

# IBEC ANNUAL REPORT

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Institute for Bioengineering of Catalonia

IBEC ANNUAL REPORT 2021



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Institute for Bioengineering of Catalonia

# 20 21

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Institute for Bioengineering of Catalonia



## WE SHAPE THE PRESENT AND FUTURE OF HEALTH WITH BIOENGINEERING

One year after the COVID outbreak, IBEC stayed at the forefront of excellent research. And we did it, once again, by shaping the present and future of health with bioengineering, pursuing a clear goal: to be at the service of society, helping not only to improve health but also to generate wealth. This annual report is a round-up of the scientific, innovation, and institutional highlights, but also a prove of the extraordinary evolution of IBEC in the last years.

In 2021, IBEC researchers achieved 230 indexed scientific papers and their own record of scientific impact, with 85% of papers in the first quartile. But much more important, our scientific papers tackle important global health problems, by deciphering fundamental issues of diseases such as cancer, Parkinson, Alzheimer or spinal cord injuries. To do so, IBEC researchers have tightly collaborated with our partners from other excellent international research centres, hospitals and companies. In this way, in 2021 we have developed, for instance, new models for cancer, muscular dystrophy, or toxicological studies in order to help to speed up the search for new drugs, saving money and offering more ethical and sustainable research pathways. The Carlos III Health Institute granted Nuria Montserrat, ICREA Research Professor and Deputy Director at IBEC, the coordination of the National Platform of Biobanks and Biomodels for the next three years.

The quality of top research in bioengineering at IBEC was recognised once again in 2021. Nuria Montserrat was awarded the National Research Award for Young Talent by the Catalan Government and the Catalan Foundation for Research and Innovation (FCRi), recognizing her pioneering research in the field of bioengineering of pluripotent cells and generation of organoids, also known as mini-organs. Another ICREA Research Professor, Xavier Trepac, was awarded the “Constantes y Vitales” Award for Talent in Biomedical

Research, by the Atresmedia group, for his pioneering contributions to the field known as mechanobiology. The American Institute for Medical and Biological Engineering (AIMBE) also announced the election of ICREA Professor Silvia Muro as a member of the college of Fellows for her achievements on the behavior of nanomedicines at, joining the elite of medical and biological engineers in the USA. Two more IBEC Group Leaders, ICREA Professor Samuel Sánchez, and Benedetta Bolognesi received this year two large and highly competitive grants by “la Caixa Foundation”. Three IBEC researchers, UB Professor Santi Marco, UPC Professor Beatriz Giraldo, and Nuria Montserrat, received “La Marató” grants to study and seek for solutions against COVID19. IBEC Director received the “Narcís Monturiol Medal” for contributing to Catalan Science and Technology ecosystem.

This year, Dr. Irene Marco was appointed new IBEC Junior Group Leader through new Chemical Biology Programme, to develop technologies to study chemical reactions inside our bodies and to find markers of disease or drug responses before anatomical changes occur. And IBEC also appointed Professor Samuel I. Stupp from the Northwestern University, in USA, as a Visiting Severo Ochoa Research Distinguished Professor. Stupp, with the participation of Zaida Álvarez Pinto as first author developed and reported in the journal Science, a new injectable therapy that uses ‘Dancing molecules’ to reverse paralysis and repair tissue after severe spinal cord injuries.

Despite the pandemy, IBEC’s turnover has reached the significant amount of 1,1M€ as a result of the collaboration with companies, that have chosen IBEC as its technological partner, through research contracts and services.

In addition, IBEC has also created a new spin-off, Vitala, a bioengineering-based company offering innovative and more ethical solutions for research in health, and we achieved 6 new filed patents, and 5 patents have entered the PCT phase.

This year, the Spanish Nanomedicine Platform (Nanomed Spain) also renewed the “Aid to Technological and Innovation Platforms” for the period 2021-2022 granted by the Ministry of Science and Innovation.

