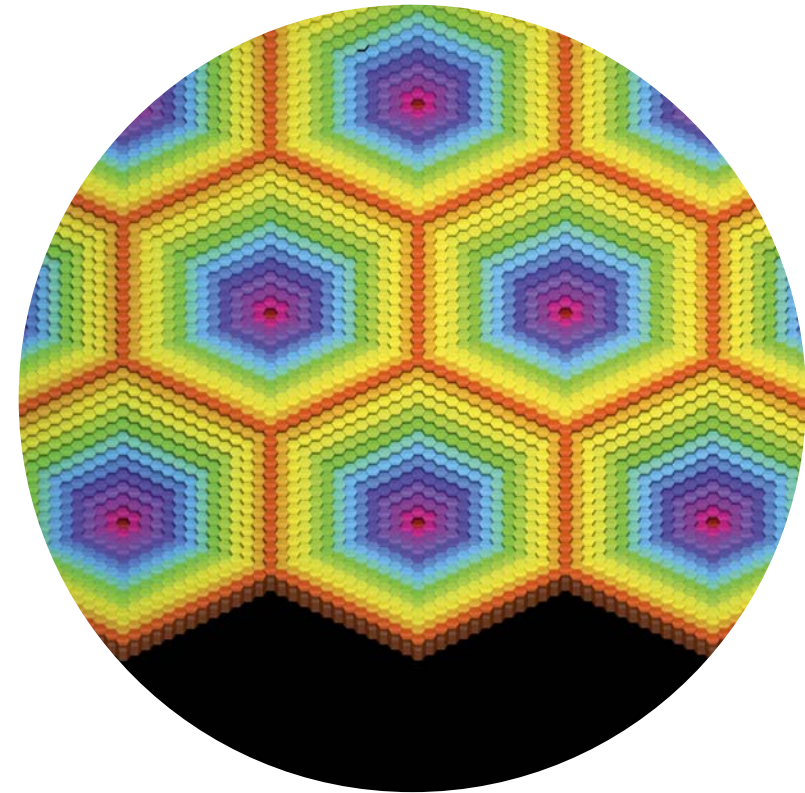
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Health  
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- First health research institute in the Basque Country: Created in 2008
- Accredited by the ISCIII: indicator of excellence, part of the elite of accredited institutes in Spain
- Unusual institute due to its collaborative (public-private) multiinstitutional and interdisciplinary structure
- The core is Donostia University Hospital, and are also incorporated Primary Care, District Hospitals, Public Health, University of the Basque Country UPV/EHU, Technological Centres, Cooperative Research Centres and private enterprises





3

Health  
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### NANOMEDICINE RELATED ACTIVITY

- Research on the immunologic response in the presence of nanoparticles

#### Research on the immunological response in the presence of nanoparticles

Study of apoptosis or necrosis of T lymphocytes incubated with metallic nanoparticles (HINAMOX, NpZn, NpCe, NpTi and NpAl) in a cell growth medium containing fetal serum.

TRL: 4

Time to market: long >5

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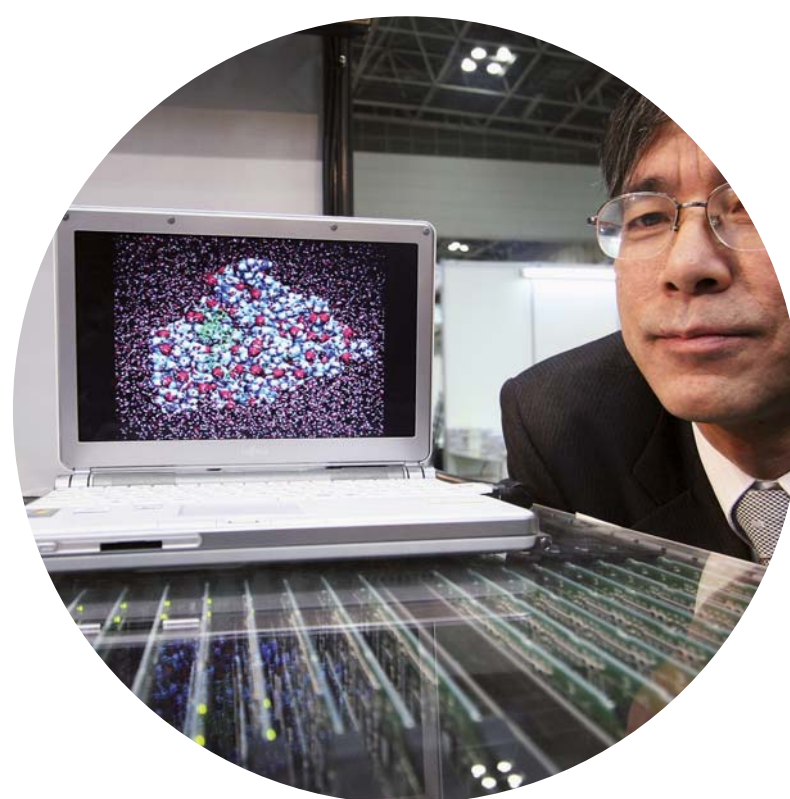
TECNALIA Research & Innovation is a private, non-profit research organization that operates in several markets (Construction, Energy, Industry, ICT, Transport, Health) and aims at generating new bridges between innovation and business.

[www.tecnalia.com](http://www.tecnalia.com)



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### NANOMEDICINE RELATED ACTIVITY

- Synthesis, functionalization and characterization of polymeric nanoparticles for targeted drug delivery
- Functionalization and characterization of carbon-based nanomaterials (graphene, nanotubes) for diagnostics
- Design of new 3D-cell-culture-based in vitro assays to study cell-nanoparticle interactions
- Toxicological assessment of nanomaterials

### MAIN INFRASTRUCTURES

- Clean rooms and laboratories for nanomaterials synthesis and characterization
- Cell culture laboratory
- Biological test laboratory

### CONTACT PERSON

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### New enabling technologies for transdermal delivery of nanoparticles

Nanoparticles introduced into the skin may be used for various purposes, from drug delivery to immunomodulation. In particular, transdermal drug delivery represents one of the most successful and innovative alternatives to oral delivery of drugs. The benefits of using transdermal drug delivery include improved systemic bioavailability resulting from by-passing the first liver metabolism as well as elimination of the impact of variables due to oral administration (pH, transit times, etc.). The use of nanoparticles can further boost the relevance of transdermal drug delivery by, for example, protecting the delivered active substance from denaturation, adding a sustained release effect, targeting specific cells, etc. Tecnalia simultaneously develops and characterizes the nanoparticles, nanoparticle release materials and control devices in order to maximize performance.

TRL: 3/4

Time to market: long



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### Nanotoxicity assessment

Nanotoxicology is a science that is still in its infancy and there is still a major lack of toxicological data for nanoparticles and nanomaterials. It has been demonstrated that the interactions between nanomaterials and cells are very complex and that conventional toxicological methods may not be appropriate to assess many of the possible hazards related to these interactions.

The experience of more than 20 years on toxicological evaluation (in vitro and in vivo) of TECNALIA has been applied in the last 8 years to adapt these methodologies to the specific characteristics and behaviour of nanoparticles. Among others, cell viability, genotoxicity, hemocompatibility, uptake, protein or/and gene expression, oral and dermal toxicity, irritation, etc. have been analyzed with several types of nanoparticles.

Moreover, Tecnalia is committed to improving the predictive capacity of in vitro assays through design of new 3D cell culture models. The aim of this work is to ensure that these assays capture in the most realistic way the nature of the interactions between cell and nanoparticles that take place in vivo.

