

IBEC ANNUAL REPORT

2019

IN REVIEW



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Institute for Bioengineering of Catalonia

2019

IN REVIEW

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INTRODUCTION

BY JOSEP SAMITIER



2019 represented another great year in the evolution of IBEC towards our main goal: to combine excellent research with the search of solutions that help to improve health and generate wealth. This annual report is, as ever, a round-up of the highlights in this year but also a description of this evolution.

In this year, IBEC has been consolidated as an excellent center receiving a second Severo Ochoa recognition, it has strengthened our international alliances with European key institutions such as EMBL and TU Eindhoven and it has hired world-class scientists such as ICREA Research Professor Giuseppe Battaglia coming from UCL London. During 2019, IBEC researchers have achieved our own record of 174 indexed scientific papers, 81% of them in the first quartile. Our researchers Elena Martínez, Samuel Sánchez and Loris Rizzello have achieved this year the highest distinctions from the European Research Council, obtaining 3 new ERC grants. Pere Roca-Cusachs won the EBSA Prize. We also have welcomed one new Associated Researcher from the University of Barcelona (UB), Professor Jordi Alcaraz, and two from the Polytechnic University of Catalonia (UPC), Professor Carlos Alemán and Dr. Jordi Puiggalí. In this year, our younger researchers presented 10 new PhD theses, one of them double appointed with the TU Eindhoven.

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But IBEC has also performed at the highest level in clinical collaborations and technology transfer. In 2019, we have contributed to clinical highlights such as a pioneer operation designed to repair the heart tissue of a patient with a bioengineered implant, the development of mHealth technology to detect sleep apnea at home or the use of virtual reality to treat speech disorders. We have submitted 2 new patents, one in the diagnostic area, achieving a total of 8 patents active under valorization programs. We have also signed 7 new contracts with Catalan and international companies. As a result of all these efforts, IBEC received in 2019 the FEI Prize as an “Innovation supporting Institution of the year” and also the TECNIO seal from the Catalan Government, allowing SMEs and companies to identify us as a partner offering differential technology and increasing innovation rates.

In 2019, IBEC has received many distinguished guests such as two Nobel Prize Laureates, the President of the European Research Council and the visit of the Catalan Vice-President. And regarding the social impact, we are proud to have reached millions of people with our press and communication activities, more than 3000 students with our outreach activities and to have been able to initiate a new collaboration with an innovative educational program, the “Magnet alliance” which aims to fight against school segregation.

Summarizing, 2019 has been another great year in the evolution of IBEC, positioning the institute as a global player in bioengineering. Thanks to the fantastic efforts of all IBEC staff and the support of our partners, we look forward to another successful year in 2020.



Institute for Bioengineering of Catalonia

Josep Samitier

Director of IBEC



A YEAR IN NUMBERS

174

INDEXED PAPERS

81%

IN THE FIRST
QUARTILE Q1

1

NEW ICREA GROUP LEADER
(7 ICREA IN TOTAL)

1

NEW SEVERO OCHOA
AWARD TO EXCELLENCE

3

NEW ERC GRANTS

6

EU RUNNING
COORDINATED PROJECTS

2

NEW INTERNATIONAL
SCIENTIFIC ALLIANCES

2

SCIENTIFIC AWARDS

1

PRIZE TO
INNOVATION

1

NEW OPEN INNOVATION
LAB ESTABLISHED

8

PATENTS ACTIVE UNDER
VALORIZATION PROGRAMS

1,1M€

INVOICED TO COMPANIES
FOR CONTRACT RESEARCH
AGREEMENTS

3

NEW “LA MARATÓ”
GRANTS

3

NEW “LA CAIXA”
GRANTS

10

PHD THESES

14,4M

PRESS RELEASES AUDIENCE

3K

STUDENTS REACHED

1

NEW SOCIAL PROGRAM

3,7K

NEW FOLLOWERS
ON SOCIAL MEDIA



RESEARCH GROUPS



Research Group:

NANOSCOPY FOR NANOMEDICINE

Group Leader: **Lorenzo Albertazzi**

Selected publication: S. Pujals et al. (2019). Super-resolution microscopy as a powerful tool to study complex synthetic materials. *Nature Reviews Chemistry* 3, (2), 68-84

Research Group:

MOLECULAR BIONICS

Group Leader: **Giuseppe Battaglia**

Selected publication: Y. Zhu et al. (2019). Metabolically Active, Fully Hydrolysable Polymersomes. *Angewandte Chemie*, Volume131, Issue14.



Research Group:

PROTEIN PHASE TRANSITIONS IN HEALTH AND DISEASE

Group Leader: **Benedetta Bolognesi**

Selected publication: B. Bolognesi et al. (2019). The mutational landscape of a prion-like domain. *Nature Communications* 10, (1), 4162

Research Group:

SYNTHETIC MORPHOGENESIS

Group Leader: **Vito Conte**

Selected publication (in collaboration with Trepát's Group): M. Uroz et al. (2019). Traction forces at the cytokinetic ring regulate cell division and polyploidy in the migrating zebrafish epicardium. *Nature Materials* 18, 1015-1023





Research Group:

BIOMATERIALS FOR REGENERATIVE THERAPIES

Group Leader: **Elisabeth Engel**

Selected publication: J. Marti-Muñoz et al. (2019). Feasible and pure P205-CaO nanoglasses: An in-depth NMR study of synthesis for the modulation of the bioactive ion release. *Acta Biomaterialia* 94, 574-584

Research Group:

NANOMALARIA

Group Leader: **Xavier Fernández- Busquets**

Selected publication: A. Biosca et al. (2019). An immunoPEGliposome for targeted antimalarial combination therapy at the nanoscale. *Pharmaceutics* 11, (7), 341



Research Group:

NANOSCALE BIOELECTRICAL CHARACTERIZATION

Group Leader: **Gabriel Gomila**

Selected publication: M. Checa et al. (2019). Mapping the dielectric constant of a single bacterial cell at the nanoscale with scanning dielectric force volume microscopy. *Nanoscale* 11, 20809-20819



Research Group:

NANOPROBES AND NANOSWITCHES

Group Leader: **Pau Gorostiza**

Selected publication: F. Riefolo et al. (2019). Optical control of cardiac function with a photoswitchable muscarinic agonist. *Journal of the American Chemical Society* 141, (18), 7628-7636





Research Group:

BIOMEDICAL SIGNAL PROCESSING

Group Leader: **Raimon Jané**

Selected publication: Y. Castillo-Escario et al. (2019). Entropy analysis of acoustic signals recorded with a smartphone for detecting apneas and hypopneas: A comparison with a commercial system for home sleep apnea diagnosis. *IEEE Access* 7, 128224-128241.

Research Group:

SIGNAL AND INFORMATION PROCESSING FOR SENSING SYSTEMS

Group Leader: **Santiago Marco**

Selected publication: J. Burgués et al. (2019). Smelling nano aerial vehicle for gas source localization and mapping. *Sensors* 19, (3), 478



Research Group:

BIOMIMETIC SYSTEMS FOR CELL ENGINEERING

Group Leader: **Elena Martínez**

Selected publication: G. Altay et al. (2019). Self-organized intestinal epithelial monolayers in crypt and villus-like domains show effective barrier function. *Scientific Reports* 9, (1), 10140

Research Group:

PLURIPOTENCY FOR ORGAN REGENERATION

Group Leader: **Núria Montserrat**

Selected publication: E. Garreta et al. (2019). Fine tuning the extracellular environment accelerates the derivation of kidney organoids from human pluripotent stem cells. *Nature Materials* 18, 397-405



Research Group:

TARGETED THERAPEUTICS AND NANODEVICES

Group Leader: **Silvia Muro**

Selected publication: R. Manthe et al. (2019). δ -Tocopherol Effect on Endocytosis and its Combination with Enzyme Replacement Therapy for Lysosomal Disorders: a New Type of Drug Interaction? *J Pharm Exp Ther.* 379(3):823-833

Research Group:

CELLULAR AND RESPIRATORY BIOMECHANICS

Group Leader: **Daniel Navajas**

Selected publication: R. Farré et al. (2019). Easy-to-build and affordable continuous positive airway pressure CPAP device for adult patients in low-income countries. *European Respiratory Journal* 53, (5), 1802290



Research Group:

BIOSENSORS FOR BIOENGINEERING

Group Leader: **Javier Ramón Azcón**

Selected publication: A. Hernández-Albors et al. (2019). Microphysiological sensing platform for an in-situ detection of tissue-secreted cytokines. *Biosensors and Bioelectronics: X* 2, 100025



Research Group:

MOLECULAR AND CELLULAR NEUROBIOTECHNOLOGY

Group Leader: **José Antonio del Río**

Selected publication: A. Hervera et al. (2019). PP4-dependent HDAC3 dephosphorylation discriminates between axonal regeneration and regenerative failure. *EMBO J* (2019)38:e101032.





Research Group:

CELLULAR AND MOLECULAR MECHANOBIOLOGY

Group Leader: **Pere Roca-Cusachs**

Selected publication: J. Kechagia et al. (2019). Integrins as biomechanical sensors of the microenvironment. *Nature Reviews Molecular Cell Biology* 20, (8), 457-473

Research Group:

NANOBIOENGINEERING

Group Leader: **Josep Samitier**

Selected publication: J. Montero et al. (2019). Destabilization of NOXA mRNA as a common resistance mechanism to targeted therapies. *Nature Communications* 10, (1), 5157



Research Group:

SMART NANO-BIO-DEVICES

Group Leader: **Samuel Sánchez**

Selected publication: A.C. Hortelão et al. (2019). Targeting 3D bladder cancer spheroids with urease-powered nanomotors. *ACS Nano* 13, (1), 429-439



Research Group:

BACTERIAL INFECTIONS: ANTIMICROBIAL THERAPIES

Group Leader: **Eduard Torrents**

Selected publication: N. Blanco-Cabra et al. (2019). Novel oleanolic and maslinic acid derivatives as a promising treatment against Bacterial biofilm in nosocomial infections: An in vitro and in vivo study. *ACS Infectious Diseases* 5, (9), 1581-1589



Research Group:

INTEGRATIVE CELL AND TISSUE DYNAMICS

Group Leader: **Xavier Trepap**

Selected publication: M. Uroz et al. (2019). Traction forces at the cytokinetic ring regulate cell division and polyploidy in the migrating zebrafish epicardium. *Nature Materials* 18, 1015-1023

Research Group:

SYNTHETIC, PERCEPTIVE, EMOTIVE AND COGNITIVE SYSTEMS (SPECS)

Group Leader: **Paul Verschure**

Selected Publication: D. Pacheco et al. (2019). Coordinated representational reinstatement in the human hippocampus and lateral temporal cortex during episodic memory retrieval. *Nature Communications*, 10, 2255



SCIENTIFIC HIGHLIGHTS

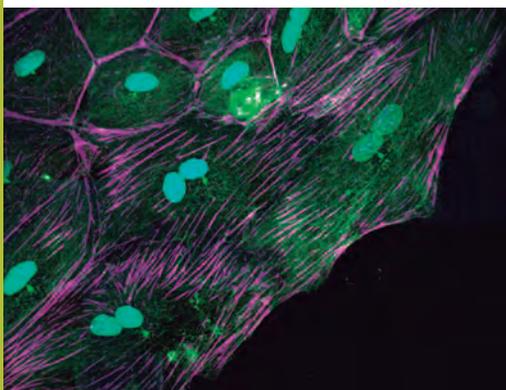
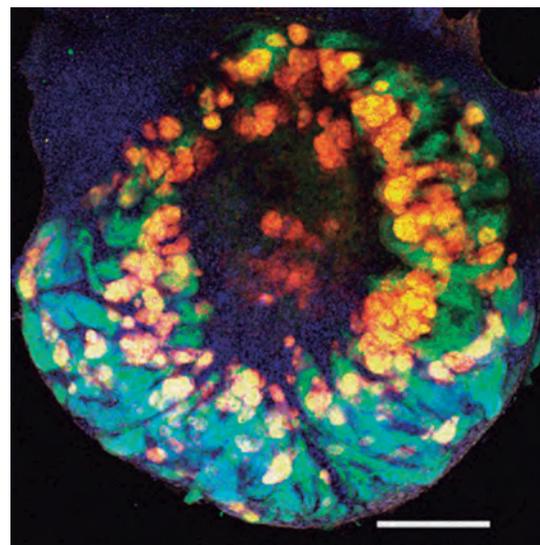
IBEC RESEARCHERS ACHIEVE VASCULARIZED MINI-KIDNEYS FROM STEM CELLS

Researchers from the IBEC have created, for the first time, 3D organoid cultures from pluripotent stem cells, which resemble human embryonic kidney tissue during the second trimester of pregnancy. Also, using biomaterials that mimic the embryonic microenvironment, researchers have achieved mini-kidneys with relevant features for immediate use in renal disease modeling.

The findings have been published in an article in *Nature Materials*, where the researchers led by ICREA Research Professor and Group Leader at IBEC, Núria Montserrat, detail how they have created these organoids and how these 3D cultures mimic essential aspects during the formation of the kidney, such as distribution, functionality and specific organization of cells.

This type of approach is a promising strategy for the development of biofunctional tissues, which can be used both for screening of drugs and for development of personalized medicine.

E. Garreta et al. (2019). Fine tuning the extracellular environment accelerates the derivation of kidney organoids from human pluripotent stem cells. Nature Materials Ahead, Vol. 18, 397-405. ■



BINUCLEATED CELLS COULD BE THE KEY IN HEART REGENERATION

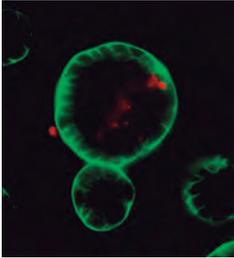
A research team led by the ICREA Research Professor and IBEC Group Leader Xavier Trepas, in collaboration with the CMR[B], discovered a mechanism that generates binucleated cells. This mechanism has been identified during the regeneration of the heart of the zebrafish, and it could be associated with the extraordinary regenerative power of this animal.

After an acute heart lesion, such as a myocardial infarction, the human heart is unable to regenerate. The adult cardiac cells cannot grow and divide to replace the damaged ones, and the lesion becomes irreversible. But this does not happen in all animals.

The extraordinary regenerative capacity of zebrafish, who can completely regenerate its heart even after 20% ventricular amputation, has attracted the attention of researchers from all over the world, who see the range of possibilities that would be opened up if this mechanism of cell regeneration could be applied in human therapies.

M. Uroz et al. (2019). Traction forces at the cytokinetic ring regulate cell division and polyploidy in the migrating zebrafish epicardium. Nature Materials, Vol. 18, 1015-1023. ■





UREA-POWERED NANOMOTORS, A PROMISING THERAPY FOR BLADDER CANCER

The IBEC's 'Smart Nano-Bio-Devices' Group led by ICREA Research Professor Samuel Sánchez published a paper describing how nanomotors can attack 3D bladder cancer spheroids *in vitro*. This nanomotors carry anti-FGFR3 on their outer surface, an antibody that not only enables cancerous cells to be specifically targeted, but also inhibits the fibroblast growth factor signaling pathway, suppressing tumor growth.