IBEC received also this year many distinguished guests such as the Spanish Minister for Science and Innovation, Pedro Duque, and the Catalan Minister for Research and Universities, Gemma Geis.

And regarding the social impact, we are proud to have reached, in 2021, millions of people with our press and communication activities, hundreds of students with our education and outreach activities and to have been able to bring to life IBBI, the first figure of a Bioengineering Superhero in a series of comic strips.

Summarizing, 2021 has been another great year in the evolution of IBEC, further positioning the institute as a global player in bioengineering. Is the best way to start the celebration of our 15th anniversary!

I would like to thank all IBEC staff and the support of our partners to the fantastic efforts. We look forward to another successful year in 2022.



**Josep Samitier**  
*Director of IBEC*

# A YEAR IN NUMBERS

230

INDEXED PAPERS

85%

IQ1 SCOPUS

3

BIG SCIENTIFIC AWARDS

2

NEW LARGE GRANTS  
“LA CAIXA RESEARCH  
FOR HEALTH”

3

NEW “LA MARATÓ”  
GRANTS

18

PHD THESES  
DEFENDED

6

NEW FILLED  
PATENTS

1

NEW SPIN-OFF  
COMPANY

1.100.225 €

INVOICED TO COMPANIES FOR CONTRACT  
RESEARCH AGREEMENTS

> 14,4 M  
AUDIENCE WITH PRESS

> 700  
ONLINE IMPACTS WITH NEWS

> 20 K  
TOTAL SOCIAL MEDIA FOLLOWERS

> 2100  
NEW FOLLOWERS ON SOCIAL MEDIA

> 2000  
STUDENTS REACHED

1  
NEW BIOENGINEERING SUPERHERO FIGURE



# RESEARCH GROUPS



Research Group:

## NANOSCOPY FOR NANOMEDICINE

Group Leader: **Lorenzo Albertazzi**

Selected publication: R. Riera et al. *Single-molecule imaging of glycan–lectin interactions on cells with Glyco-PAINT*. *Nature Chemical Biology*. 17, 1281–1288, 2021.

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Research Group:

## MOLECULAR BIONICS

Group Leader: **Giuseppe Battaglia**

Selected publication: N. Jesus et al. *Amphiphilic Histidine-Based Oligopeptides Exhibit pH-Reversible Fibril Formation*. *ACS Macro Letters*. 10 (8): 984–989, 2021.

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Research Group:

## SYNTHETIC MORPHOGENESIS

Group Leader: **Vito Conte**

Selected publication: A. Nyga et al. *Oncogenic RAS instructs morphological transformation of human epithelia via differential tissue mechanics*. *Science Advances*, Vol 7, Issue 42, 2021.



Research Group:

## PROTEIN PHASE TRANSITIONS IN HEALTH AND DISEASE

Group Leader: **Benedetta Bolognesi**

Selected publication: M. Seuma et al. *The genetic landscape for amyloid beta fibril nucleation accurately discriminates familial Alzheimer's disease mutations*. *eLife*, e63364, 2021.





Research Group:

## BIOMATERIALS FOR REGENERATIVE THERAPIES

Group Leader: **Elisabeth Engel**

Selected publication: G. Rubí-Sans et al. *Development of Cell-Derived Matrices for Three-Dimensional in Vitro Cancer Cell Models*. ACS Applied Materials & Interfaces. 13 (37): 44108-44123 13, 44108-44123, 2021.

Research Group:

## NANOPROBES AND NANOSWITCHES

Group Leader: **Pau Gorostiza**

Selected publication: A. Barbero-Castillo et al. *Control of Brain State Transitions with a Photoswitchable Muscarinic Agonist*. Advanced Science. e2005027, 2021.



Research Group:

## NANOMALARIA

Group Leader: **Xavier Fernández-Busquets**

Selected publication: Y. Avalos-Padilla et al. *The ESCRT-III machinery participates in the production of extracellular vesicles and protein export during Plasmodium falciparum infection*. PLOS Pathogens. 17 (4): e1009455- 17, e1009455, 2021.