Time to market: long



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Technology  
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GAIKER

ik4 research alliance

Fundación GAIKER is a organization devoted to the development of new technologies from sectors such as Health, Fine Chemistry, Food and Agriculture, among others. From 1985, the Centre has carried out more than 1.100 R+D Projects related to its Knowledge Areas: Biotechnology Plastics and Composites, Environment and Recycling.

[www.gaiker.es](http://www.gaiker.es)



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### NANOMEDICINE RELATED ACTIVITY

- *In vitro* evaluation of the absorption capacity of nanodrugs
- ITS for toxicity assessment of nanodrugs

### CONTACT PERSON

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### MAIN INFRASTRUCTURES

- Fully equipped *in vitro* tests laboratory (GLP)
- Molecular biology laboratory
- Microscopes laboratory
- Genomic and proteomic laboratories



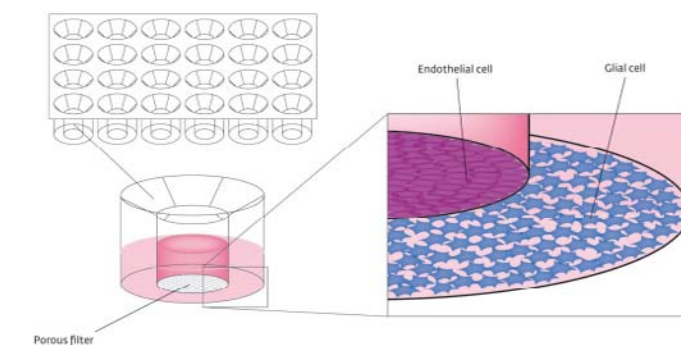
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## *In vitro* evaluation of the absorption capacity of nanodrugs

Development of models to simulate physiological barriers *in vitro* with an aim to estimate the potential absorption capacity and toxicological profiles of purpose-designed nanodrugs for the BBB, skin and inhalation routes.



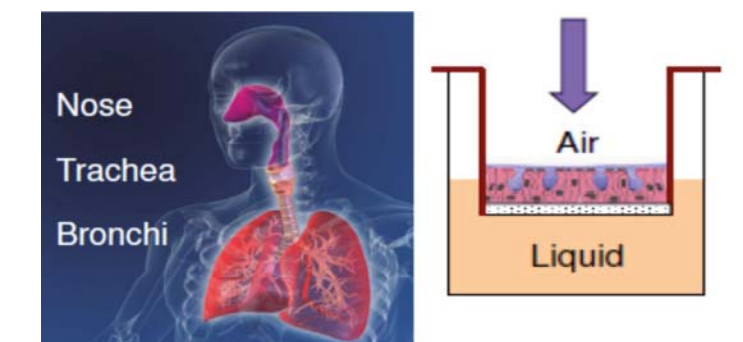
### Blood Brain Barrier

- Permeability potential
- Transport mechanisms
- Neurotoxic profiles
- Efficacy



### Skin

- Safety and Efficacy
- Inflammation
- Fototoxic potential
- Permeability



### Inhalation route

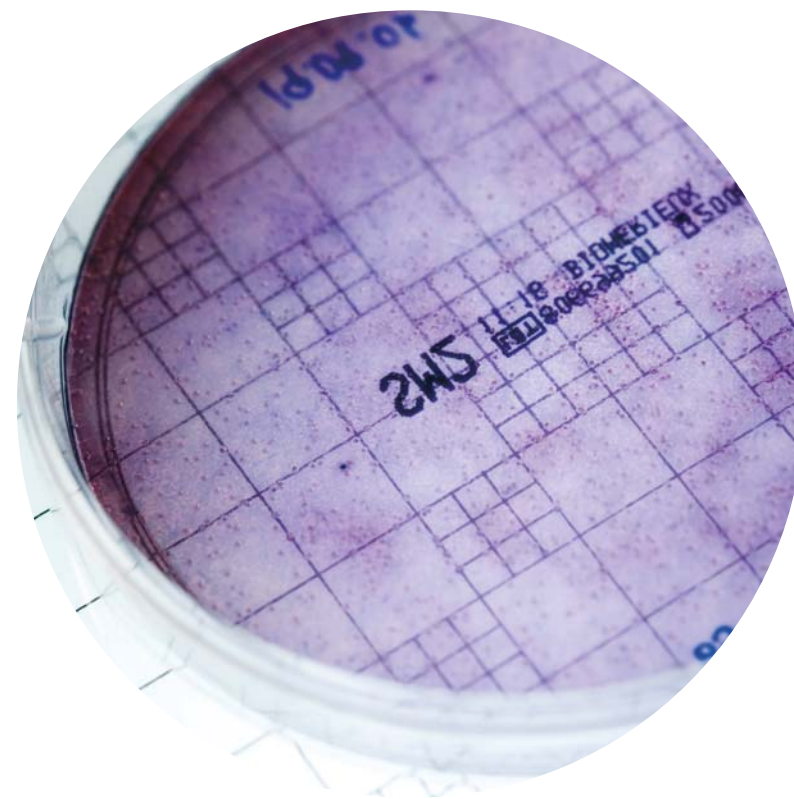
- Toxicity (inhaled nanodrugs)
- Acute, Sub-acute, Subchronic, Chronic, Multidose
- Inflammation potential