Crucially, the fuel that gives the nanomotors the capability of autonomous motion is urea, which is present at high concentrations in the bladder –making these particular nanomotors a promising avenue for this particular cancer, which is the ninth most common cancer worldwide and presents serious recurrence levels.

With urea-powered nanomotors we noticed a better suppression of the bladder cancer cells than when we used nanomotors without the antibody modification, and even more when compared with passive nanoparticles, states Professor Sánchez.

A C Hortelão et al. (2019). Targeting 3D Bladder Cancer Spheroids with Urease-Powered Nanomotors. ACS Nano, Vol. 13, 429-439. ■



LABORATORY MUTATIONS HELP TO UNDERSTAND AMYOTROPHIC LATERAL SCLEROSIS

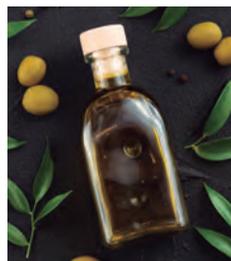
A group of researchers led by IBEC's Junior Group Leader Benedetta Bolognesi used a novel approach called high-throughput mutagenesis to study Amyotrophic Lateral Sclerosis (ALS), with unexpected results.

The results of the study, carried out in collaboration with CRG, showed that aggregation of TDP-43, a protein that aggregates in the motor neurons of nearly all ALS patients, is not harmful but actually protects cells, changing our understanding of ALS and opening the door to radically new therapeutic approaches and other degenerative diseases.

By studying all possible mutations in a protein, we have a much more reliable way to understand toxicity and we are excited to move on to many more proteins implicated in neurodegenerative diseases, asserts Benedetta Bolognesi, who leads the 'Protein Phase Transitions in Health and Disease' Group at IBEC.

It still remains to be established whether aggregation of TDP-43 is also protective in mammalian cells and neurons, something Bolognesi is working on, but if this proves to be the case, it means we will have to entirely change the way we therapeutically address ALS if we want to have significant effects.

B. Bolognesi et al. (2019). The mutational landscape of a prion-like domain. Nature Communications. Volume 10, 1-12. ■



BIOENGINEERED OLIVE OIL FOR THE FIGHT AGAINST ANTIBIOTIC RESISTANCE

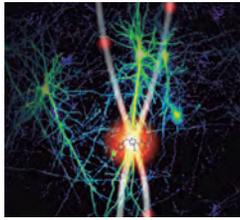
Researchers from IBEC headed by Group Leader Eduard Torrents contributed to new insights that increase the already well-known antimicrobial properties of olive oil by synthesizing two potent antimicrobials from oleanolic acid and maslinic acid, both of which are found in olive oil.

The experts have demonstrated the effect of these derivatives on the bacteria *Staphylococcus aureus*, one of the main causes of infections in catheters and prostheses.

The study, carried out in collaboration with the University of Granada, have been published in the journal ACS Infectious Diseases and reveals for the first time how the antibacterial properties of the synthesized molecules far exceed those of the original compounds.

The antimicrobial properties of oleanolic and maslinic acid have been known for years. In fact, these acids present in olives are not only harmless to the cells in our body, but also, bacteria are not resistant to them, states Eduard Torrents, principal investigator of IBEC's 'Bacterial Infections: Antimicrobial Therapies' Group.

N Blanco-Cabra et al. (2019). Novel Oleanolic and Maslinic Acid Derivatives as a Promising Treatment against Bacterial Biofilm in Nosocomial Infections: An in Vitro and in Vivo Study. ACS Infect. Dis., Vol. 5, 1581-1589. ■



CLOSER TO A FUNCTIONAL ATLAS OF THE BRAIN

Scientists from IBEC led by Pau Gorostiza, ICREA Research Professor and Group Leader at the ‘Nanoprobes and Nanoswitches’ Group, developed a technique to determine the specific function of a neuroreceptor with high spatial and temporal precision, which opens the door to mapping a functional atlas of the brain.

The study, published in PNAS, is based on the activation of photoswitchable drugs with micrometric precision and offers new opportunities on the treatment of neurological diseases such as schizophrenia or depression, which are due to the malfunctioning of a neuronal receptor.

There are already atlases of the brain that allow us to know its anatomy and what neuroreceptors there are in each region, but we still don't know what roles the same type of receptor can play in different regions of the brain, which could locate us be closer to understanding the entire neural network, states Pau Gorostiza.

Pittolo et al. (2019) Reversible silencing of endogenous receptors in intact brain tissue using two-photon pharmacology. PNAS, Vol. 116, 13680-13689. ■

THE HIPPOCAMPUS ORCHESTRATES THE CEREBRAL PROCESS THAT ALLOWS US TO RECALL MEMORIES



Researchers from IBEC have simultaneously recorded, for the first time in humans, the brain activity of the two key areas linked to memory: the hippocampus and the neocortex.

The study, led by ICREA Research Professor and IBEC's Group Leader Paul Verschure, was published in the journal Nature Communications. The results showed

that the hippocampus is responsible for coordinating the memory recovery process, a hypothesis that until now was considered only theoretically.

Our study demonstrates that episodic memory is based on coordinated interactions in a hippocampus-neocortex network, which provides a breakthrough in our understanding of the cerebral mechanism underlying episodic memory and opens up new lines of research related to the orchestration of memory engrams from a more holistic perspective, states Paul Verschure, Group Leader of the ‘Synthetic, Perceptive, Emotive and Cognitive Systems’ Group (SPECS) at IBEC.

D. Pacheco et al (2019), Coordinated representational reinstatement in the human hippocampus and lateral temporal cortex during episodic memory retrieval. Nature Communications, Volume 10, 1-13. ■



FIRST BIOTRANSISTORS TO HEAR SMALL BEATS OF LIFE

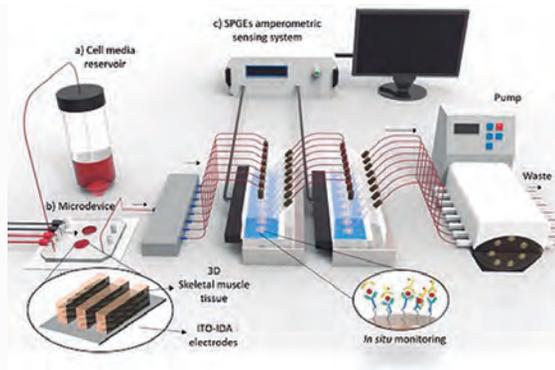
Researchers at IBEC in collaboration with the Institute of Materials Science of Barcelona (ICMAB) have developed a flexible, cheap and biocompatible transistor platform able to record an electrocardiogram of cells and micro-tissues during long periods of time. Also, this bio-platform can measure the effect of drugs on beating cells, opening the door to several applications such as implantable devices for health.

This work was led by Gabriel Gomila, UB Professor and Leader of ‘Nanoscale Bioelectrical Characterization Group’ at IBEC. The findings were published in the journal Biosensors and Bioelectronics, where the researchers explain that they have not only tested the device on cardiac cells and on cardiac micro-tissues, but they have also investigated the effect of two well-known drugs affecting cardiac performance.

It was amazing to see how the electrophysiological platform developed with seeded cardiac cells was functional for several weeks without degrading its performance. This capability opens endless applications in biology and biomedicine, states Adrica Kyndiah, the first author of the study and IBEC researcher.

Kyndiah A et al. (2019) Bioelectronic Recordings of Cardiomyocytes with Accumulation Mode Electrolyte Gated Organic Field Effect Transistors. Biosens Bioelectron, Vol. 150, 111844. ■

A PLATFORM TO DETECT PRO-INFLAMMATORY MOLECULES IN MUSCULAR DISORDERS



Researchers at IBEC led by Javier Ramón, Junior Group Leader of the 'Biosensors for Bioengineering' Group, have developed a sensing platform for the in-situ detection of tissue-secreted pro-inflammatory molecules, the so-called cytokines.

This new methodology opens a new door in the understanding of metabolic-disorders such those found in muscular diseases, and also in the development of drug-screening applications, since allow the scientists monitor the time-dependence secretion of interleukines IL-6 and TNF- α resulting from the electrical and chemical stimulation of 3D skeletal muscle tissues.

From the point of view of the researchers, this revolutionary technology not only contributes to further metabolic-disorder studies, but can be also exported to any laboratory environment and can have a huge impact on the drug-screening process for any organ system.

M. A. Ortega, et al. (2019) Muscle-on-a-chip with an on-site multiplexed biosensing system for in situ monitoring of secreted IL-6 and TNF- α . Lab on a Chip, Vol. 19, 2568-2580. ■



THE MINI- FACTORY OF HUMAN CARDIAC TISSUE

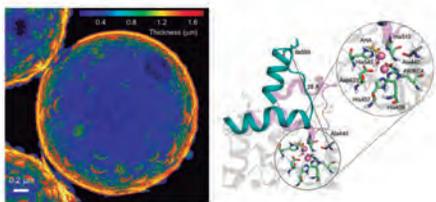
Researchers from the IBEC and the Centre of Regenerative Medicine in Barcelona (CMR[B]) have developed a system called CardioSlice capable of producing tissues in a laboratory that simulate the behaviour of the human heart that and could be used to pre-evaluate the toxicity of drugs in the heart without using animal models. The work was led by Elena Martínez, UB Professor and Group Leader at IBEC.

The findings have been announced in an article published in the journal *Stem Cell Reports* where the authors detail that this new technology is capable of producing cardiac tissues with very special properties from human pluripotent stem cells (PSC) and three-dimensional matrices. For example, they are capable of beating autonomously, produce an electrical signal similar to an electrocardiogram and respond to drugs in the same way that a human heart does.

CardioSlice is like a mini-factory of tissues that could help us to discern which medicines can harm our heart, states Elena Martínez, who leads the 'Biomimetic Systems for Cell Engineering' Group at IBEC. Also, the researcher highlights the physiological relevance of the tissues produced by CardioSlice, at the forefront of the production of human cardiac macro tissues designed to date.

Valls-Margarit et al. (2019). Engineered macroscale cardiac constructs elicit human myocardial tissue-like functionality. Stem Cells Report, Volume 13, 207-220. ■

DISCOVERED THE DETERMINING FACTORS FOR THE PROPULSION OF MICROROBOTS

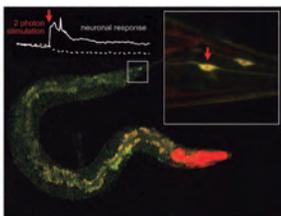


Researchers at IBEC led by ICREA Professor Samuel Sánchez, Group Leader of ‘Smart Nanobio Devices’ Group at the Institute, have discovered the determining processes that allow so-called micromotors to be propelled in a liquid, which was up to now a mystery for the scientific community.

The results have been published in an article in the specialized journal *Nature Communications* where Sánchez and his collaborators describe how it is possible that enzymes, which are catalytic machines on a nanoscopic scale, manage to propel enormous particles in relation to themselves.

This is the first time we can predict whether an enzyme is going to be useful for us to propel microscopic objects, states Professor Sánchez.

Arqué, X et al. (2019). Intrinsic enzymatic properties modulate the self-propulsion of micromotors, Nature Communications, Vol. 10, 1-12. ■



FOCUSING THE ACTION OF DRUGS VIA INFRARED LIGHT

A scientific team at IBEC led by ICREA Research Professor Pau Gorostiza, in collaboration with UAB, managed for the first time to efficiently activate molecules located inside neural tissue with an efficiency of almost 100% using two-photon excitation of with infrared light lasers, a precise technology to manipulate neuronal activity.

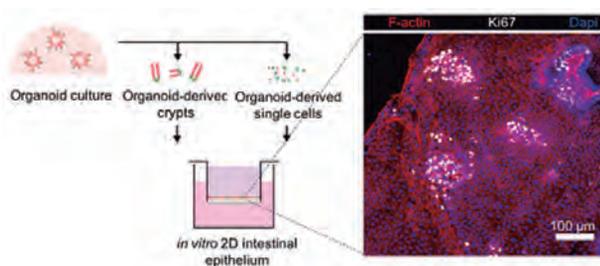
The results of the study have been published in the scientific journal *Nature Communications*, where the authors assure that the findings open the door to a large number of applications, from drugs that only act at the

point of our body that is illuminated and are therefore free from unwanted side-effects in other regions, to the spatial and temporal control of any protein whose function we want to study in the context of an organism.

With the technique described scientists will possess unprecedented spatiotemporal control over any photoswitchable molecule they wish to investigate, which could importantly assist photopharmacology studies.

Gisela Cabré et al. (2019). Rationally designed azobenzene photoswitches for efficient two-photon neuronal excitation. Nature Communications, Vol. 10, 1-12. ■

NEW CULTURE TECHNOLOGY FOR FUNCTIONAL INTESTINAL ASSAYS



During the last decade, intestinal organoids have emerged as a crucial tool to study intestinal biology in vitro. However, their sphere-like geometry limits the access to the organoid’s lumen hampering their use in many functional experiments where independent access to the different sides of the epithelium is required.

Researchers at IBEC led by UB Professor Elena Martínez in collaboration with IRB, described in a paper published in *Scientific Reports* a simple method to generate intestinal epithelial monolayers on thin Matrigel® films. These monolayers recapitulate the in vivo-like cell type composition and organization in a tissue culture format that allows independent access to the apical and basolateral compartments. As a unique characteristic, these epithelial monolayers form functional epithelial barriers with an accessible surface and physiologically relevant electrical properties. This technology offers an up-to-date physiologically relevant intestinal culture method compatible with functional assays such as drug absorption, intracellular trafficking and microbe-epithelium interaction assays.

The paper was among the top 25 downloaded papers of the section Cell and Molecular Biology in *Scientific Reports*.

G. Altay et al. (2019). Self-organized intestinal epithelial monolayers in crypt and villus-like domains show effective barrier function. Scientific Reports, Vol. 9, 10140. ■



A NANODRONE ABLE TO DETECT TOXIC GASES IN EMERGENCIES

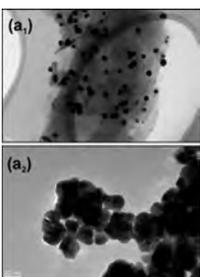
Researchers of the Signal and Information ‘Processing for Sensing Systems Research’ Group at IBEC, led by UB Professor and Group Leader Santiago Marco, have designed a nanodrone that could identify toxic gases in buildings that collapsed due to the effects of earthquakes or explosions.

The gadget, described for the first time in an article in the journal *Sensors*, weighs thirty five grams and could be useful to detect the presence of victims in closed spaces which are hard to enter.

Different from other larger gadgets, the one designed by Santiago and his colleagues is able to work in interior spaces –it can cross holes and cracks- and can work in large areas –about 160 square meters- where the chemical emission source is hidden in areas such as false ceilings or air duct systems.