Research Group:

## NANOSCALE BIOELECTRICAL CHARACTERIZATION

Group Leader: **Gabriel Gomila**

Selected publication: M. Checa et al. *Fast Label-Free Nanoscale Composition Mapping of Eukaryotic Cells Via Scanning Dielectric Force Volume Microscopy and Machine Learning*. Small Methods. Vol. 5, Issue7, 2021.





Research Group:

## **BIOMEDICAL SIGNAL PROCESSING AND INTERPRETATION**

Group Leader: **Raimon Jané**

Selected publication: Y. Castillo-Escario et al. *Assessment of trunk flexion in arm reaching tasks with electromyography and smartphone accelerometry in healthy human subjects*. Scientific Reports, 11, 5363, 2021.

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Research Group:

## **SIGNAL AND INFORMATION PROCESSING FOR SENSING SYSTEMS**

Group Leader: **Santiago Marco**

Selected publication: J. Burgués et al. *Aerial mapping of odorous gases in a wastewater treatment plant using a small drone Remote Sensing*. 13 (9): 13, 2021.



Research Group:

## **MOLECULAR IMAGING FOR PRECISION MEDICINE**

Group Leader: **Irene Marco**

Selected publication: I Marco-Rius et al. *Probing hepatic metabolism of [2-13C]dihydroxyacetone in vivo with 1H-decoupled hyperpolarized 13C-MR*. Magnetic Resonance Materials In Physics Biology And Medicine. 34 (1): 49-56 34, 49-56, 2021.

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Research Group:

## **PLURIPOTENCY FOR ORGAN REGENERATION**

Group Leader: **Núria Montserrat**

E. Garreta et al. *Rethinking organoid technology through bioengineering Nature Materials*. 20 (2): 145-155 20, 145-155, 2021.





Research Group:

## BIOMIMETIC SYSTEMS FOR CELL ENGINEERING

Group Leader: **Elena Martínez**

D. Vera et al. *Engineering Tissue Barrier Models on Hydrogel Microfluidic Platforms*. ACS Applied Materials & Interfaces. 13 (12): 13920-13933 13, 13920-13933, 2021.

Research Group:

## CELLULAR AND RESPIRATORY BIOMECHANICS

Group Leader: **Daniel Navajas**

Selected publication: M. Júnior et al. *Baseline stiffness modulates the non-linear response to stretch of the extracellular matrix in pulmonary fibrosis*. International Journal of Molecular Sciences. 22 (23): 2, 2021.



Research Group:

## TARGETED THERAPEUTICS AND NANODEVICES

Group Leader: **Silvia Muro**

Selected publication: N. Roki et al. *A method to improve quantitative radiotracing-based analysis of the in vivo biodistribution of drug carriers*. Bioeng Transl Med. 6, e10208, 2021.

Research Group:

## MOLECULAR AND CELLULAR NEUROBIOTECHNOLOGY

Group Leader: **José Antonio del Río**

Selected publication: O. Castaño. *Chemotactic TEG3 Cells' Guiding Platforms Based on PLA Fibers Functionalized With the SDF-1 $\alpha$ /CXCL12 Chemokine for Neural Regeneration Therapy*. Frontiers In Bioengineering And Biotechnology. 9 (627805): 627805- 9, 627805, 2021.





Research Group:

## **BIOSENSORS FOR BIOENGINEERING**

Group Leader: **Javier Ramón Azcón**

Selected publication: X. Fernández-Garibay et al. *Bioengineered in vitro 3D model of myotonic dystrophy type 1 human skeletal muscle*. *Biofabrication*, 13 (3), 035035, 2021.

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Research Group:

## **CELLULAR AND MOLECULAR MECHANOBIOLOGY**

Group Leader: **Pere Roca-Cusachs**

Selected publication: I. Andreu et al. *The force loading rate drives cell mechanosensing through both reinforcement and cytoskeletal softening*. *Nature Communications*, 12, 4229, 2021.