TRL: 7

Time to market: short <3

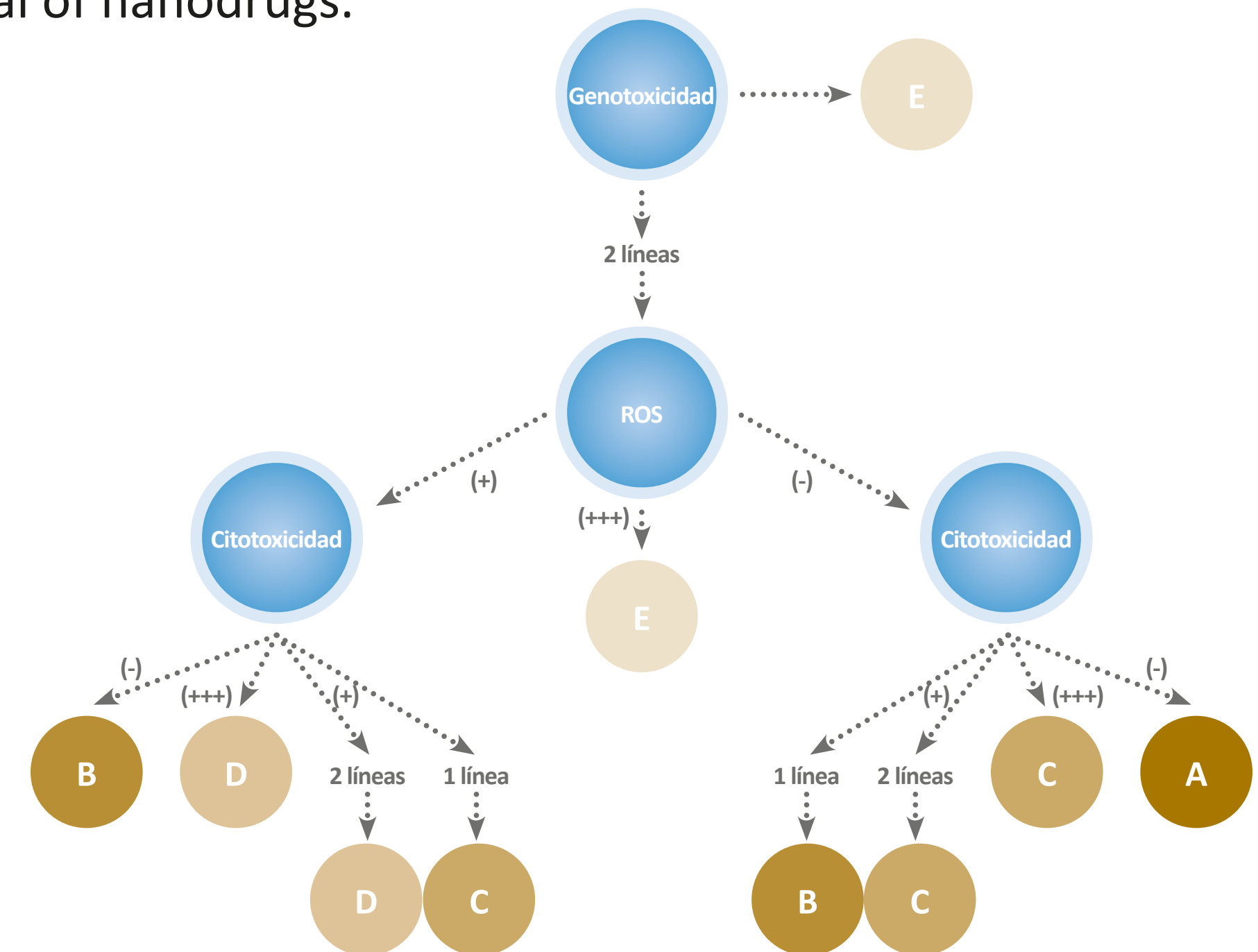


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## ITS for toxicity assessment of nanodrugs

An Intelligent Testing Strategy has been designed to screen for the toxicity potential of nanodrugs.



TRL: 4

Time to market: medium / 3-5 /



4

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IK4  CIDETEC  
Research Alliance

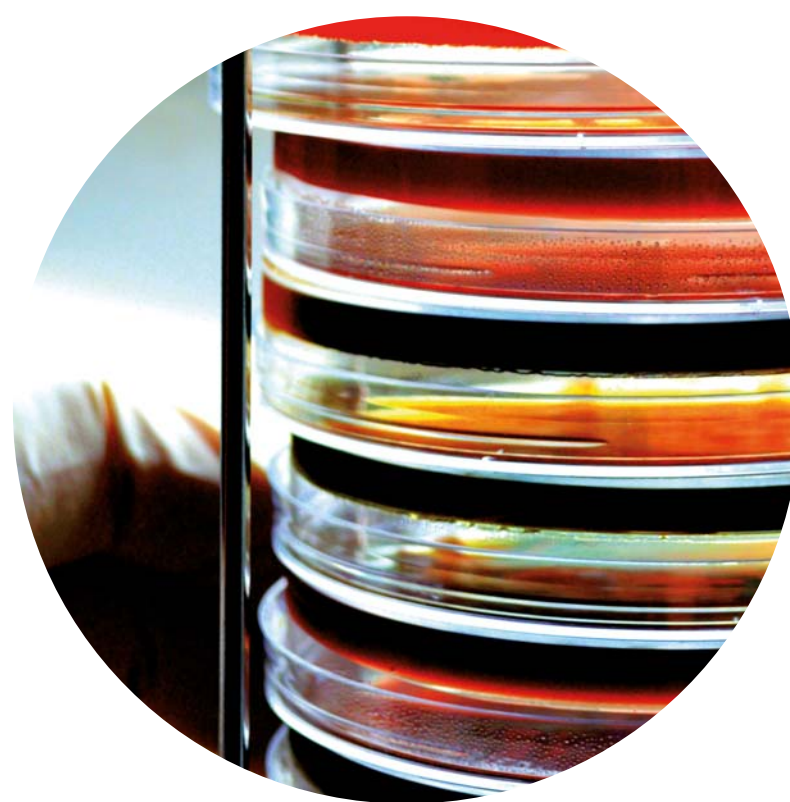
IK4-CIDETEC is a Research Institute specialized in generating and transferring knowledge and technology in the areas of materials, surfaces and energy.

[www.cidetec.es](http://www.cidetec.es)



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### NANOMEDICINE RELATED ACTIVITY

- Synthesis of Biomaterials
- Polymer NPs for theragnosis
- Nanogels, nanocapsules: pH responsive waterborne colloidal systems for drug-delivery and tissue engineering
- Injectable hydrogels for tissue engineering
- Bioactive surfaces
- Electrochemical biosensors based on plastic electronics

### MAIN INFRASTRUCTURES

- 350 m<sup>2</sup> classified labs prepared for GMP production
- Chromatography (FPLC, HPLC, GPC)
- Polymer characterization
- Spectroscopy and microscopy
- Cell culture

### CONTACT PERSON

Name: Dr. Iraidia Loinaz  
E-mail: [iloinaz@cidetec.es](mailto:iloinaz@cidetec.es)



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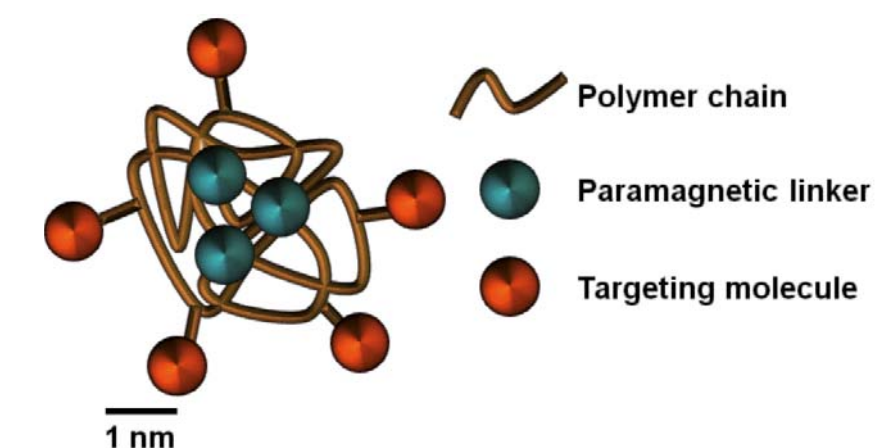
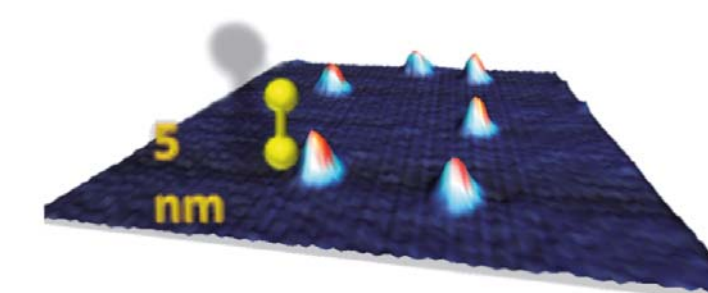
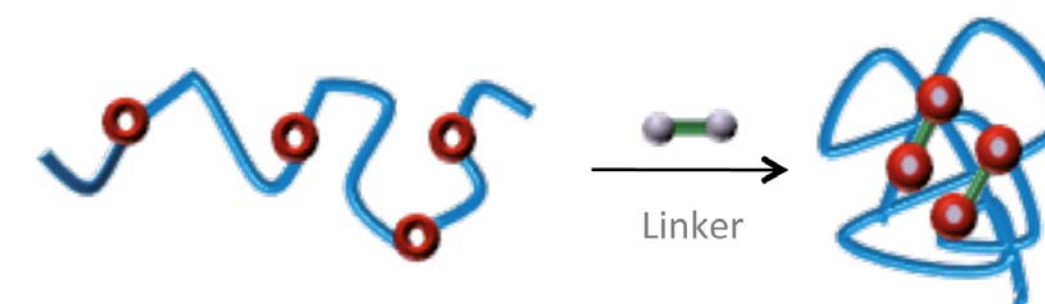
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## POLYMER NANOPARTICLES FOR TARGETED IMAGING AND THERAPY OF CANCER

### Multifunctional colloidal systems of nanometric size

Single chain polymer nanoparticles of nanometric size (<20nm) produced in water by easily scalable process for drug delivery and imaging applications.