J. Burgués, et al. (2019). Smelling Nano Aerial Vehicle for Gas Source Localization and Mapping. Sensors., Volume 19, 478. ■

NANOPARTICLES TO FIGHT BACTERIAL RESISTANCE

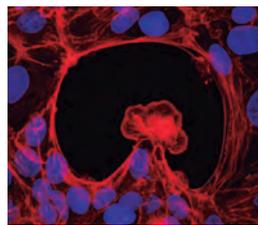


Researchers at IBEC led by Eduard Torrents, Group Leader of the ‘Bacterial Infections: Antimicrobial Therapies’ Group, designed a new method that enables to check precisely antimicrobial treatment efficacy in the presence of metallic nanoparticles that attach to bacterial membranes.

The new methodology has been tested with gold nanoparticles and have been used with drugs that attack three different species of bacteria: *Escherichia coli*, *Staphylococcus aureus* and *Pseudomonas aeruginosa*, responsible for infections such as gastroenteritis or meningitis.

As well as being cheap, this technique has a high resolution, is highly sensitive and opens up the door to using nanoparticles to treat bacterial infections, an objective that we have been working in for years, states Eduard Torrents, who is sure that the new methodology can have a big impact on people’s overall health.

Vukomanovic M and Torrents E (2019). High time resolution and high signal-to-noise monitoring of the bacterial growth kinetics in the presence of plasmonic nanoparticles. Journal of Nanobiotechnology, Volume 17, 21. ■



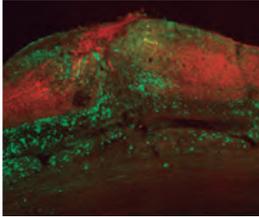
DISCOVERING THE DIFFERENT MECHANISMS OF CELL MIGRATION

An international team including IBEC researchers from the Group of ICREA Research Professor Xavier Trepast, confirmed the existence of two mechanisms of cell migration, an essential biological process that drives tissue and organ formation during embryo development and also helps to protect the body through immune response and wound healing mechanisms.

According to a study published at *Nature Physics*, while at regions of positive curvature cells developed lamellipodia for cell crawling, at regions of negative curvature strong actin cables assembled that followed the concave edge.

With the new knowledge of this actin flow switch, scientists may be better able to understand how cells can continue migration during wound healing, or in situations where migration can be damaging such as the metastatic progression of cancer.

Chen T et al. (2019). Large-scale curvature sensing by directional actin flow drives cellular migration mode switching. Nature Physics, Volume 15, 393-402. ■



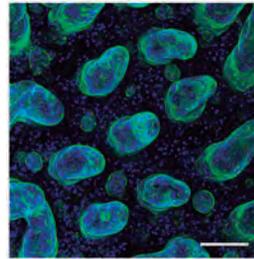
A KEY MECHANISM THAT COULD IMPROVE SPINAL CORD INJURIES

A study led by researchers from the group of UB Professor and Group Leader at IBEC, José Antonio del Río, in collaboration with the Imperial College in London, identified a mechanism that regulates the regenerative failure in lesions of the central nervous system. Moreover, the experts have also proven how the genetic or pharmacological inhibition of the new therapeutic target could overcome regeneration failure following spinal cord injury.

“Lesions of the peripheral nervous system respond differently to those of the central nervous system. Identifying differences in the cellular response in both branches of the sensory system allows us to identify possible targets for treating spinal cord injuries”, explains Simone Di Giovanni, who headed the investigation.

Although lesions of the peripheral nervous system may be partially reversible, lesions of the central nervous system cannot regenerate themselves in the same way and this lack of regenerative capacity is mainly responsible for the functional deficits that appear after a spinal cord injury. Therefore, these findings open the door specially to future treatments for patients with this kind of lesions.

A. Hervera et al. (2019). PP4-dependent HDAC3 dephosphorylation discriminates between axonal regeneration and regenerative failure. The EMBO Journal, Vol. 38. ■



DESIGNING 3D INTESTINAL TISSUE MODEL USING HYDROGELS

Researchers at IBEC led by UB Professor Elena Martínez, Group Leader of ‘Biomimetic Systems for Cell Engineering’ Group, have developed a new method to generate 3D intestinal tissue using hydrogels.

This new in vitro model has been improved by providing cells with a more physiologically realistic environment, including tissue architecture, cell-matrix interactions and chemical signaling while remaining compatible with standard cell characterization techniques.

Also, the methodology is simple and cost-effective for producing models of intestinal epithelium that can be easily integrated into standard cell culture platforms.

Epithelial tissues contain complex three-dimensional microtopographies that are essential for their proper performance. These 3D microstructures provide cells with the physicochemical and mechanical signals needed to guide their self-organization into functional tissue structures and are key to their proper functioning.

CA.G Castaño et al. (2019). Dynamic photopolymerization produces complex microstructures on hydrogels in a moldless approach to generate a 3D intestinal tissue model. Biofabrication, Volume 11, 025007. ■

INSTITUTIONAL HIGHLIGHTS



SECOND SEVERO OCHOA AWARD FOR EXCELLENCE

The Institute for Bioengineering of Catalonia was one of the six centers in Spain to be awarded in the 2019 round of the Severo Ochoa Excellence program. Furthermore, IBEC was the only center that receives this accreditation for the second time.

The distinction, given by Ministry of Science, Innovation and Universities, is decided by an international panel of experts, taking into account the scientific results and strategic programme of the research centers. The Severo Ochoa Excellence Awards identify and promote public research centers and units in Spain that stand out as international references in their specialized fields.

IBEC Director Josep Samitier expressed his gratitude for the award and highlights that: "the obtention of the Severo Ochoa accreditation for the second time satisfies us greatly because it recognizes the leadership and excellence of IBEC activities both in research and in translation of the obtained results to society". ■

IBEC RECEIVES THE FEI AWARD FOR ITS SUPPORT TO INNOVATION

The Innovative Companies Forum ("FEI", in Spanish) celebrated the seventh edition of the 2019 "Innovation Awards". The awards ceremony, which aims to highlight the commitment to innovation of organizations, companies and research centers, recognized IBEC as "Innovation Support Agency" of the year. David Badia, Managing Director of the institute, received the award during the ceremony, which took place in Madrid.

During his ceremony speech, Mr. Badia noted that IBEC is devoted to the field of bioengineering, with the objective not only to study, but also to promote the research's application in the field of medicine, health and the improvement of people's quality of life. ■



IBEC AND EMBL JOIN FORCES

The European Molecular Biology Laboratory (EMBL) and the Institute for Bioengineering of Catalonia (IBEC) have strengthened the collaboration between the two research institutions. With this purpose, IBEC Director's Josep Samitier and Edith Heard, Director of EMBL, signed a 5-year agreement at EMBL Barcelona headquarters.

This collaboration is the beginning of a working framework for activities between EMBL and IBEC which support strategic long-term scientific and general collaboration in areas of mutual interest. Some of the proposed joint projects are a postdoc EMBL-IBEC program and a series of EMBL-IBEC seminars. Moreover, it is also planned to reinforce visitors' exchange whereby scientific personnel affiliated to EMBL or IBEC will have the possibility to visit the facilities of the other institution in order to study research developments and techniques and to foster interdisciplinary collaborations. ■



IBEC HIRES TOP SCIENTIST GIUSEPPE BATTAGLIA

Giuseppe Battaglia joined the Catalan Institution for Research and Advanced Studies (ICREA) and the Institute for Bioengineering of Catalonia (IBEC) in 2019. Professor Battaglia was affiliated to the University College London in UK where he holds EPSRC Established Career fellowship until 2022, and the Chair in Molecular Bionics in the Department of Chemistry.

Prior to UCL Professor Battaglia held positions as Lecturer -2006, Senior Lecturer -2009 and Professor -2011 in the Departments of Materials Sci. Eng. (2006-2009) and Biomedical Science (2009-2013) at the University of Sheffield.

His research aims to design bionic units that mimic specific biological functions to introduce operations that do not exist in nature. For that, they apply molecular engineering to tackle clinical challenges associated with drug delivery in order to design new therapies, also known as nanomedicine.

Professor Battaglia is an expert in the pioneer technique of liquid phase TEM microscopy. By hiring him, IBEC aimed not only to increase the family of excellent ICREA Research Professors at IBEC, but also to strength the technological capacity of our country. ■

ELENA MARTÍNEZ GRANTED BY THE EUROPEAN COMMISSION TO BRING RESEARCH TO THE MARKET



Elena Martínez, Group Leader at IBEC and UB Professor, was awarded in 2019 with the prestigious "Proof of Concept" grant of the European Research Council (ERC). With her "GUT3D-PLATE" project, Martínez and her team at the "Biomimetic systems for cell engineering" group will further develop technology to fabricate ready-to-commercialize 3D cell culture substrates mimicking the intestinal physiology.

Elena Martínez and her group developed 3D cell culture scaffolds that accurately mimic the villus and crypt morphologies of the human intestine using soft materials. To achieve these scaffolds, they used an innovative light-based approach to fabricate hydrogel scaffolds with the proper dimensions and mechanical properties of the tissue, in a reproducible manner.

Thanks to this top-up funding awarded to ERC grantees, beneficiaries can explore the innovation potential of their scientific discoveries and bring the results of their frontier research closer to market and explore business opportunities. ■



SAMUEL SÁNCHEZ WINS AN ERC CONSOLIDATOR GRANT TO STUDY THE COLLECTIVE BEHAVIOUR OF SELF-PROPELLED NANOROBOTS

Samuel Sánchez, Group Leader at IBEC and ICREA Research Professor, was awarded in 2019 with the prestigious “Consolidator Grant” of the European Research Council (ERC). With his i-NANOSWARMS project, Sánchez and his team at the Smart Nano-Bio-Devices Group will study the collective behaviour of nanorobots capable of self-propelling, and thus study their possible application in drug delivery and imaging diagnosis.

The highly sought-after ERC Consolidator grants are awarded to EU-based principal investigators with at least seven and up to twelve years of experience after his PhD who have demonstrated talent and scientific potential.

With an average funding of 2 million euros per project, granted by the Horizon 2020 research and innovation program, selected researchers will be able to consolidate their research teams. ■

The PANDORA project of Dr. Rizzello aims to revolutionize the way we cure infections caused by intracellular pathogens, finding a universal therapy able to attack infectious diseases and, at the same time, avoiding antibiotic resistance. More specifically, the winning project of the prestigious ERC Starting Grant will seek solutions that help eradicate tuberculosis, one of the worst pandemics so far, identifying the molecular “barcode” of infected cells, in order to design polymeric nanoparticles that selectively attack infected cells, without affecting healthy cells. ■

CATALAN VICE-PRESIDENT VISITS IBEC



The Vice-President of the Catalan Government, Pere Aragonès, together with the General Director of Research, Joan Gómez, visited IBEC laboratories and facilities. The delegation made a tour through two of the most innovative laboratories at IBEC, the Smart Nano-Bio-Devices Research Group led by ICREA Research Professor Samuel Sánchez, and the Bioengineering for reproductive Health Lab led by Samuel Ojosnegros.

Samuel Sánchez presented to the Vice-President some of the systems developed at his lab such as nanobots, 3D Bioprinted actuators and flexible biosensors, and explained how these systems can play a major role in future nanomedicine and environmental applications. On the other hand, Samuel Ojosnegros explained how the use of bioengineering methods helps the study and development of embryos for reproductive health. Ojosnegros also introduced the concept of IBEC’s Open Innovation Lab, a multidisciplinary environment where biologists, biophysicists, clinicians and business developers synergize to create a unique environment shaped by science and entrepreneurship. ■



IBEC RESEARCHER AWARDED WITH THE ERC STARTING GRANT TO FIGHT TUBERCULOSIS

IBEC researcher Loris Rizzello receives 1.5 million Euros from the prestigious ERC Starting Grant for his PANDORA project, focused on creating a new therapy to eradicate tuberculosis.

In September 2019 the European Research Council (ERC) announced the projects awarded with an “ERC Starting Grant”. Among the 408 projects selected is the PANDORA project of Dr. Loris Rizzello, a researcher of the Nanobioengineering group of the IBEC led by Prof. Josep Samitier.

THE PRESIDENT OF THE EUROPEAN RESEARCH COUNCIL VISITS IBEC



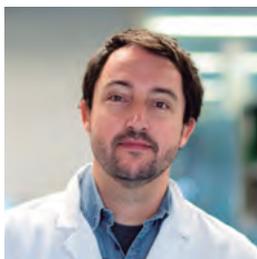
The President of the European Research Council (ERC), Jean-Pierre Bourguignon, visited in May 2019 the Institute for Bioengineering of Catalonia (IBEC).

The event was inaugurated by IBEC's Director, Josep Samitier, who presented an overview on the cutting-edge research carried out at the institute in the fields of bioengineering and nanomedicine.

Afterwards, ERC Grantees working at IBEC had the opportunity to explain the impact of ERC grants on their professional careers and established a dialogue with ERC President on the past, present and future of the European Research Council.

In the afternoon, Paul Verschure, Group Leader at IBEC and ICREA Professor, was invited to present his work during the event +300 ERC Grants- Scientific excellence.

The highly-competitive ERC grants are Europe's most prestigious research awards. ■



PERE ROCA WINNER OF EBSA YOUNG INVESTIGATOR'S PRIZE

Pere Roca-Cusachs, Group Leader at IBEC and Assistant Professor at the University of Barcelona won in 2019 the Young Investigator Prize for his contributions to the field of mechanobiology. The award was given by the European Biophysical Societies Association (EBSA).

EBSA association grants this prize every two years. The prize recognizes an investigator who has defended his thesis 12 years ago or less across Europe and who is expected to contribute an article to the European Biophysics Journal. The decision of the winning researcher is made by the Executive Committee based on scientific excellence, leadership and creativity.

The research group of Pere Roca-Cusachs at IBEC aims to elucidate how mechanical interaction with the environment determines how cells proliferate, differentiate, and move, and regulates development, tumorigenesis or wound healing.

Pere Roca-Cusachs had been previously awarded with the EMBO Young Investigator Award, the City of Barcelona Award to the Life Sciences and also with the ICREA Academia. ■



ROSSELLA CASTAGNA WINS THE ISOP2019 PRIZE

Rossella Castagna, researcher in the Nanoprobes and Nanowitches group at IBEC, was awarded in 2019 with the ISOP2019 Prize at the 9th International Symposium on Photochromism held in Paris. This recognition comes from her contribution to the field of photochromism and for the results that were collectively obtained in their group in the field of photopharmacology.

Dr. Castagna presented the group results on photoswitchable drugs at the reference international meeting for photochromism, held every 3 years, where she was awarded with the conference prize. According to the organizing committee, such a prize rewards the most talented young researchers whose contribution is expected to notably impact the field of photochromism. Dr. Castagna is one of the 24 researchers incorporated to IBEC in the last four years thank to the COFUND-Attracting Talent program. ■

IBEC WELCOMES THREE NEW ASSOCIATED RESEARCHERS



Three new Associated Researchers were affiliated to IBEC in 2019. Professor Jordi Alcaraz (UB), Professors Carlos Alemán (UPC) and Dr. Jordi Puiggali (UPC).