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Research Group:

## **NANOBIOENGINEERING**

Group Leader: **Josep Samitier**

A. Manzano-Muñoz et al. *MCL-1 Inhibition Overcomes Anti-apoptotic Adaptation to Targeted Therapies in B-Cell Precursor Acute Lymphoblastic Leukemia*. *Front. Cell Dev. Biol.* 9:695225, 2021.



Research Group:

## **BACTERIAL INFECTIONS: ANTIMICROBIAL THERAPIES**

Group Leader: **Eduard Torrents**

Selected publication: N. Blanco-Cabra et al. *A new BiofilmChip device for testing biofilm formation and antibiotic susceptibility*. *Biofilms and Microbiomes*, 7:62, 2021.





Research Group:

## SMART NANO-BIO-DEVICES

Group Leader: **Samuel Sánchez**

Selected publication: A. C. Hortelao et al. Swarming behavior and in vivo monitoring of enzymatic nanomotors within the bladder. *Science Robotics*, Vol. 6, Issue 52, 2021.

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Research Group:

## SYNTHETIC, PERCEPTIVE, EMOTIVE AND COGNITIVE SYSTEMS (SPECS)

Group Leader: **Paul Verschure**

Selected Publication: D. Pacheco et al. **Volitional learning promotes theta phase coding in the human hippocampus**. *PNAS*, 118 (10) e2021238118, 2021.



Research Group:

## INTEGRATIVE CELL AND TISSUE DYNAMICS

Group Leader: **Xavier Trepát**

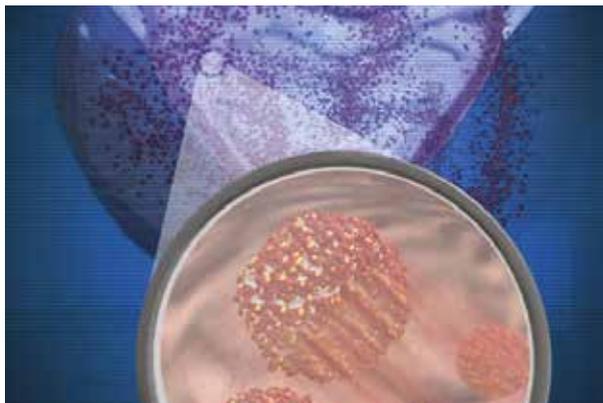
Selected publication: C. Pérez-González et al. *Mechanical compartmentalization of the intestinal organoid enables crypt folding and collective cell migration*. *Nature Cell Biology*, 23, pages 745–757, 2021.

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# SCIENTIFIC HIGHLIGHTS

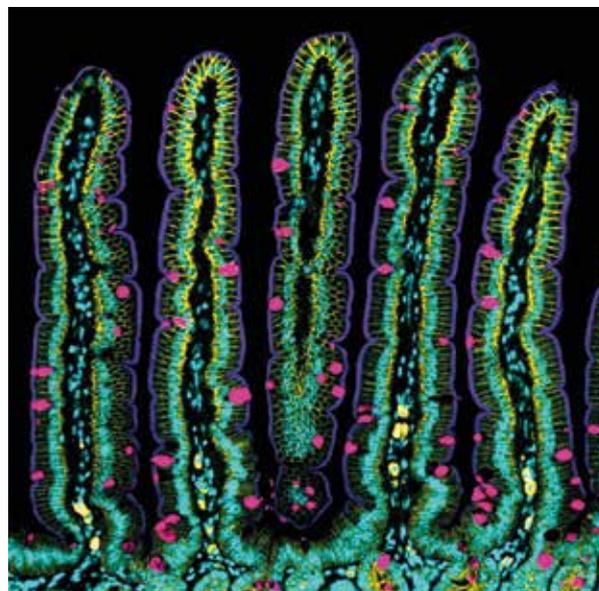
## OBSERVED IN VIVO THE COLLECTIVE MOVEMENT OF NANOROBOTS



In a study published in the journal *Science Robotics*, researchers led by ICREA Research Professor Samuel Sánchez and his team at the Group at the Institute for Bioengineering of Catalonia (IBEC), together with the group Radiochemistry & Nuclear Imaging Lab from CIC biomaGUNE led by Jordi Llop and the Universitat Autònoma de Barcelona (UAB), managed to observe in vivo, using radioactive isotope labelling, the collective behaviour of a large number of nanorobots designed at IBEC to have autonomous movement inside the bladder of living mice.