IK4-CIDETEC applies this technology for image and treat pancreatic cancer.



TRL: 4

Time to market: medium/long 3-5 / >5



4

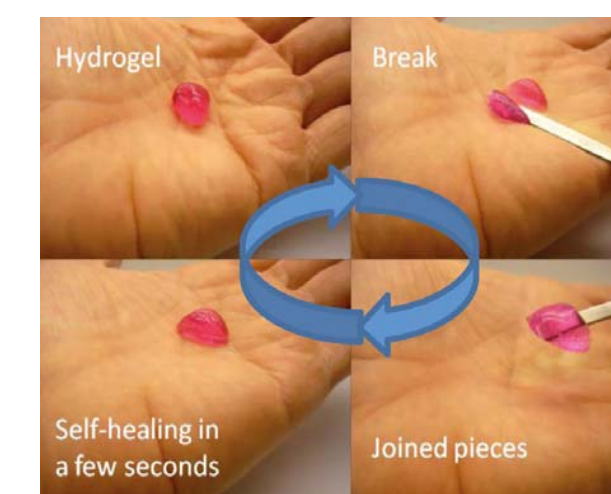
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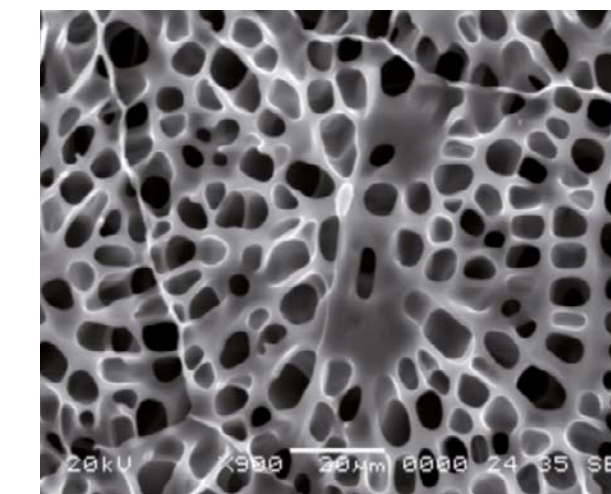
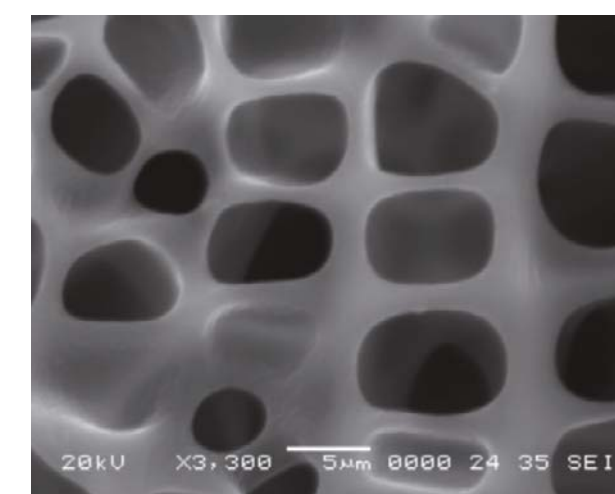
## HYDROGELS

### Injectable hydrogels with self-healing properties

Owner technology of a new family of injectable hydrogels with astounding self-healing and shear thickening properties to be used as medical device or injectable scaffold in regenerative medicine.



Self-healing process  
of a hydrogel



SEM micrographs of the  
freeze-dried hydrogel

**TRL:** 4-5

**Time to market:** short if it is applied as a medical device



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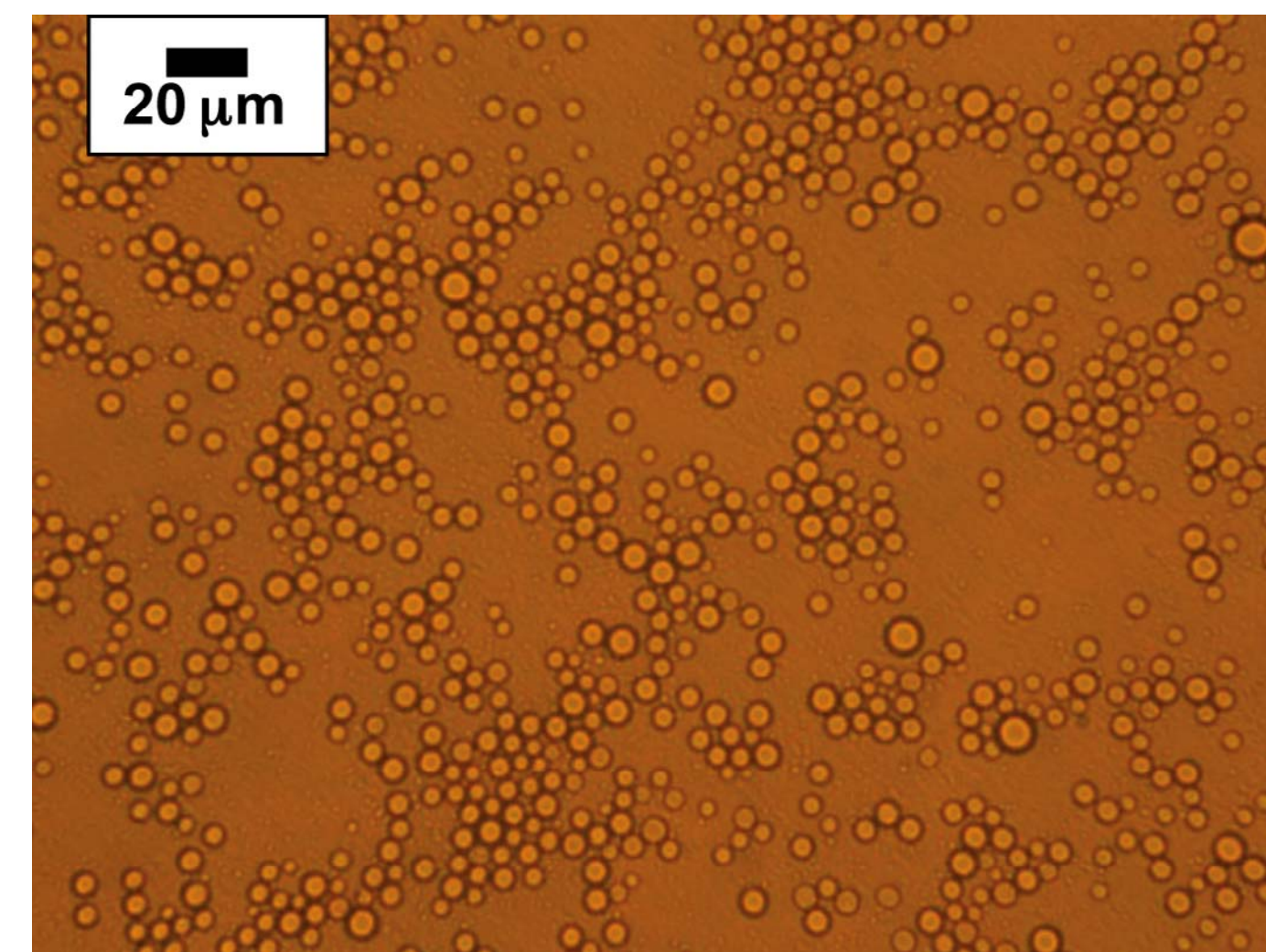
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## NANOCAPSULES

### Emulsifiers based on amphiphilic diblock copolymers

pH responsive capsules based on block copolymers for the encapsulation of Active Pharmaceutical Ingredients in cosmetics, pharma or food industry. The length of both diblocks can be adjusted to encapsulate preferentially hydrophilic or hydrophobic phase.