Associated researchers are university professors seconded to IBEC who are working on topics that are of interest or complementary to IBEC's research areas. They participate in IBEC's scientific strategy, academic activities and support initiatives, and have the option to submit project proposals and papers with IBEC affiliation. Recruitment is carried out according to several criteria such as scientific excellence and alignment with IBEC's institutional strategy. Associated researchers are approved by the International Scientific Committee, which evaluates their performance on a regular basis. ■

CONGRESS OF THE SPANISH SOCIETY OF BIOMEDICAL ENGINEERING



With the slogan "for a personalised and universal health", the 2019 Congress of the Spanish Society of Biomedical Engineering brought together more than 200 researchers. UPC Professor Raimon Jané, President of the Spanish Society of Biomedical Engineering (SEIB), Group Leader of the Bioengineering Institute of Catalonia (IBEC), and CIBER-BBN, inaugurated the conference with the Health Minister of the Government of Cantabria, the Dean of the University of Cantabria, the Director of the Hospital and the President of the CASEIB2019 Organising Committee.

The Marqués de Valdecilla Hospital in Santander hosted from November 27th to 29th the XXXVII Annual Congress of the Spanish Society of Biomedical Engineering (CASEIB2019). During the opening ceremony, the Minister of Health stressed the "vital importance" of Biomedical Engineering and his commitment in creating the professional category within the health service.

CASEIB2019 had numerous high-level scientific studies within: Signal Processing, Image Processing, Biomedical Instrumentation, Telemedicine, e-Health, System Modelling, Intelligent Systems, Robotics, Surgical Planning and Simulation, Biophotonics and Biomaterials. ■



SANTIAGO MARCO ELECTED NEW VICE-PRESIDENT OF THE

INTERNATIONAL SOCIETY FOR OLFACTION AND CHEMICAL SENSING

Santiago Marco, Group Leader of the Signal and information processing for sensing systems research group at IBEC and UB Professor was appointed in 2019 as Vice-President for the next two years of the International Society for Olfaction and Chemical Sensing (ISOCS). The appointment was announced during the general assembly held at the International Symposium on Olfaction and Electronic Nose Conference (ISOEN) in ACROS, Fukuoka, Japan.

The ISOCS was launched in May 2008 by the Network of Excellence General Olfaction and Sensing Projects on a European Level (GOSPEL), the EU Network of Excellence in artificial olfaction, and Santiago Marco is one of its founding partners.

The Signal and information processing for sensing systems research group is interested in intelligent chemical instruments for the detection of volatile compounds and smells. The group, led by Santiago Marco, develops algorithmic solutions for the automatic processing signals and data in chemistry. ■

IBEC ACQUIRES NEW EQUIPMENT AND SCIENTIFIC PLATFORMS



IBEC signed in 2019 an agreement with the Ministry of Science, Innovation and Universities to acquire a Mask Aligner equipment, which will be located at the Microfab and Microscopy Characterization Facilities at IBEC. This acquisition, scheduled for the first quarter of 2020, will be co-financed by the FEDER of the 2014-2020 multi-regional operational program in Spain. The new Mask Aligner equipment will be used to carry out photolithography processes.

In addition, IBEC as an international player in bioengineering, was also granted in 2019 by the same Ministry to allocate a high-performance analytical platform for the characterization of nanoparticles. ■

IBEC STRENGTHENS ITS INTERNATIONAL RELATIONS WITH ASIA



During 2019, IBEC reinforced its internationalization program with a series of trips to Asia and, especially to China. In October, Josep Samitier and Nuria Montserrat travelled to Beijing to participate, as speakers and session chairs, at the “International Workshop on Engineering and Manufacture of Living Systems”. In July, Núria Montserrat also travelled to the Chinese city of Dailan, together with a Delegation of the European Research Council (ERC), to participate at the Summer Davos annual Meeting, organised by the World Economic Forum (WEF). During the year, several Chinese delegations also visited IBEC in Barcelona, invited by Samuel Sánchez, IBEC Deputy Director for Internalization, who also travelled to Beijing in October in order to strength relations with several Chinese Institutions such as the Chinese Academy of Sciences and the University of Tsinghua. ■

CLINICAL COLLABORATIONS

IBEC CONTRIBUTES TO A PIONEER HEART IMPLANT

IBEC researchers led by UB Professor and IBEC Group Leader, Daniel Navajas, contributes to an operation designed to repair the heart tissue of a 70-year-old patient who had suffered a heart attack. This was made possible by the creation of a bioimplant enriched with stem cells. The operation is the result of the joint work of scientists, doctors and engineers over more than ten years. According to the hospital, it is the first surgical intervention of this type worldwide.

A myocardial infarction can affect the patient's ability to carry out day-to-day activities, as well as their life expectancy and quality of life. In extreme cases, the patient may need a heart transplantation, or the heart evolves into heart failure.

In 2019, a collaboration between the 'Germans Trias i Pujol' Hospital, the Blood and Tissue Bank (BST) and the IBEC in Barcelona has been able to take a step forward for heart patients, thanks to a simple formula: combining medicine, science and engineering. The therapeutic approach of the researchers was to incorporate the cells into a pericardium matrix, acting as a vehicle, which enabled application of the cells that it contained directly on the infarcted area.

ENGINEERING 16 CM² STEM CELLS

The great challenge in doing was to transform a 2 cm² prototype used in the preclinical model into a 16 cm² bioimplant, and to comply with all safety and regulatory requirements for human use. Scientists and engineers of the IBEC 'Cellular and Respiratory Biomechanics' Group, led by Daniel Navajas, studied the mechanical properties of the different matrices that were developed in the successive phases of the project. According to Navajas, these studies have ensured that the implant applied to the patient has a hardness comparable to that of the ventricle. The end result is a bioimplant formed by decellularised human pericardium and enriched with mesenchymal stem cells. Researchers who have developed it have named it PeriCord, after the two components that form it: the pericardium and the (umbilical) cord.

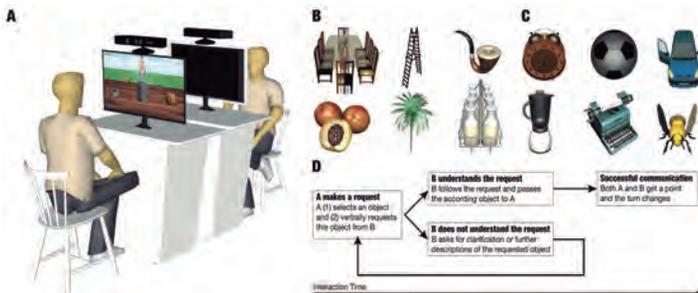


PIONEERING SURGERY APPROVED BY THE AEMPS

In late 2018, final approval of the PeriCord for human use was obtained from the Spanish Agency for Medicines and Health Products (AEMPS). It was necessary to wait until May 2019 to implant the new therapy in a first patient, in a procedure coordinated by the Cardiac Surgery Service. The clinical part was made in the advanced therapy white rooms of the Blood and Tissue Bank, and is implanted in the operating rooms of the 'Germans Trias' Hospital.

The patient improved considerably, and the first MRI scan shows a reduction in the size of the infarction scar at 3 months post-implantation, but his progress needs to be still monitored. This project was made possible by the support of the Department of Health of the Generalitat de Catalunya, through 'PERIS' grants; the Carlos III Health Institute and "la Caixa". ■

A VIRTUAL REALITY SYSTEM TO TREAT SPEECH DISORDERS



Researchers from the Synthetic, Perceptive, Emotive and Cognitive Systems Lab (SPECS) at IBEC, led by ICREA Research Professor Paul Verschure, developed a virtual reality-based system for rehabilitating patients with Broca's aphasia. The system, called Rehabilitation Gaming System for aphasia (RGSa), showed to improve patient's communicative frequency and effectiveness in daily life, as well as sustaining improvements in testing. The work, performed in collaboration with Hospital Universitari Joan XXIII de Tarragona, Spain, Department of Psychiatry at the Charité Universitätsmedizin Berlin, Germany and the Berlin School of Mind and Brain, Humboldt University, Germany was published at the prestigious journal *Stroke*.

In a Randomised Controlled Trial (RCT), researchers treated 17 patients with chronic Broca's aphasia (persisting six months after the cerebrovascular accident) and divided them into two parallel groups. One of the groups, the control group, received standard treatment targeting specific linguistic deficits in a therapist-patient setting. The other group, the experimental group, received therapy augmented with RGS, which provided multi-modal lexical and syntactic building targeted at daily tasks. The same therapy intensity was applied to both groups and they both used the same materials during daily sessions for two months.

After the two months of therapy, the results in the primary testing revealed that both groups had significantly improved, after assessing language function in people with language disorders, and in secondary testing, after assessing other parameters such as lexical access and speech execution in the prepared stimuli, amongst others. However, only the group treated with RGSa improved in communicative frequency and effectiveness in their daily life at the end of the study. ■

A SMARTPHONE FOR DETECTING SLEEP APNEA AT HOME



The 'Biomedical Signal Processing and Interpretation' IBEC Group led by UPC Professor Raimon Jané developed a portable, cheap and non-invasive system to detect obstructive sleep apnea (OSA) at home, a disorder characterized by recurrent airflow cessation during sleep. Researchers propose a novel method consisting of analyzing acoustic signals recorded with a smartphone.

This new approach was designed and tested in collaboration with the "Sleep Lab" at Hospital Clínic in Barcelona, is not only able to detect sound from oral and nasal breathing during sleep at home and thus identify breathless events, but also to analyze the data with special algorithms developed at IBEC and to differentiate between apneas -complete cessation of airflow for more than 10 s- and hypoapneas- a partial cessation of airflow for more than 10 s. ■

SKIN REGENERATION USING NANOPARTICLES AND 3D PRINTING



Elisabeth Engel, UPC Professor and Group Leader of the "Biomaterials for regenerative therapies" group at IBEC coordinates since 2019 a three-year project with the aim of boosting skin self-regeneration. This transnational Eu-

ropean consortium will develop the project over the next 3 years, including partners from University of Ioannina, Greece, Hospital Universitari Vall d'Hebron, Spain, the Université Grenoble-Alpes, France and MicroLight 3D, France. The project falls under the scope of EuroNano-Med3 programme, and the consortium will receive a total of 747.000 € through the corresponding national funding agencies of the countries involved. In particular, the "Agencia Estatal de Investigación" (Ministerio de Ciencia, Innovación y Universidades) will fund IBEC's contribution with 190.000 €.

Under the name of « nAngioDerm – Ion-release materials to promote Angiogenesis on DERMal regeneration » the project will focus on skin regeneration, specifically in regenerating the tissue of chronic wounds and skin burns. To reach that end, they will use nanoparticles and 3D printing to promote self-regeneration of the damaged tissues. The nAngioDerm project seeks to address the global burden of skin and subcutaneous diseases. Since 2009, it is said that such ailments affect up to 20 million people living with acute wounds, as a result of surgery or chronic skin ulcers. ■

vered the liposome with an antibody that recognises a protein expressed by red blood cells (whether they are infected or not) and gametocytes (the sexual phase of the parasite, responsible for host-to-host transmission).

Reference article: Biosca A, Dirscherl L, Moles E, Imperial S, Fernàndez-Busquets X. An ImmunoPEGliposome for Targeted Antimalarial Combination Therapy at the Nanoscale. *Pharmaceuticals*. 2019 Jul 16;11(7). pii: E341. doi: 10.3390/pharmaceuticals11070341. ■



JOAN MONTERO AND COLLEAGUES IN BOSTON SUGGEST A NEW STRATEGY

FOR MELANOMA PATIENTS

IBEC researcher Joan Montero authors a paper in *Nature Communications* which uncovers a key adaptation that melanoma cancer cells use to evade current therapies. This finding might allow physicians to use better drug combinations to improve patient outcomes in the future.

Despite significant advances in cancer diagnosis and treatment, most targeted cancer therapies fail to achieve complete tumor regressions or durable remission. Understanding why these treatments are not always efficient has remained a main challenge for researchers and physicians. Now, Joan Montero from the IBEC and colleagues at Dana-Farber Cancer Institute-Harvard Medical School in USA report in *Nature Communications* a mechanism that uncovers why some therapies fail to treat melanoma.

The results show that sequential treatment of BRAF targeted therapies with MCL-1 inhibitors (now in clinical trials) could overcome treatment resistance in melanoma patients.

This work was performed with financial support from the SU2C, the V foundation and the Ramón y Cajal programme.

Reference Paper: Joan Montero et al. Destabilization of NOXA mRNA as a common resistance mechanism to targeted therapies. *Nature Communications*, 10, Article number: 5157 (2019). ■

NANOVECTORS TO IMPROVE ADMINISTRATION OF ANTIMALARIAL DRUGS

A study led by Xavier Fernández Busquets, Group Leader of the 'Joint Nanomalaria' Group at the Institute for Bioengineering of Catalonia (IBEC) and the Barcelona Institute for Global Health (ISGlobal)- Hospital Clínic Barcelona showed that encapsulating two drugs with different properties into nanovesicles surrounded by antibodies can greatly improve their delivery and efficacy.

Fernández Busquets and his developed a nanovector – consisting of small spheres or liposomes– that can simultaneously transport compounds that are soluble in water (hydrophilic) and in lipids (lipophilic).

By encapsulating both drugs in the same nanovector, we make sure that both will persist for the same time in the organism, explains Fernández-Busquets. As proof of concept, the research team introduced the water-soluble drug pyronaridine in the liposome lumen and the lipid-soluble drug atovaquone in its membrane. In addition, they co-



IBEC LAUNCHES ITS CLINICAL COLLOQUIA PROGRAM



As a part of IBEC's strategy to facilitate the transfer of excellent science into health solutions for patients and hospitals, the Institute fosters relations and partnerships with clinicians and companies. Within this framework, the Institute for Bioengineering of Catalonia has now launched the IBEC Clinical Colloquia Program.

The first colloquium was held in November 14th at IBEC and the first speaker was Dr. Josep Pous, Medical Director at Cematec-Teknon in Barcelona and gave a talk on Theoretical and practical aspects of biophysiotherapy. ■

THREE IBEC PROJECTS GET FUNDING FOR THE FIGHT AGAINST CANCER



Three IBEC projects were selected in 2019 to receive funding from "La Marató 2018", Against Cancer." One of the projects is led by the researcher Pere Roca-Cusachs and the other two are co-led by the researchers Xavier Trepat and Núria Montserrat.

The awarding ceremony took place on October 30 in the Auditorium of the Academy of Medical and Health Sciences of Catalonia and the Balearic Islands. In this edition, over the 188 evaluated projects, 43 have been selected by an international committee of experts in cancer based on their excellence, methodology and relevance. La Marató de TV3, together with Catalunya Ràdio, broadcasts its annual telethon to raise funds for scientific research into various diseases with a different theme each year. The 2018 edition of La Marató raised €15M for the 43 projects and 96 teams awarded. ■

IBEC PROJECTS GRANTED FOR THEIR PIONEERING AND APPLIED RESEARCH FOR HEALTH



Two IBEC researchers and Group Leaders received in 2019 "La Caixa Health Research Grant" for their research in health. José Antonio del Río, UB Professor and Group Leader of the Molecular and Cellular Neurobiotechnology Group at IBEC, was one of the winners. Del Río's project focuses on analysing the molecular mechanisms involved in the genesis and propagation of tau protein in brain cells. This protein is linked with several neurodegenerative processes and is present in numerous diseases such as Alzheimer's.