This study demonstrates the high efficiency of millions of nanoscopic devices to move in a coordinated way, both in vitro and in vivo environments, a fact that constitutes a fundamental advance in the race of nanorobots to become the key players in highly precise therapies and treatments. Future applications in medicine of these nano-scale devices are promising.

Ana C. Hortelao, Cristina Simó, Maria Guix, Sandra Guallar-Garrido, Esther Julián, Diana Vilela, Luka Rejc, Pedro Ramos-Cabrer, Unai Cossío, Vanessa Gómez-Vallejo, Tania Patiño, Jordi Llop, Samuel Sánchez. Swarming behavior and in vivo monitoring of enzymatic nanomotors within the bladder, Vol 6, Issue 52. *Science Robotics*, 2021.



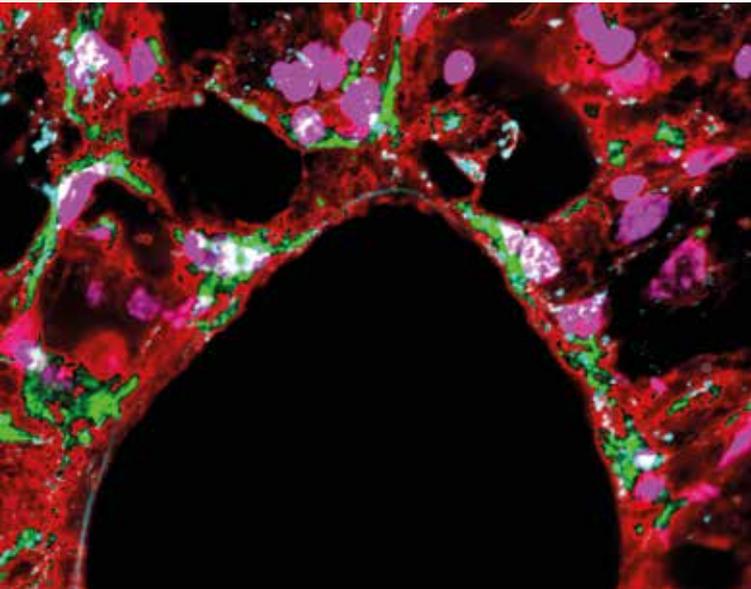
## RESEARCHERS DISCOVER HOW THE INTESTINAL EPITHELIUM FOLDS AND MOVES BY MEASURING ITS FORCES

An international team led by ICREA Research Professor Xavier Trepát at IBEC measured the cellular forces in mini-intestines grown in the laboratory, deciphering how the inner wall of this vital organ folds and moves. The scientists also showed that the movement of new cells to the peak is also controlled by mechanical forces exerted by the cells themselves, specifically by the cytoskeleton, a network of filaments that determines and maintains cell shape. The mini-intestines, or organoids, were developed using mouse stem cells, bioengineering and mechanobiology techniques, resembling the three-dimensional structure of peaks and valleys, recapitulating tissue functions in vivo.

The study, published in *Nature Cell Biology*, opens the doors to a better understanding of the bases of diseases such as celiac disease or cancer, and to the ability to find solutions for gut diseases through the development of new therapies.