TRL: 4  
Time to market: medium



A person wearing a white lab coat and safety glasses is holding a small, square, green microchip with gold pins. The background is a blurred laboratory setting. There are three overlapping circles on the left side of the image: a gold one at the top and two blue ones below it.

4

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IK4  TEKNIKER

Research Alliance

IK4-TEKNIKER (TKN) is a private non-profit research organisation. IK4 Tekniker is part of the IK4 Research Alliance. Micro-Nano manufacturing, Electronics and Smart System activities are closely related in IK4 Tekniker, aiming to integrate the expertise of their main technology areas to support key industrial and service sectors in non-conventional system development.

[www.tekniker.es](http://www.tekniker.es)



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## NANOMEDICINE RELATED ACTIVITY

- Micro and Nanofabrication Unit in a Clean-room
- *In-vitro* diagnostic tools for biomolecules and cells detection by electrochemistry and optical principles
- Physical and biochemical modification of scaffolds for medicine regenerative on synthetic and natural biopolymers
- Coordination of the FP7 Project NEURIMP ([www.neurimp.eu](http://www.neurimp.eu)) in the field of regenerative medicine (2014-2017)

## CONTACT PERSON

Name: Santos Merino  
E-mail: [smerino@tekniker.es](mailto:smerino@tekniker.es)

## MAIN INFRASTRUCTURES

- Micro and Nanofabrication by UV-Lithography, Nanoimprinting, Plasma Etching and Physical Vapour Deposition
- Surface Plasmon Resonance, Impedimetric and Voltammetry measurements and own developments based on nanostructures on chip for biomolecules detection
- Micro and Nanofluidics. Chips integration on Smart systems
- Biofunctionalization of biomolecules and cells on substrates or conjugation with micro/na.particles



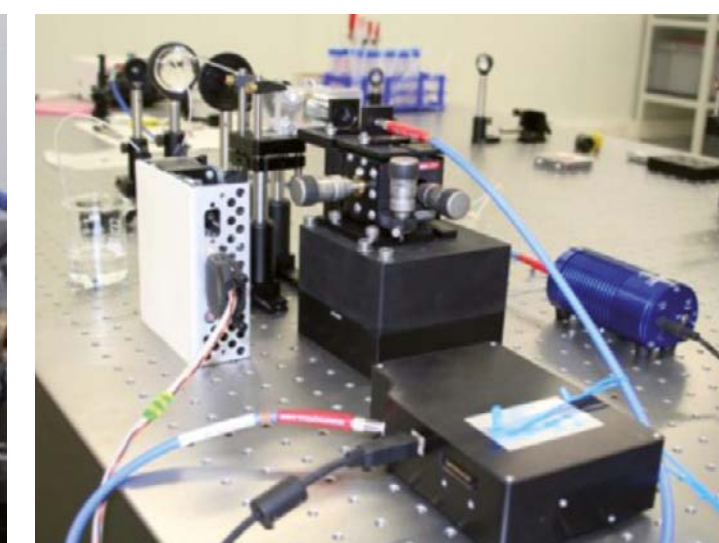
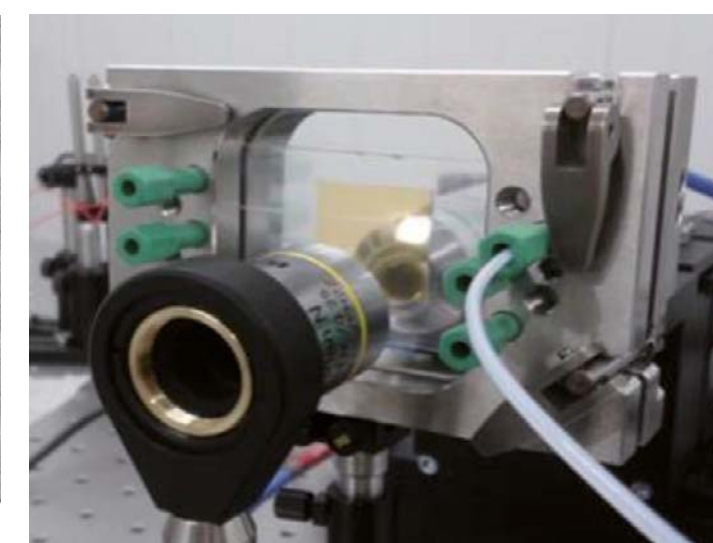
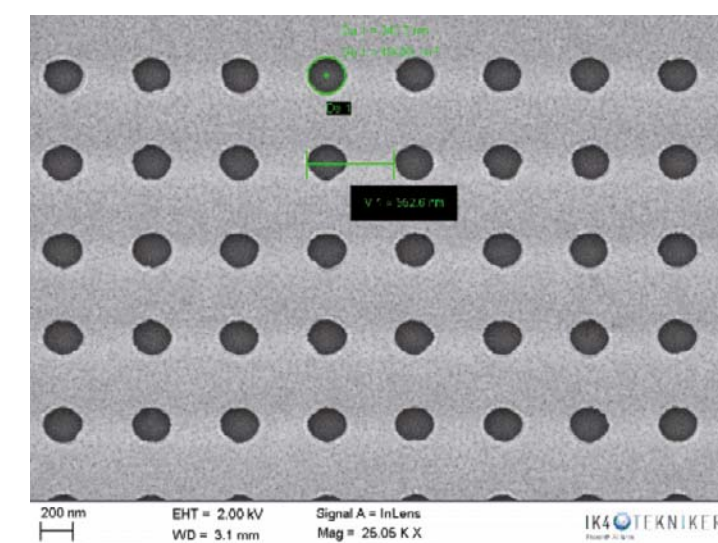
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### In-vitro diagnostic by LSPR

System integration for microfluidic and sample processing on chip. Multiplexed detection of biomolecules by Localized Surface Plasmon Resonance (LSPR).