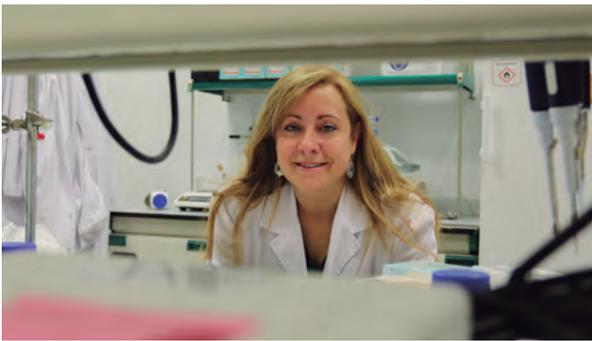
Another of the winners was Pau Gorostiza, ICREA Research Professor and Group Leader of the 'Nanoprobes and Nanoswitches' Group at IBEC. In this case, for his project on degenerative eye conditions such as retinitis pigmentosa, which causes blindness due to the progressive degeneration of the cones and rods, the light sensitive cells. Gorostiza's Group collaborates for several years with different patient associations and foundations such

as the Spanish Association against Blindness (FUNDA-LUCE) and the Barcelona Macula Foundation (BMF). In this project, Gorostiza aims to recover the light sensitivity of retinal neurons by using light-activated smart pharmaceuticals acting as molecular prosthetics. The research, which has already been successfully conducted on fishes, now aims to replicate its results in other animal subjects. The end goal is to recover the light sensitivity of a human retina under laboratory conditions. ■

ces in equilibrium and when walking, tremors and muscle stiffness among others.

The money raised by the FF campaign “Let’s tackle Parkinson” will be invested in the development of an antibody that will be capable of trespassing the blood–brain barrier and will carry a drug to the brain that favors the elimination of lipids stored inside the neurons. ■

SECOND EDITION OF FASTER FUTURE WAS DEDICATED TO FIGHT AGAINST PARKINSON



The program IBEC Faster Future, an initiative that aims to help accelerate research that is close to tackling major challenges in health, chose in 2019 a project focused in developing a new antibody for the treatment of Parkinson’s disease. The Faster Future program campaign “Let’s tackle Parkinson”, aims to raise 50,000 € needed to accelerate this research, seeking to obtain favorable results within a year and a half.

The project led by Silvia Muro, ICREA Research Professor and Group Leader of the Targeted therapeutics and nanodevices group at IBEC, aims to collaborate with scientists, hospitals and patient associations, and with every person that wants to get involved, by making donations during the fundraising campaign.

The causes of Parkinson’s disease are still unknown, and yet it affects around 8 million patients around the world, but the latest studies have demonstrated that the people that suffer this disease have an alteration in the function of eliminating lipids in cells, which means that cells are not capable of getting rid of the “fat residues” and this accumulate inside the cell. This leads to the point of provoking its dysfunction or cell death, affecting the central nervous system and causing symptoms such as disturban-

TECHNOLOGY TRANSFER HIGHLIGHTS

IBEC DOUBLE THE ECONOMIC INCOME DUE TO CONTRACT RESEARCH WITH PRIVATE COMPANIES

In 2019 IBEC multiplied by 2,5 the invoicing to companies due to contract research compared to 2018, reaching an amount of 1.174.000 € during the year. The effort done by IBEC during the last years in the area of contracting have been clearly fruitful, being the amount invoiced every year the double of the previous year. More than the economic result, there is a clear positive impact in promoting and facilitating the culture of collaboration among researchers and companies. An increasing number of companies are discovering IBEC as an important source of innovation and new products and technology. IBEC's researchers efficiently combine the excellent and high impact research with the more applied solutions to the market and patients requirements. From the market pull perspective, IBEC have an active portfolio of 8 valorization programme, based on patents and executing proof of concept projects in order to increase the value of the technology, always based on the Market Driven technology transfer model developed by IBEC. ■



IBEC RECEIVES THE TECNIO SEAL TO PROMOTE TECHNOLOGY TRANSFER TO COMPANIES

The Institute for Bioengineering of Catalonia was accredited in 2019 through ACCIO, the Agency for the competitiveness of the company under the Department of Enterprise and Knowledge of the Catalan Government, with the TECNIO seal.

IBEC was among the six Catalan centers that received the TECNIO seal in 2019. The TECNIO seal allows SMEs

and large companies to identify institutions that offer differential technology, with the objective to facilitate the access of Catalan productive sector to technological innovations that solve project's needs, products and services. On the other hand, TECNIO seal is an opportunity for technology centers to reach new partners, suppliers and international R + D + i programs. ■

ESTABLISHED THE FIRST OPEN INNOVATION LAB



In 2019, IBEC accomplished an enterprise initiated few years ago: to establish its first open innovation lab. In 2018, IBEC signed an agreement for an initial investment round of one and a half million euros with Scranton Enterprises B.V., an investment association headquartered in the Netherlands. The Open Innovation Lab offers a co-working laboratory and office space for enterprises and investors who want to develop high potential research projects that are clearly market-oriented.

The first unit of IBEC's Open Innovation Lab is "Bioengineering in reproductive health" led by Dr. Samuel Ojosnegros, which is developing image and genomic technology that allows to choose those embryos that will be more fitted for implantation. This type of selection is currently carried out by criteria that are still too subjective, therefore, this technology aims to provide modern tools to doctors and embryologists to increase the success rate of assisted reproduction.

This initiative aims to allow investors and companies to participate directly in IBEC's research units that are exclusively focused on reaching faster both patients and the market, while maximizing capital efficiency says Xavier Rubies, Head of the Technology Transfer Department at IBEC. ■

SPIN-OFF CLOSES A €5 MILLION INVESTMENT



Rob Surgical, the spin-off created by the Institute for Bioengineering of Catalonia (IBEC) and the Polytechnic University of Catalonia (UPC) in 2012, closed in 2019 a €5 million Euros investment round with the Dutch holding Scranton Enterprises to fund the final phase of the new Bitrack System and launch the product onto the market

Rob Surgical is a company which designs and develops new robotic systems for minimally invasive surgery. The investment will facilitate the obtention of the CE marking for the new Bitrack System, which will enable it's break into the market to improve the effectiveness of current surgical robotics.

The Bitrack System will be an alternative to the current laparoscopy surgical robot Da Vinci and will be an improvement on what is currently available in terms of efficiency. ■



THE ISCHEMSURG PROJECT RECEIVES SUPPORT FROM AGAUR

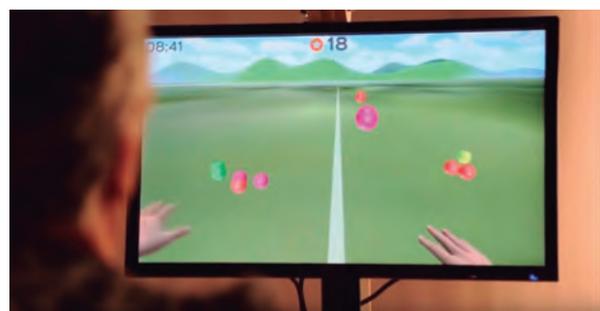
The ISCHEMSURG project, which aims to combat ischemia associated with regenerative surgery received in 2019 funding from the Agency for Management of University and Research Grants (AGAUR) with the goal to obtain

prototypes and transfer of research results. ISCHEMSURG will develop a miniaturized electrochemical sensor for real-time non-invasive control of tissue ischemia in the post-operative period. This technology will provide an effective and affordable solution to this need that still has no solution.

Mònica Mir, the entrepreneurial scientist of this project which is being developed in the Nanobioengineering group led by Josep Samitier, comments: "ISCHEMSURG will facilitate the follow-up of patients and healthcare professionals and will help reduce morbidity by early detecting the decrease of blood flow, avoiding the occurrence of severe medical complications and reducing hospital expenditure derived from second interventions".

The AGAUR program, which provides € 100,000 funding, has also allowed the entrepreneurial scientist, Mònica Mir, to participate in a training program for entrepreneurs that, in a structured way, helps participants validate technology with the market and to guide the necessary actions towards its transfer. ■

NEUROREHABILITATION AT HOME



The group SPECS of IBEC and spin-off Eodyne Systems have developed and commercialized the Rehabilitation Gaming System (RGS), a science-based ICT solution for neurorehabilitation combining brain theory, artificial intelligence, cloud computing and virtual reality, targeting motor and cognitive recovery after stroke. RGS provides a continuum of diagnostic and therapeutic solutions that accompany the patient from the clinic to the therapy center to home.

To realize significant benefits in the Quality of Life of stroke patients, RGS aims to become an at home solution providing 24/7 monitoring, diagnostics, and care. For this

via the EIT-health project RGS@home, the RGS solution will be brought to the home of about 100 stroke patients in a multicentric study that include the hospital San Joan de Déu in Barcelona, Spain, the Uppsala Hospital in Sweden and Limoges Hospital in France. ■

NANOROBOTS FOR BLADDER CANCER RECEIVE FUNDING

Samuel Sánchez, principal investigator of the ‘Smart Nano-bio Devices’ Group at IBEC, received the caixaimpulse award for his “Teranobots” project. This patented technology based on nanomotors powered by urease offers an alternative for reducing the recurrence of bladder cancer. Teranobots represents a completely novel approach that combines the powerful effect of antibody immunotherapies, with the enhanced capabilities offered by the self-propelled nanomotors. As a result of their improved mobility, nanomotors can better penetrate the cancerous tissue and improve treatment efficacy.

Some of the advantages of this approach include: reduced antibody doses; improved antibody diffusion into solid-tumour masses; improved antibody stability; improved treatment efficacy; and integration of image-based diagnostic tools for cancer tumour detection by means of PET-CT, which represents an improved alternative to cystoscopy. ■

IBEC PRESENTS ITS CAPABILITIES IN 3D BIOPRINTING AT INDUSTRY

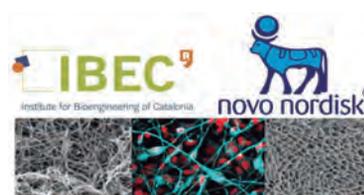
IBEC participated in 2019 in the fourth edition of “INDUSTRY: From Needs to Solutions”, the international meeting dedicated to 3D printing, and also the HELTHIO Days where Josep Samitier moderated the round table on 3D printing applications in healthcare.

In its fourth edition, IN(3D)USTRY becomes INDUSTRY to include more industrial sectors, the main goal was to cover the entire value chain and provide intelligent manufacturing solutions. The institute had a stand in the exhibition area, where the representatives of the IBEC Technology Transfer office welcomed the interested visitors to learn more about the 3D bioprinting capabilities of IBEC.

Also, IBEC took the opportunity to show other relevant inventions in the field of diagnosis, wound care, sensory and determination of volatile gases.

It is very important for us to be able to show at INDUSTRY the different industrial fields in which IBEC is already working, and very specifically in the field of 3D bioprinting, said Xavier Rubies, Head of Technology Transfer at IBEC. ■

IBEC AND THE COMPANY NOVO NORDISK SIGN A COLLABORATION AGREEMENT



The Institute for Bioengineering of Catalonia (IBEC) and the company Novo Nordisk signed in 2019 an agreement to work together on the development of biomaterials to support stem cell therapies. IBEC is an institution engaged in excellent basic and applied research in bioengineering and nanomedicine located at the Barcelona Science Park. Together both companies are planning to design, fabricate and test, new biomaterials to support cell transplantation in regenerative medicine. ■



IBEC LAUNCHES A CHALLENGE AT THE 2ND INNOVATION DAYS

75 participants from different fields participated in the 2nd edition of the Innovation Days (i-Days) organised by EIT Health. Thirty-two locations around Europe hosted the i-Days and for the second time in a row, IBEC was involved in many parts of the workshop held in Barcelona.

I-Days promote health innovation among university students through one-to-two-day programmes held at academic institutions around Europe. Students receive an introduction to practical health innovation tools and work in multidisciplinary teams to tackle real life health challenges posed by EIT Health projects, local organisations and private corporations. The event counted with inspirational speakers and coaches that introduced students to practical tools in innovation, design thinking and pitching ideas. ■

GOVERNANCE

THE IBEC FOUNDATION

IBEC was established in 2005 by the Department of Innovation, Universities and Enterprises and the Department of Health of the Generalitat de Catalunya (Autonomous Government of Catalonia), the University of Barcelona (UB) and the Polytechnic University of Catalonia (UPC).

The institute currently has 22 research groups, 318 researchers and 50 administrative staff. IBEC's headquarters and most of its labs are located in the Barcelona Science Park, which offers a highly stimulating biomedical environment in which the institute can work closely with organizations from the public and private sector interested in biomedical applications. A few of IBEC's labs are located at The Clinic and Bellvitge Health Sciences Campus and the Diagonal-Besòs Campus, which provide the clinical access, equipment or collaborative requirements specific to those groups.

The main governing body of IBEC is its Board of Trustees with representatives from the Catalan ministries of Health and Research, the UB and the UPC.

 UNIVERSITAT DE BARCELONA	UNIVERSITY OF BARCELONA (UB)
 UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH	TECHNICAL UNIVERSITY OF CATALONIA (UPC)
 Generalitat de Catalunya Departament de Salut	DEPARTMENT OF HEALTH, GENERALITAT DE CATALUNYA
 Generalitat de Catalunya Departament d'Economia i Coneixement	DEPARTMENT OF ECONOMY AND KNOWLEDGE (FORMERLY INNOVATION, UNIVERSITIES AND ENTERPRISES), GENERALITAT DE CATALUNYA

BOARD OF TRUSTEES

The governing body of IBEC is its Board of Trustees, composed of members of the four founding institutions. IBEC's Board of Trustees receives advice from the director of the institute and from the International Scientific Committee. The Board of Trustees meets twice a year to approve IBEC's annual budget and monitor its activities to ensure that it pursues scientific excellence with an impact for society.