TRL: 4

Time to market: short/medium/long <3 / 3-5 / >5



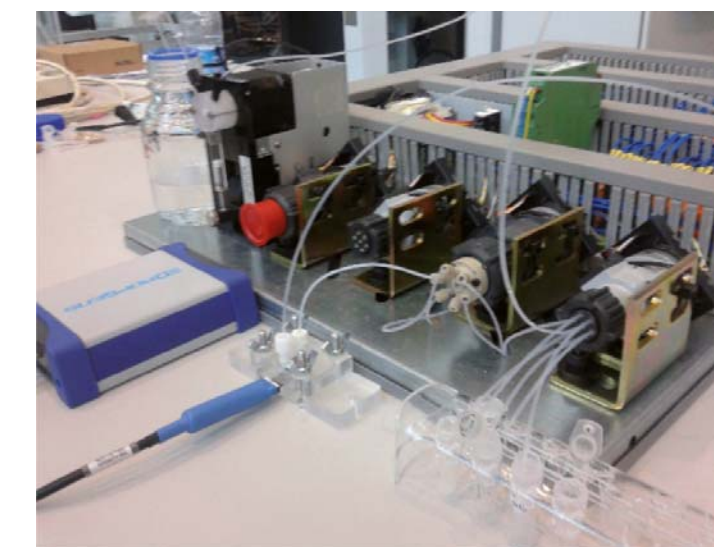
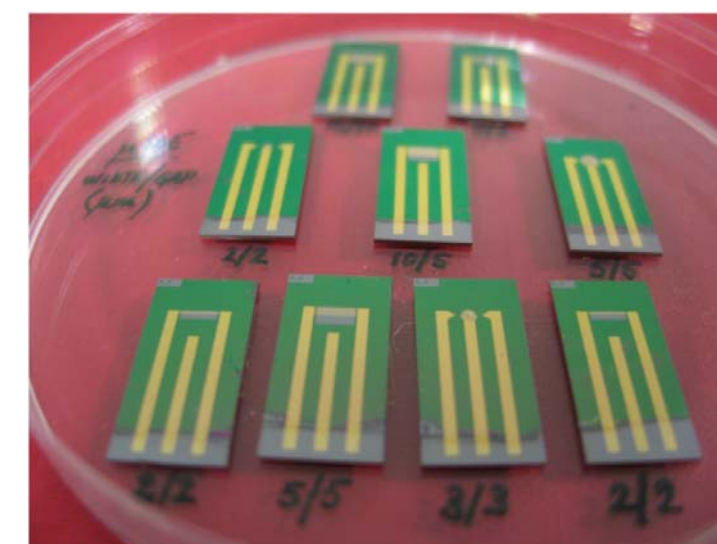
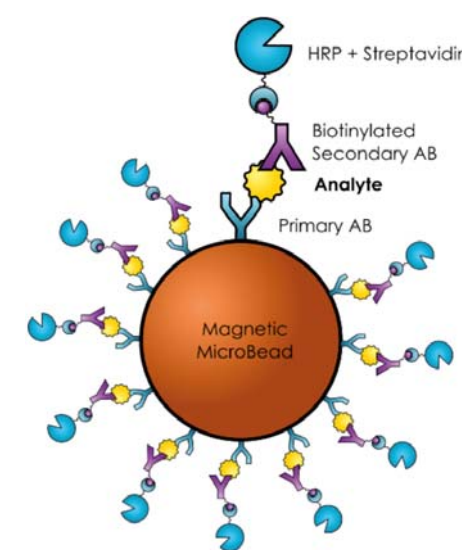
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### In-vitro diagnostic of biomolecules by electrochemistry measurements

Fluidic integration and sample preparation on chip  
for robust and sensitive detection of biomolecules.



TRL: 5

Time to market: short/medium/long <3 / 3-5 / >5



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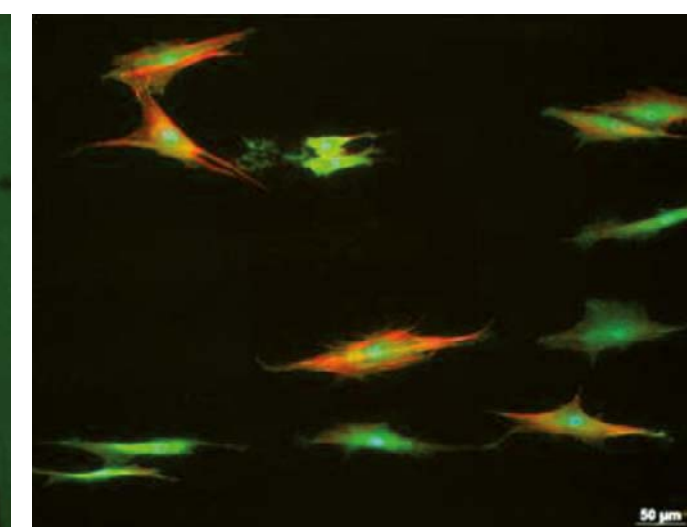
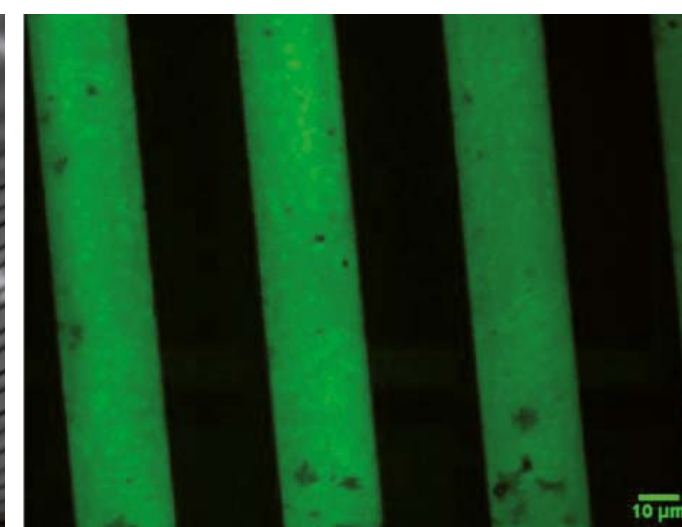
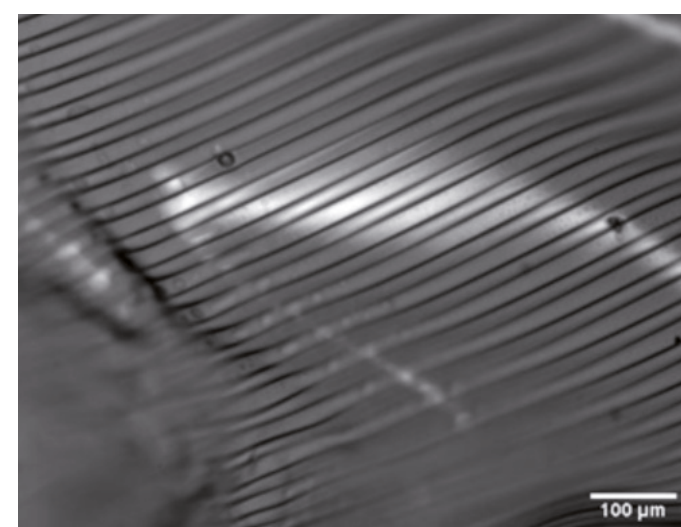
Technology  
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### Micro and Nanostructures for cell attachment, proliferation and differentiation

- Physical and Biochemical cues on natural and synthetic biopolymers (PLA, PLGA, PLC, Hyaluronic acid, Chondroitin Sulphate, Heparin) through topography and chemical signals induced by ox-Glycosaminoglycans and proteins with control on the microscale.
- Peripheral nerve implants containing an internal aligned channels array.

 NEURIMP

 SEVENTH FRAMEWORK  
PROGRAMME



TRL: 5

Time to market: short/medium/long <3 / 3-5 / >5



4

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vicomtech

ik4 research alliance

eHealth & Biomedical  
Application department

Vicomtech-IK4 is a non-profit  
applied research centre specialised  
in Computer Graphics, Visual  
Computing and Multimedia  
technologies with 105 employees,  
28 of whom are PhD.

[www.vicomtech.org](http://www.vicomtech.org)



# vicomtech

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### NANOMEDICINE RELATED ACTIVITY

- Biomedical Image Reconstruction
- Biomedical Image Processing, Analysis and Quantification
- Biomedical Multi-Modal Image Registration
- Biomedical Image Visualisation
- Systems Biology
- Data Mining, Knowledge Engineering and Visual Analytics
- Potential applications: molecular imaging, image-guided drug delivery, in-vitro assay analysis, etc.