PRESIDENT	Hble. Sra. Maria Àngels Chacón i Feixas	Minister of Business and Knowledge, Generalitat de Catalunya
FIRST VICE PRESIDENT	Hble. Sra. Alba Vergés i Bosch	Minister of Health, Generalitat de Catalunya
SECOND VICE PRESIDENT	Excm. i Mgfc. Sr. Joan Elías i Garcia	Rector, University of Barcelona
SECOND VICE PRESIDENT	Excm. i Mgfc. Sr. Francesc Torres Torres	Rector, Technical University of Catalonia
MEMBERS	Sr. Francesc Xavier Grau i Vidal	Secretary for Universities and Research, Ministry of Economy and Knowledge, Generalitat de Catalunya
	Sr. Joan Gomez i Pallarés	Director General for Research, Ministry of Economy and Knowledge, Generalitat de Catalunya
	Sr. Robert Fabregat i Fuentes	Director General for Research and Innovation, Ministry of Health, Generalitat de Catalunya
	Sra. Montserrat Llavayol i Giralt	Deputy Director General for Research and Innovation, Ministry of Health, Generalitat de Catalunya
	Prof. Maria Pau Ginebra Molins	Full Professor, Technical University of Catalonia
	Dr. Francisco Ciruela Alférez	Full Professor, University of Barcelona
	Prof. Domènec Espriu i Climent	Vice-Rector of Research, University of Barcelona
	Prof. Luca Pelà	Vice-Rector of Research, University of Barcelona
SECRETARY	Sr. Josep Maria Alcoberro Pericay	CERCA, Àrea jurídica

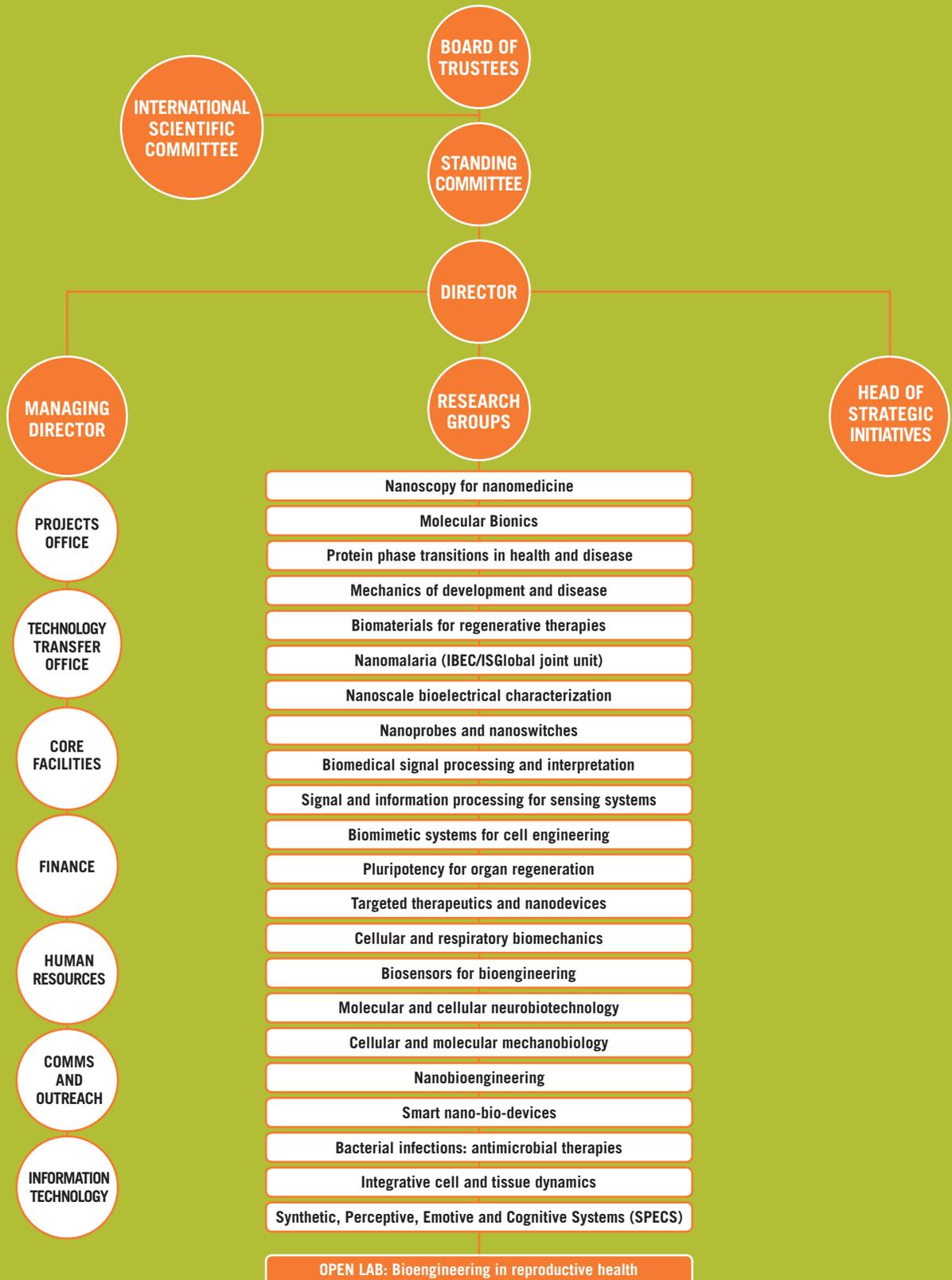
INTERNATIONAL SCIENTIFIC COMMITTEE

IBEC's International Scientific Committee plays a key role in the activities of the institute, focusing especially on the selection and evaluation processes of the research group leaders. The committee is composed of international renowned scientists in different bioengineering fields, as well as prestigious professionals in key areas within the activities of IBEC, such as research results valorization or medical technologies validation.

Samuel Stupp (President)	Director, Simpson Querrey Institute for BioNanotechnology, Northwestern University, Chicago (USA)
Karljin Bouten	Professor of cell-matrix interaction for cardiovascular regeneration, Department of Biomedical Engineering, Eindhoven University of Technology, Netherlands
Sergio Cerutti	Professor in Biomedical Signal and Data Processing, Department of Biomedical Engineering, Politecnico di Milano, Italy
Lim Chwee Teck	Provost's Chair Professor, Deputy Head, Department of Biomedical Engineering, National University of Singapore
Charles J. Dorman	Chair of Microbiology at Trinity College Dublin
Roger Kamm	Cecil and Ida Green Distinguished Professor of Biological and Mechanical Engineering and former Associate Head of the Department of Mechanical Engineering at MIT
Krishna Persaud	Professor of Chemoreception, School of Chemical Engineering and Analytical Science, University of Manchester
Bernat Soria	Director, Departamento de Células Troncales, Centro Andaluz de Biología Molecular (CABIMER)
Molly Stevens	Professor of Biomedical Materials and Regenerative Medicine and the Research Director for Biomedical Material Sciences in the Institute of Biomedical Engineering at Imperial College
Fiona M. Watt	Director, Centre for Stem Cells & Regenerative Medicine, King's College London
Luis de Lecea	Professor of Psychiatry and Behavioral Sciences Stanford University
Heiko Zimmermann	Managing Head of the Fraunhofer Institute for Biomedical Engineering

GOVERNANCE

ORGANIGRAM



GOVERNANCE

TRANSPARENCY

In compliance with Law 19/2014 (Transparency, public access to information and good governance), a section of the IBEC website includes all the information we are obliged to provide in order to adhere to the principles of this law.

ORGANIZATION

ORGANIZATIONAL AND OPERATIONAL STRUCTURE

- Government organs
- Organization charts
- Agreements for the creation and operation of public sector entities
- Lists and catalogues of services
- Catalogue of procedures

SENIOR POSITIONS AND MANAGERS

- List of senior positions and managers
- Incompatibilities
- Activities, goods and interests
- Remuneration, compensation and subsistence allowance
- Code of good practices for posts of the Generalitat of Catalonia

PUBLIC EMPLOYEES

- List of jobs in the public sector
- Staff assigned by contract bidding agreed with the Administration
- Remuneration, compensation and subsistence allowances

CALLS: ACCESS AND RESOLUTION

- Calls for work staff, specific groups and promotion training

UNION REPRESENTATION

- Number and cost of full-time union representatives

PROCEDURES AND LEGAL ACTIONS

REGULATIONS

- Sectoral regulations
- Directives, instructions and memos
- Regulations in process

ADMINISTRATIVE INTERVENTION RULES

REVIEW OF ADMINISTRATIVE ACTS

ADMINISTRATIVE AND JUDICIAL RESOLUTIONS

WITH PUBLIC RELEVANCE

OPINIONS

LINES OF ACTION

GENERAL AND SECTORAL PLANS AND PROGRAMS, AUDITS, AND STATISTICAL INFORMATION

- IBEC Annual Report (years 2007 to 2018)
- IBEC Strategic Plan 2014-2017
- Human resources strategy for researchers

ECONOMICS AND FINANCES

BUDGETS

- Approved budgets; executed; liquidated
- Annual accounts

AUDITING AND AUDITING REPORTS

- Auditing and auditing reports (years 2014-2017)

PATRIMONY OF THE GENERALITAT OF CATALONIA

- Inventory of real estate
- Movable assets of special value
- Assets management
- Patrimonial management and contracting

SUBSIDIES AND GRANTS

- Subsidies and public aid (planned and awarded)
- Financial monitoring of subsidies and aid

CONTRACTING

CONTRACTS

- Bidding and related procedures

AGREEMENTS

- Registration of collaboration agreements
- Other agreements

TERRITORY

SECTORAL TERRITORIAL PLANS

CARTOGRAPHIC INFORMATION

HEALTH AND SAFETY AT WORK

RISK PREVENTION AND SAFETY AND HEALTH OF EMPLOYEES AT WORK

- Report of the Prevention Service 2017
- Occupational risks prevention audit certificate
- Rights and responsibilities of personnel

GOVERNANCE

IBEC PEOPLE > ADMINISTRATION



DIRECTORATE

Director Josep Samitier

Managing Director David Badia

Assistant to the Director Cristina Del Campo

Assistant to the Director Ester Sánchez



PROJECTS OFFICE

Head of Project Office Javier Adrián

Assistant to the Projects Office Judith Forné

Funding Manager Esther Gallardo

Project Managers Daniel Caudepón, Guillermo Talavera, Isabel Sáez, Javier Selva, Rosa Miralles, Sara Vicente



INFORMATION TECHNOLOGY

IT Manager Julio Bafaluy

IT Technician Alejandro Silverio, Francisco Contreras



FINANCE

Head of Finance Ana María González

Public Procurement Specialist Meritxell Macias

Accounting Manager José Antonio Martín

Accounting Technician Laura Casas, Victòria López

Purchasing Technician Mayte Muñoz

Finance Assistant Berta Pla, Jessica Díaz



HUMAN RESOURCES

Head of Human Resources Carolina Marí

Senior HR Officer Anke Kleff

Biosafety Officer Marta Llorens

Human Resources Technician Ciara Boter, Karem Morelia García, Neus Vilalta, Núria Jané

Occupational Hazards Prevention Technician Raquel Guillén



COMMUNICATIONS

Head of Communications (until January 2019)

Vienna Leigh

Head of Communications and Public Relations

Guillermo Orts

Coordinator of Media Relations and Branding

Àngels López

Coordinator of Events and Outreach Pilar Jiménez

Events and Communications Officer Clara Civit

Internship Assistant Oriana Ortiz



STRATEGIC INITIATIVES

Head of Strategic Initiatives Teresa Sanchis

Project Manager Cristina Arimany, Sergio González



CORE FACILITIES

Head of Core Facilities Isabel Oliveira

Administrative Assistant Sonia Lertxundi, Tania Bordoy

MicroFabSpace and Microscopy Characterization

Facilities Coordinator Maria Teresa Galán

Microscopy and MicroFabSpace Characterization

Facilities Technician Alicia Nadal, David Izquierdo, Judit Linacero, Marina Cazorla, Sandra Segura

Research Technician Claudia Di Guglielmo

Laboratory Technician Inmaculada Moreno, Laura Gómez, Ramona Bravo

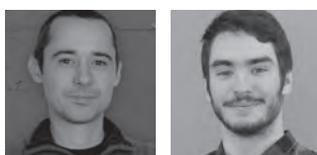


TECHNOLOGY TRANSFER

Head of Technology Transfer Xavier Rúbies

Project Manager Diana M^a González, Xavier Puñet

Promotor Tecnològic Esteve Juanola



INTEGRATED MANAGEMENT SYSTEMS

IMS Developer Carles Ortega

Junior Developer Marc Purgimon

STATISTICS

IBEC IN FIGURES, 2019

In 2019, the total number of IBEC's staff (including administration personnel as well as researchers, students and technicians) was **368**, representing an increase of **27** people since 2018. Of this total, **253** were hired by IBEC, while the rest are seconded, affiliated, externals, visitors or other status.

The following statistics reflect the situation on 31st December 2019.

01 Age of all IBEC scientific Staff

66% OF SCIENTIFIC STAFF WERE UNDER **35** **2019**

02 Gender of all IBEC scientific Staff (researchers, technicians and administration)

56% OF ALL STAFF WERE FEMALE **2019**

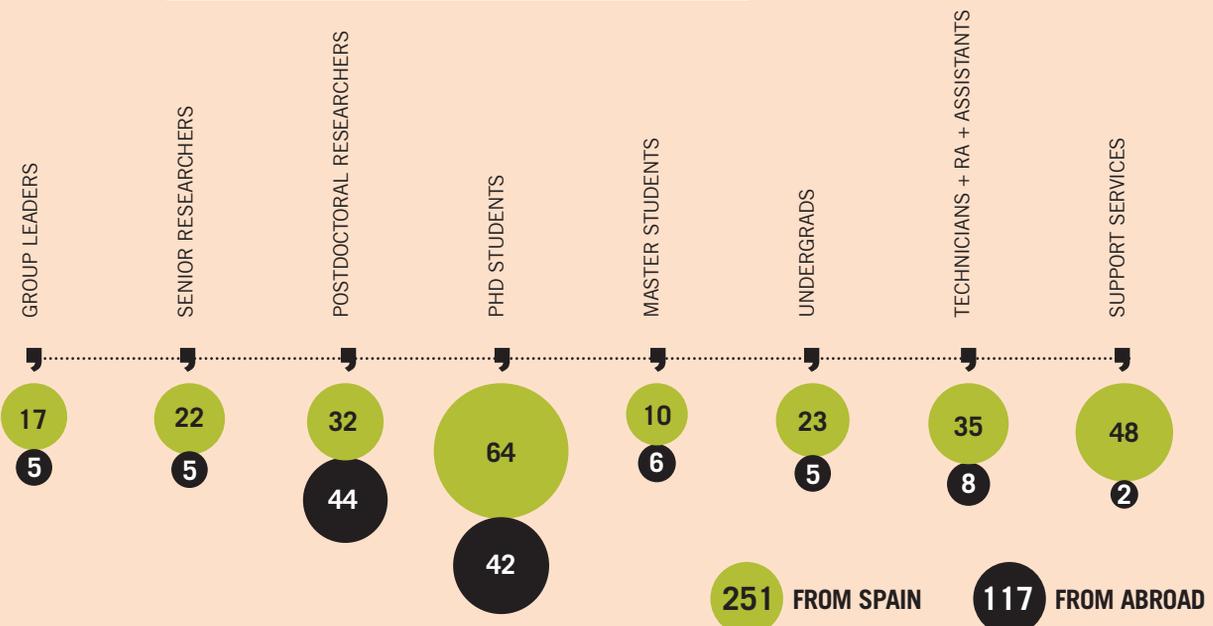
03

All Staff by gender and job category



04

All Staff by nationality (Spain/Other and Jobs category)