### CONTACT PERSON

Name: Grégory Maclair

E-mail: [gmaclair@vicomtech.org](mailto:gmaclair@vicomtech.org)

### MAIN INFRASTRUCTURES

- Vicomtech-IK4 is equipped for research into new medical image display techniques, intraoperative navigation, rapid prototyping, etc. The four clinical stages - Diagnosis, Preoperative, Intraoperative and Postoperative - are covered:
- Equipment: MicroCT, Microscope, US devices, surgical microscope and endoscopes, etc...

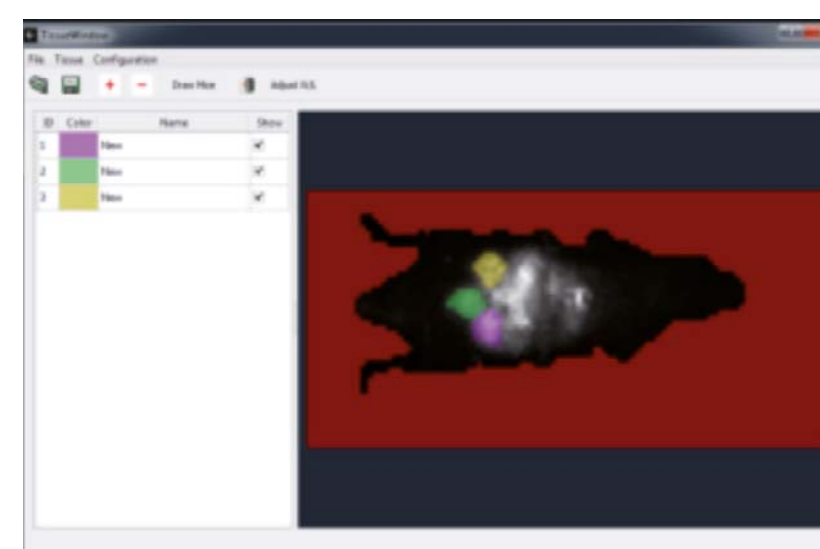


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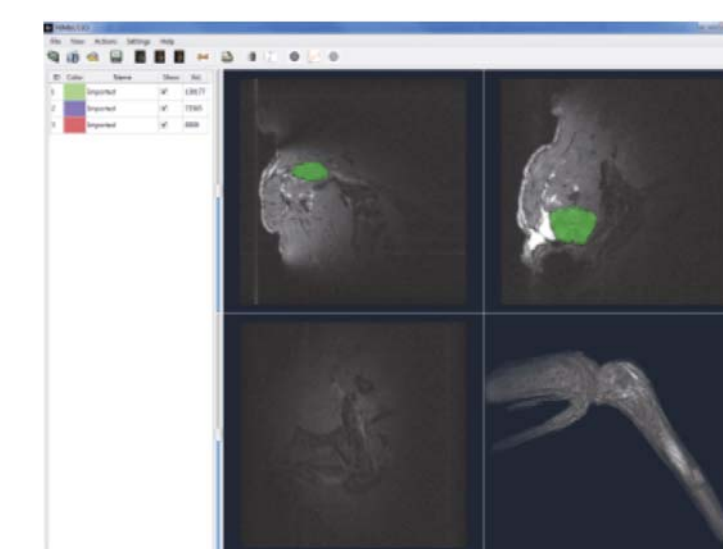
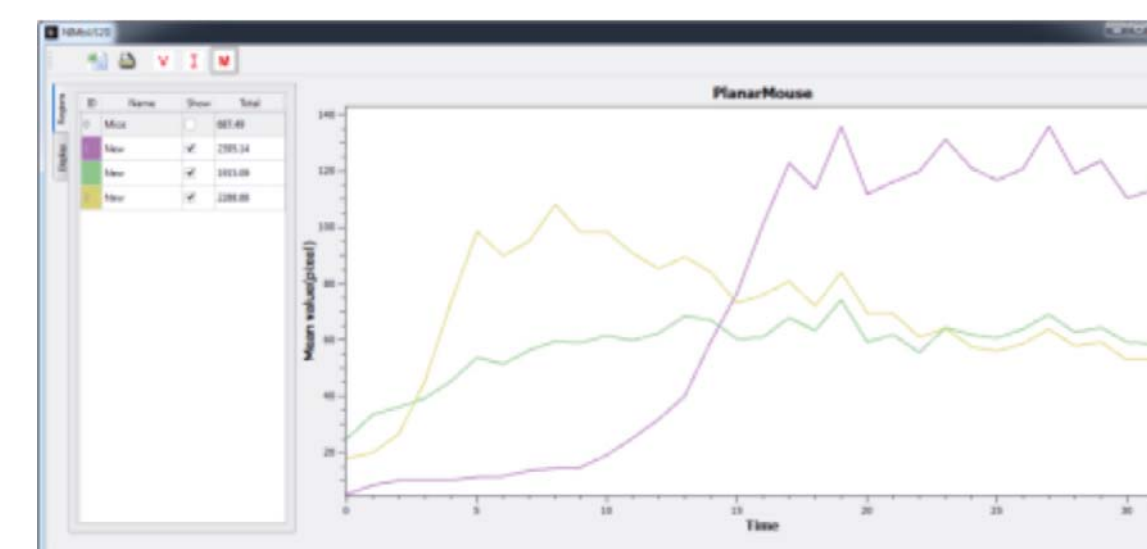
Technology  
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## Image processing solution for nanosystems's development and validation

Tools for processing and analysis of MRI and SPECT/PET images in combination with magnetic and radiolabelled nanosystems for theranostics. The designed solution enables the evaluation of NPs biodistribution and kinetic behavior of the nanosystems developed.



PET-based NPs biodistribution and kinetic monitoring for toxicity evaluation



MRI-based NPs segmentation for diagnostic

**TRL: 3**  
**Time to market: 3-5**





A network diagram with a background of light gray nodes and lines. A subset of nodes and their connecting lines are highlighted in black. On the right side, a large, semi-transparent orange circle highlights five of these black nodes. Inside this circle, the number '5' and the word 'Companies' are written in white.

**5**  
Companies





**5**  
Companies



Biopraxis Research AIE constitutes the R&D division of Praxis Pharmaceutical Group. Praxis is a young pharma company, which focuses in offering novel drugs and diagnosis tools for rare and neglected diseases, combining bio and nano sciences.

[www.grupo-praxis.com](http://www.grupo-praxis.com)





**5**  
**Companies**

### **NANOMEDICINE RELATED ACTIVITY**

Nanomedicine is a key pillar for Biopraxis development strategy. We have established a capacitation program supported by the Basque Government, and we have developed an international network of partners to make nanomedicine applied to rare and neglected diseases a reality. A key issue is the-always challenging-industrialization of this technologies.

### **MAIN INFRASTRUCTURES**

- Equipment for production and characterization of nano lipid entities
- Pilot plant for nanovesicles based on compressed fluids (together with Nanomol tech)
- cGMP production lines

### **CONTACT PERSON**

Name: Angel Del Pozo  
E-mail: [apozo@praxisph.com](mailto:apozo@praxisph.com)





**5**  
Companies

### Novel strategy for the treatment of chronic wounds

Lipid nanoparticles are currently receiving increasing interest because they permit the topical administration of proteins, such as recombinant human epidermal growth factor (rhEGF), in a sustained and effective manner.

Because chronic wounds have become a major healthcare burden, the topical administration of rhEGF-loaded lipid nanoparticles, namely solid lipid nanoparticles (SLN) and nanostructured lipid carries (NLC), appears to be an interesting and suitable strategy for the treatment of chronic wounds. Praxis is has developed this approach in cooperation with University of the Basque Country UPV/EHU, optimizing prototypes and validated their efficacy in vitro and in vivo. Lipid nanoparticles are also applicable to the reformulation of other APIs (i.e. antibiotics or anti parasitic).

The production process has being up scaled in our production facilities in Miñano, and will fulfill legal preclinical in the following months.

**TRL: 5**

**Time to market:** medium 3-5





**5**  
Companies

### Theranostics for treatment of glioma

In the framework of the FP7 project Theraglio, novel systems for theranostics for glioma are being developed. These systems are based in the use of microbubbles or micro-vesicles as enhanced contrasts agents, including elements to obtain fluorescence, targeting of tumor vessels and RMI. The diagnosis elements are further decorated with nanoparticles, in order to give complementary therapeutic properties as in situ drug delivery systems. TheraGlio will provide multimodal image guidance during surgery with the final goal of prolonging patients' survival, as a result of a safer and larger tumour resection and tailored delivery of specific chemotherapeutic molecules. The Consortium, composed by ten EU partners will set up a clinical trial for 2017 (More info at [www.theraglio.eu](http://www.theraglio.eu)).

The TheraGlio project is receiving funding from the European Union Seventh Framework Programme (FP7/2007-2013) under Grant Agreement n° 602923”.

**TRL: 6**  
**Time to market:** medium 3-5







**5**  
Companies

### Innovative drugs based on nano entities produced by compressed fluids

This technology, developed by ICMAb-CSIC/ Nanomol and GMP up scaled by Praxis is based on the use of compressed fluids (CFs), mainly CO<sub>2</sub>, as green solvents for the preparation, in a single unit operation, of nanopharmaceuticals. These nanoparticulate materials are obtained with outstanding control of their structural characteristics (size, polymorphic purity, crystallinity level, morphology, supramolecular assembly). This technology has already shown its wellness for the production of innovative multifunctional NVs for drug delivery and yielded nanomedicine candidates, which are in advanced stage of pre-clinical development and with promising perspectives to proceed to clinical testing. Nano vesicles are easy to conjugate with targeting molecules, meaning an interesting platform for drug repositioning for different applications (Rare lysosomal deposit diseases like Fabry and Sanfilippo, novel antimicrobials, anti cancer drugs, etc.

**TRL: 5**

**Time to market:** medium 3-5





5  
Companies

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M I D A T E C H

Midatech is a world leader in the design, synthesis and manufacture of biocompatible gold nanoparticles with a core focus on therapeutics for diabetes and cancer. The Company is also exploring the use of GNPs in other healthcare applications including vaccines, diagnostics and medical imaging.

[www.midatechgroup.com](http://www.midatechgroup.com)





**5**  
Companies

### NANOMEDICINE RELATED ACTIVITY

- Novel particles with single or multiple active pharmaceutical ingredients tailored to optimal therapeutic benefits
- Seasoned management to guide development of therapeutics from bench top to bedside
- Advancing drug pipeline: successful phase I safety and drug properties demonstrated

### MAIN INFRASTRUCTURES

- State-of-the-art manufacturing facility with sufficient capacity for manufacturing clinical trial materials
- Separate sterile production unit within its GMP manufacturing facility

### CONTACT PERSON

Name: Justin Barry  
E-mail: [barry@midatech.eu](mailto:barry@midatech.eu)





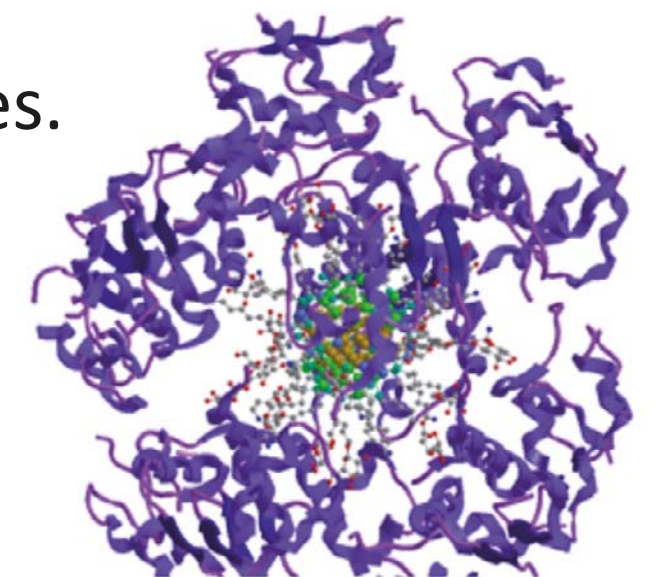
5  
Companies



## METABOLIC DISEASE: DIABETES

### Transbuccal insulin

Midatech's most advanced programme takes advantage of the fact that binding a peptide hormone to a nanoparticle allows its absorption across the mucosa of the cheek. This has enabled Midatech and its partner, Monosol Rx, to develop needle-free delivery of insulin for diabetes mellitus. As part of this joint venture, Midatech has combined its unique GNP technology with its partner's expertise in transitioning pharmaceuticals to film to develop a self-dissolving strip containing nanoparticle insulin referred to as Midaform™ Insulin PharmFilm®. This mode of administration provides a more convenient and discrete form of insulin delivery than injections and has the potential to make injections redundant in the treatment of diabetes.



**TRL:** a Phase II trial is planned to start in 2015  
**Time to market:** medium 3-5





5  
Companies

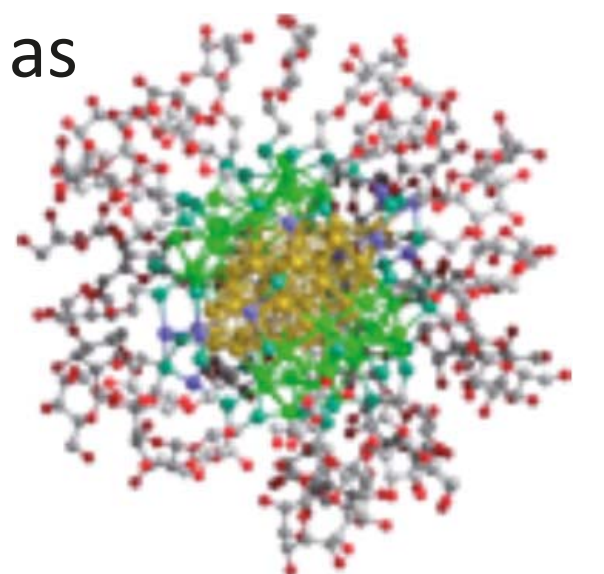
## ONCOLOGY

Midatech is developing a new cancer therapies based on nanomedicines combining validated chemotherapeutics, targeting molecules and gold NPs.

**Ovarian Cancer:** Development of GNPs which carry a tumour-targeting agent, folic acid (FA) and a platinum cytotoxic compound. The targeting agent has been selected because ovarian carcinoma cells over-express the receptor for FA on their membranes and platinum is an effective cytotoxic for ovarian cancer.

**Liver Cancer:** Chemotherapeutics will be attached to liver-targeting GNPs and tested for effectiveness in liver cancer models. A range of chemotherapeutics are being studied.

**Brain Cancer:** The Company has demonstrated the specific migration of GNPs to the brain. Optimization of the passage of GNPs through the blood-brain-barrier combined with chemotherapeutic agents will allow a new generation of therapeutic options for diseases such as glioblastomas.



**TRL:** pre-clinical stage of development  
**Time to market:** long >5





[www.nanobasque.eu](http://www.nanobasque.eu)

[nanobasque@spri.es](mailto:nanobasque@spri.es)

 nanoBasque

EUSKO JAURLARITZA



GOBIERNO VASCO

EKONOMIAREN GARAPEN  
ETA LEHIAKORTASUN SAILA

DEPARTAMENTO DE DESARROLLO  
ECONÓMICO Y COMPETITIVIDAD