05

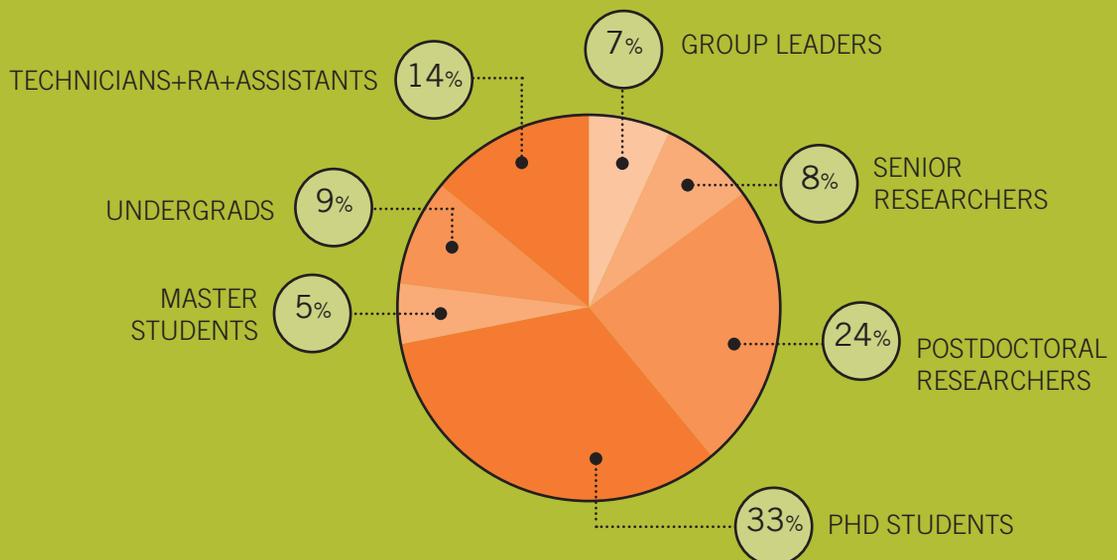
All IBEC by Nationality (map)

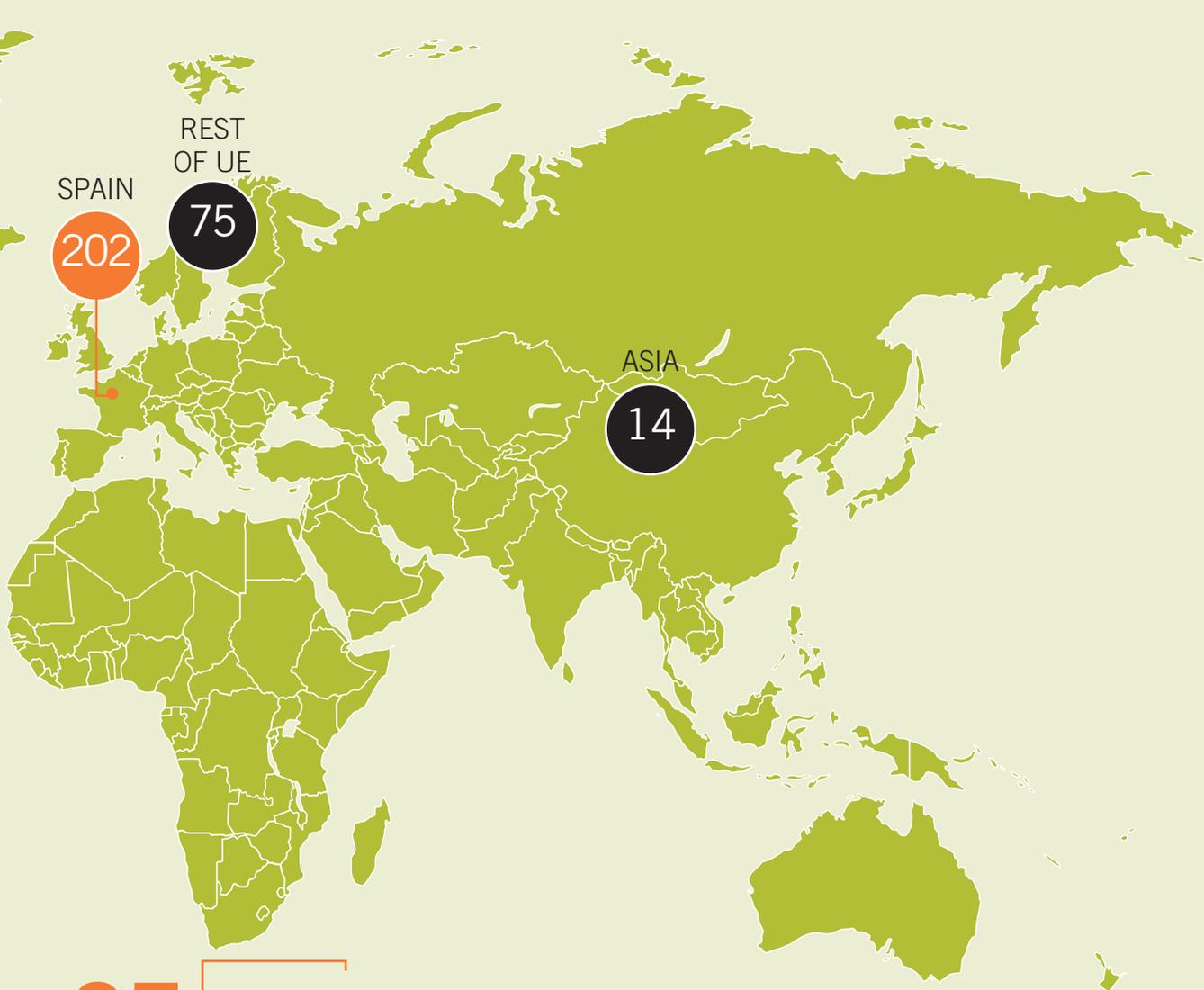
ALL 318 OF SCIENTIFIC PERSONNEL AT IBEC IN 2019 ARE REPRESENTED (NOT INCLUDING ADMINISTRATION STAFF)



06

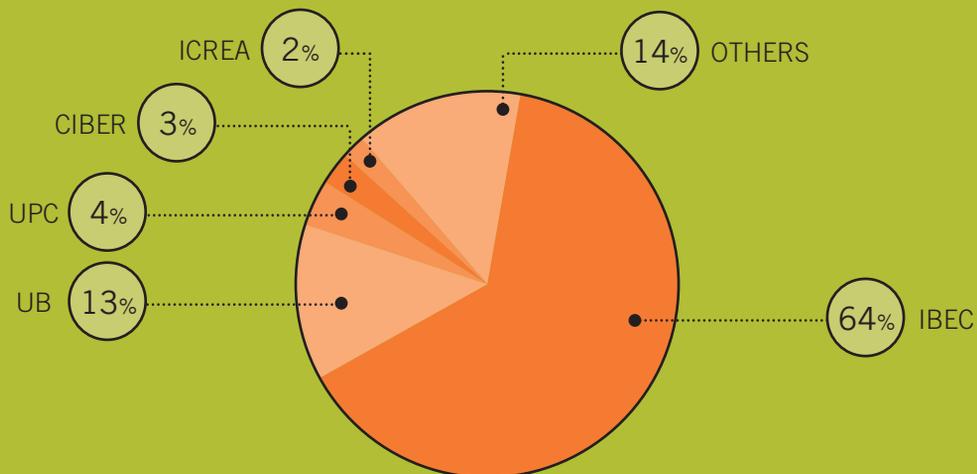
IBEC researchers and technicians by job category





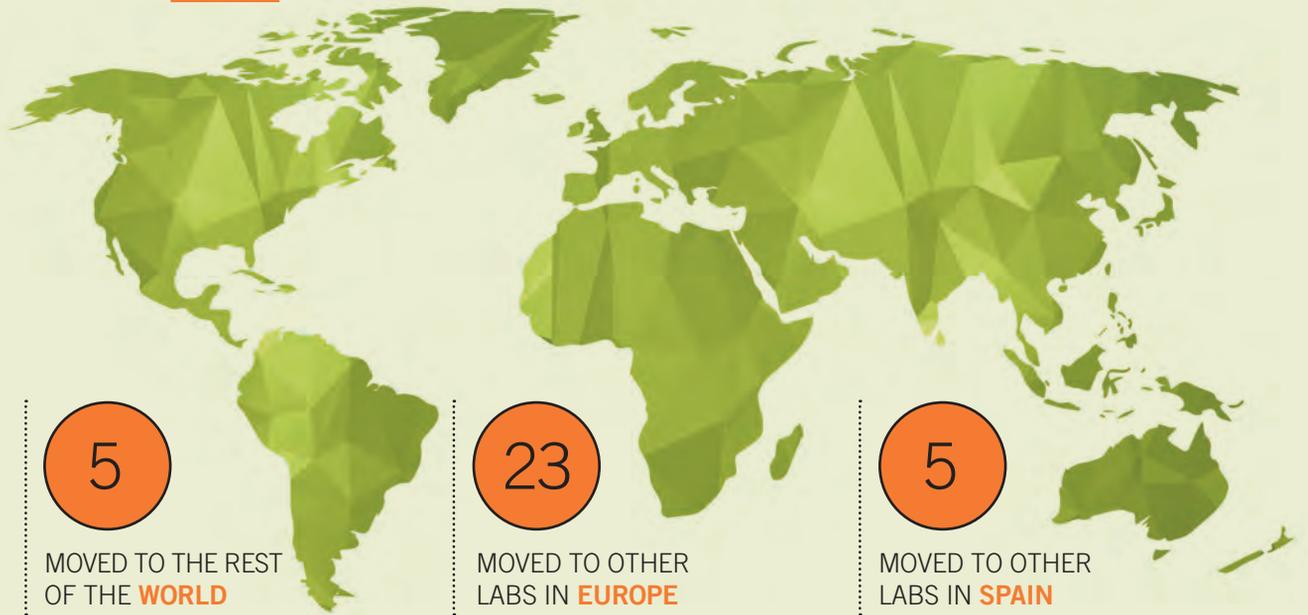
07

IBEC researchers and technicians by associated or contracting institution



08

Mobility in 2019

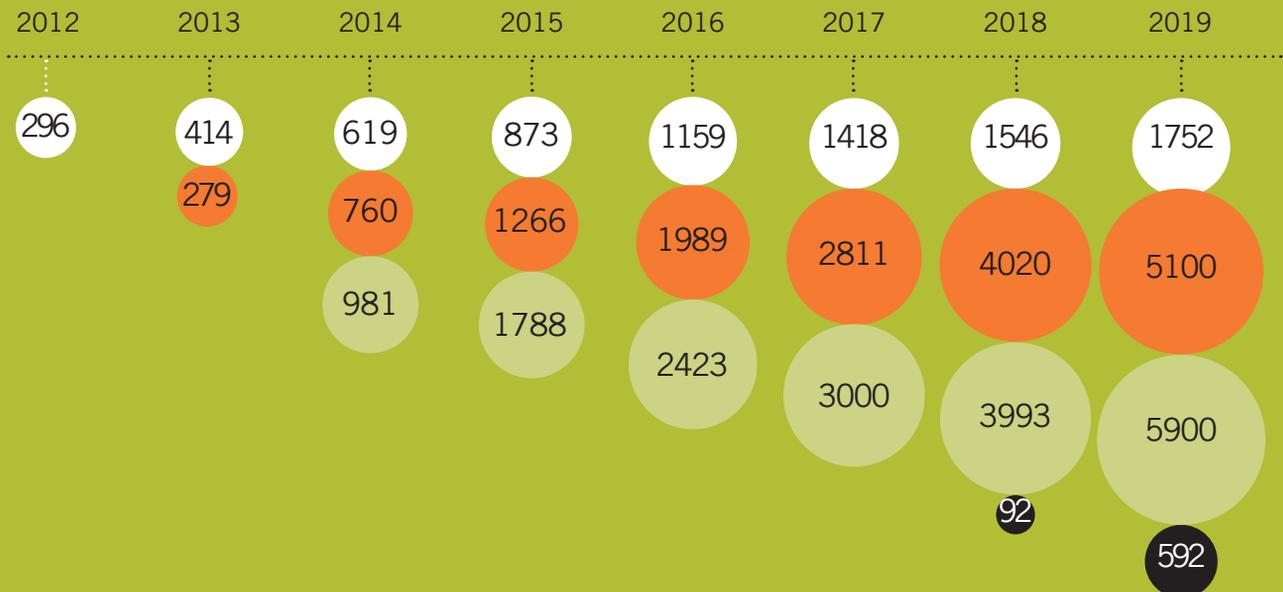


33

NUMBER OF RESEARCHERS WHO SPENT TIME **ELSEWHERE** IN 2019

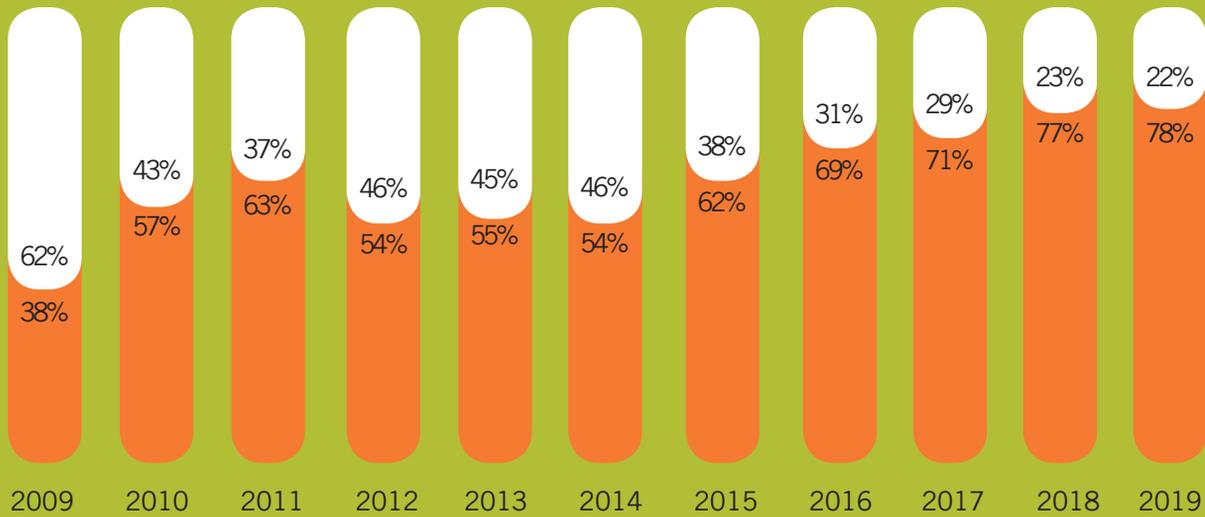
09

Number of followers on social media 2012-2019



10

Funding sources in 2019



Percentage of funding from core vs. competitive sources. Core funding is funding from trustees. Soft funding includes competitive projects (funded by sources such as the EU's H2020 program, the Spanish Ministry of Science and the Catalan Ministry of Research), industry contracts, funding from private institutions.

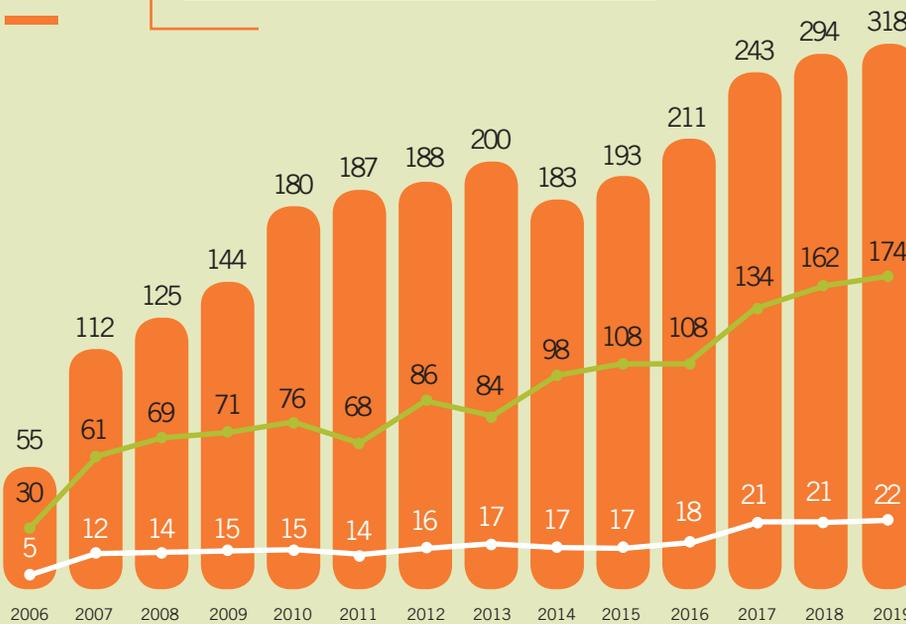
CORE FUNDING ● SOFT FUNDING ●

DIFFERENT RESOURCES OF SOFT FUNDING IN 2019, BROKEN DOWN INTO TYPES



11

Evolution of IBEC



RESEARCHERS ●
 PUBLICATIONS ●

Indexed journal articles only, not including conference proceedings, etc.

81% OF IBEC'S INDEXED JOURNAL PAPERS IN 2019 WERE IN THE FIRST QUARTILE

NUMBER OF GROUPS ●

VISIBILITY

TOP MEDIA MENTIONS

NÚRIA MONTSERRAT INSPIRES A YOUNG GENERATION AT “EL PAÍS CON TU FUTURO”

Núria Montserrat, principal investigator of the “Pluripotency for organ regeneration” group, gave an inspiring talk about bioengineering and organ regeneration before an audience of 1500 high school students. During her talk she explained how as a child she was a very curious girl, she wanted to understand how the things around her worked and how she was inspired by nature to carry out her work in the lab.

In their laboratory they have a super ambitious goal: to generate cells, tissues and eventually organs to restore those functions that have been lost, either due to aging or disease.



ELISABETH ENGEL ON RADIO EUSKADI

On the occasion of the annual meeting of the centres of excellence “Severo Ochoa and Maria de Maeztu” (SOMMa) at the 100xCiencia event, held in San Sebastián on November 22 and 23, Elisabeth Engel spoke on radio Euskadi about the intelligent devices they are developing in their laboratory. These bandages release nanoparticles containing calcium ions that are able to heal chronic lesions such as ulcers.

RAIMÓN JANÉ AT COPE RADIO TALKS ABOUT THE SMART TELEPHONE THAT MONITORS APNEA

Raimón Jané was interviewed at Cope radiostation to talk about the smartphone they developed in their research group that allows to diagnose apnea in an economic, reliable and non-invasive way, the sleep disorder is characterized by recurrent cessation of the flow of air during sleep.



HOW TO CHOOSE THE BEST DRUG FOR EACH CANCER PATIENT? IRENE MARCO FEATURED AT BIGVAN LA VANGUARDIA NEWSPAPER



Irene Marco explains at BigVan, the scientific section of La Vanguardia journal, how thanks to microfluidics and research based on the use of “organ-on-a-chip” devices, we can go a step forward towards personalized medicine.

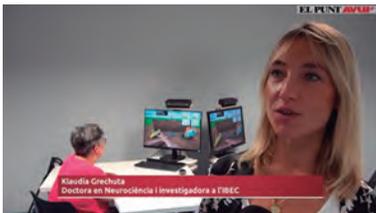
IBEC FEATURED AT THE TV PROGRAM

“FIVE DAYS AT THE PARK”

The show “5 days at...” is a TV documentary series at the national television that approaches the everyday life of very diverse places: monuments, hotels, schools, sports facilities... and now was the time for the sciens environment to take over the TV. The program takes place at the Barcelona Science Park, where IBEC is headquartered.



VIRTUAL REALITY FOR STROKE RECOVERY FEATURED ON TV



The SPECS group, together with the physical medicine and rehabilitation department of the hospital Sant Joan de Barcelona, explain us in the news of Punt Avui television, their study in virtual reality for patients who have suffered a stroke. The study began in 2014 and is a reinforcement of the basic rehabilitation treatment. In this case, a study has been done with 18 patients and a clear improvement has been observed after two months thanks to this system.



SANTI MARCO'S NANODRONE REACHES INTERNATIONAL PRESS

Researchers of the Signal and information processing for sensing systems research group at IBEC, led by Santiago Marco, have designed a nanodrone that could identify toxic gases in buildings that collapsed due the effects of earthquakes or explosions. The new gadget, which weights thirty-five grams, could be useful to detect the presence of victims in closed spaces which are hard to enter.

JOSÉ ANTONIO DEL RÍO INTERVIEWED AT “LA MARATÓ DELS INVESTIGADORS” TV PROGRAM

Last sunday 14th July, José Antonio del Río was interviewed at “La marató dels investigadors” TV program to celebrate the closure of cycle of “la Marató 2013” which was dedicated to neurodegenerative diseases, in which his research recieved funding.



NÚRIA MONTSERRAT ON TV

Last Friday, Núria Montserrat was invited at the TV show “Terrícoles” at Betevé where she discussed with the journalist Milagros Pérez about organs and artificial tissues, stem cells, 3D bioprinters and bioinformatics, among other things.

VISIBILITY

TOP EVENTS

INTERNATIONAL EXPERTS IN BIOENGINEERING MEET IN BARCELONA FOR THE 12TH IBEC SYMPOSIUM



The 12th IBEC Annual Symposium was held at the Hotel Catalonia Plaza in Barcelona. With the participation of more than 300 assistants and the exhibition of more than 102 scientific posters, this year, the event focused on Bioengineering for active aging – one of the three main research areas of IBEC- and had the participation of three Massachusetts Institute of Technology (MIT) speakers, among others.

IBEC BRINGS TOGETHER TWO NOBEL PRIZES ON THE INTERNATIONAL DAY OF WOMEN AND GIRLS IN SCIENCE



The Institute of Bioengineering of Catalonia (IBEC) has brought together in the same act the American physicist Jerome Friedman, Nobel Prize in Physics in 1990, and the Israeli crystallographer Ada Yonath, Nobel Prize in Chemistry in 2009. During the conference, Ada Yonath, has explained her work focused on the determination and study of the three-dimensional structure of ribosomes. Jerome Friedman, who on this occasion has participated as a listener, wanted to share with Ada this day that was established by the General Assembly of the United Nations in order to achieve full and equal access and participation in science for women and girls, as well as well as, to achieve gender equality and the empowerment of women and girls.

IBEC AND TU EINDHOVEN CELEBRATE THEIR SECOND SYMPOSIUM



Three members of the ICMS participated at the second IBEC-ICMS symposium, celebrated last 16th July at the Barcelona Science Park. The event aimed to identify synergies and potential for collaboration between IBEC groups and the researchers of the Institute for Complex Molecular Systems (ICMS), a research institute of the Eindhoven University of Technology (TU/e).

THE MECHANOBIOLOGY OF CANCER SUMMER SCHOOL 2019



More than 60 people attended the “Mechanobiology of Cancer Summer School 2019” organised by IBEC in the frame of the Mechano-control project. The summer school was held in Prullans, a tiny village located at the Catalan Pyrenees between 17 and 21 of September. The aim of the summer school was to provide training on mechanobiology, and specifically its application to breast cancer, and promote interactions between professionals of the field.

The school included lectures as well as practical workshops in different techniques and disciplines, ranging from modelling to biomechanics to cancer biology. The Mechano-Control project, coordinated by Pere Roca-Cusachs, principal investigator of the IBEC is the largest European project coordinated by the IBEC to date.

HEALTH TECH WORLD CANCER DAY



The Spanish Nanomedicine Platform, NanoMed Spain, managed by IBEC, co-hosted the sixth edition of Health TECH World Cancer Day, a global initiative organized as part of World Cancer Day.

It's the fourth year running that the platform hosted the conference, which took place at the headquarters of the Asociación Española Contra el Cáncer (AECC) in Barcelona and was opened by Laureano Molins, president de AECC Cataluña and IBEC/NanoMed Spain's Josep Samitier, who also gave a presentation about the platform.

INFORMATIVE SESSION “INDIVIDUAL ACTIONS MARIE SKŁODOWSKA-CURIE 2019”



The Institute for Bioengineering of Catalonia (IBEC) co-organised the informative session “Individual actions Marie Skłodowska-Curie (MSCA), call 2019”, together with the European Office of FECYT and the Agency for Management of University and Research Grants (AGAUR). The event brought together more than 100 assistants between project managers and researchers. The conference, inaugurated by Professor Josep Samitier, Director of the IBEC, started with the participation of Cristina Gómez, National Contact Point of the European Office of the Ministry MICIU, and with Aida Díaz in representation of AGAUR.

VISIBILITY

EDUCATION AND OUTREACH

The Institute for Bioengineering of Catalonia organizes or takes part in a range of dissemination activities throughout the year. These outreach activities are coordinated by the Communication and Outreach Department at IBEC, with direct collaboration with researchers from all groups. Together they develop materials for students and teachers to bring science, and especially bioengineering, to a broad non-scientific audience in a series of high quality programme such as in fairs, festivals, shows, open doors and collaboration with schools.

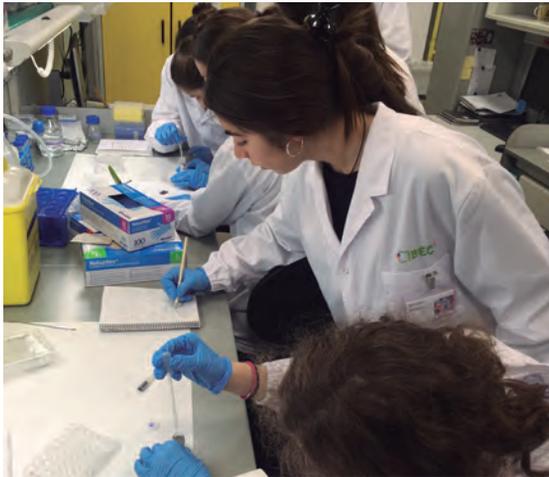
In 2019, the work of the Communications and Outreach Unit at IBEC brought bioengineering to more than 3000 students ranging from primary school to high school. Below you can find a selection of programme.



IBEC JOINS THE MAGNET PROGRAM FOR EDUCATIONAL INNOVATION

In 2019 IBEC started its activity with the “Magnet, alliances for educational success” promoted by Fundació Jaume Bofill in collaboration with the Education Department of the Catalan Government. This is a program that unites educational centers that have an unbalanced social composition with an institution of excellence for 4 years. This union will allow the educational center to develop an innovative project that will become a reference project in its territory.

Within the framework of the Magnet program, IBEC scientists and staff interact with teachers and students from the center.



SECOND EDITION OF “CRAZY ABOUT BIOENGINEERING” PROGRAM

In 2019 IBEC celebrates the second edition of “Crazy about Bioengineering”, within the ‘Bojos per la Ciència’ initiative by La Pedrera Foundation. This is a course devoted to bioengineering, where 24 students come to IBEC on eighteen Saturdays between January and October in order to theoretical and practical sessions about the main areas of research in bioengineering applied to health: controlled drug release, biomaterials, regenerative therapies and the medicine of the future, among other topics.

IBEC CONTRIBUTES TO THE FIRST BARCELONA BIENNIAL CIUTAT-CIÈNCIA



IBEC contribute as a driving to a major science festival that took place across the city of Barcelona during 2019. This initiative, promoted by the Institut de Cultura de Barcelona (ICUB), Ciutat-Ciència, was planned by a committee of seven researchers, including IBEC’s group leader Nuria Montserrat. IBEC participated in some activities and events of Ciutat-Ciència – which included talks, debates, hackathons, exhibitions and school activities – will have two major areas of focus, ‘Gender’ and ‘Open City’.

IBEC ORGANISES THE FIFTH RESEARCH4TALENT EDITION



More than fifty undergraduate and master students attended ReSearch4Talent at IBEC, the fifth time we’ve opened our doors to young scholars interested in a scientific career. During this day, students have the possibility to meet IBEC scientists, to listen about their research and experiences and to visit IBEC laboratories.

PEOPLE

PHD THESES IN 2019

■ ANDREU MATAMOROS ANGLÈS

Molecular and cellular neurobiotechnology

'Noves funcions de PrPC en neurotransmissió, neuroprotecció i neurodegeneració'

(UB)

■ CARLOS PÉREZ GONZÁLEZ

Integrative Cell and Tissue Dynamics

'Active forces driving spreading and retraction of living tissues'

(UB)

■ ELISABET MARTÍ COM-CROS

Nanomalaria

'Investigation of branched and linear polymers as oral delivery systems of antimalarial drugs'

(UB)

■ IRENE CANO TORRES

Biomaterials for Regenerative Therapies

'Cell-derived extracellular matrix scaffolds using polylactic acid microparticles for tissue engineering and cell therapy'

(UPC)

■ IGNASI JORBA MASDÉU

Cellular and respiratory biomechanics

'Multiscale nonlinear mechanics of soft biological tissues'

(UB)

■ JAVIER BURGUÉS CALDERÓN

Signal and information processing for sensing systems

'Signal processing and machine learning for gas sensors: gas source localization with a nano-drone'

(UB)

■ JORDI-YSARD PUIGBÒ LLOBET

Synthetic, Perceptive, Emotive and Cognitive Systems (SPECS)

'Learning Mechanism of Uncertainty and Neuromodulation'

(UPF)

■ KLAUDIA GRECHUTA

Synthetic, Perceptive, Emotive and Cognitive Systems (SPECS)

'Grounding Body Ownership and Language in Action: Evidence from Healthy and Damaged Brains'

(UPF)

■ ROBERTO PAOLI

Nanobioengineering

'Cell culture interfaces for different organ-on-chip applications: from photolithography to rapid-prototyping techniques with sensor embedding'

(UB)

■ VÍCTOR GONZÁLEZ TARRAGÓ

Cellular and molecular mechanobiology

'Control of integrin-mediated mechanoresponse by binding partners and force loading rates'

(UB)



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