C. Pérez-González, G. Ceada, F. Greco, M. Matejčić, M. Gómez-González, N. Castro, A. Menendez, S. Kale, D. Krndjija, A. G. Clark, V. Ram Gannavarapu, A. Álvarez-Varela, P. Roca-Cusachs, E. Batlle, D. Matic Vignjevic, M. Arroyo and X. Trepát. Mechanical compartmentalization of the intestinal organoid enables crypt folding and collective cell migration. *Nature Cell Biology*, 2021.

## CELLULAR PUSH AND PULL, A KEY TO THE BODY'S RESPONSE TO PROCESSES SUCH AS CANCER



An international team co-led by Pere Roca-Cusachs, UB Professor and IBEC Group Leader, and Isaac Almendros, a researcher at the Respiratory Diseases Networking Biomedical Research Centre (CIBERES) and IDIBAPS, both professors at the Faculty of Medicine and Health Sciences of the University of Barcelona, proved that what determines mechanical sensitivity in cells is the rate at which the force is applied, in other words, how fast the force is applied. The paper was published in the prestigious journal *Nature Communications* and showed, for the first time *in vivo*, the predictions of the “molecular clutch” model.

These results will help, for example, to gain a better understanding of how a cancerous tumour proliferates, as well as how the heart, the vocal cords or the respiratory system respond to the constant variation of forces to which they are repeatedly exposed.

I. Andreu, B. Falcones, S. Hurst, N. Chahare, X. Quiroga, A. Le Roux, Z. Kechagia, Amy E. M. Beedle, A. Elósegui-Artola, X. Trepal, R. Farré, T. Betz, I. Almendros & P. Roca-Cusachs. **The force loading rate drives cell mechanosensing through both reinforcement and cytoskeletal softening.** *Nature Communications*, 2021.

## THE FIRST COMPREHENSIVE MAP OF AMYLOID PLAQUE MUTATIONS OPENS NEW AVENUES FOR EARLY DETECTION OF ALZHEIMER'S DISEASE



A study published in the journal *eLife*, and led by IBEC's Junior Group Leader Benedetta Bolognesi, explored all the possible mutations in the amyloid beta peptide (A $\beta$ ) and tested how they influence its aggregation into plaques, a pathological hallmark of Alzheimer's disease.

The researchers quantified all possible mutations in the amyloid beta peptide and how this influenced the formation of aggregates by using a cell-based high throughput system where the growth of cells depends on the aggregation of the different versions of A $\beta$  inside them. This allowed them to test the effects of more than 14,000 different versions of A $\beta$  in a single experiment.

Alzheimer's disease is the most common form of dementia, a neurodegenerative disease that affects more than 50 million people around the world. This study opens the door to identify early in life the people that are likely to develop the disease.

Mireia Seuma, Andre J. Faure, Marta Badia, Ben Lehner, Benedetta Bolognesi. “The genetic landscape for amyloid beta fibril nucleation accurately discriminates familial Alzheimer's disease mutations.” *eLife* 2021; 10:e63364.

## CONTROLLING BRAIN STATES WITH A RAY OF LIGHT



A study led by IBEC researchers achieved, for the first time, to control of brain state transitions using a molecule responsive to light, named PAI. The results not only pave the way to act on the brain patterns activity, but they also could lead to the development of photomodulated drugs for the treatment of brain lesions or diseases such as depression, bipolar disorders or Parkinson's or Alzheimer's diseases.

The work, led by ICREA Research Professors Pau Gorostiza (IBEC-CERCA, BIST, CIBER-BBN) and Mavi Sanchez-Vives (IDIBAPS), has been recently published in the journal *Advanced Science*. Results show that this new molecule, named PAI (for Phthalimide-Azo-Iper) can specifically and locally control the muscarinic cholinergic receptors, that is, the acetylcholine receptors, a brain neurotransmitter very important in several processes as learning, attention, or memory.

Almudena Barbero-Castillo, Fabio Riefolo, Carlo Matera, Sara Caldas-Martínez, Pedro Mateos-Aparicio, Julia F. Weinert, Aida Garrido-Charles, Enrique Claro, Maria V. Sanchez-Vives, Pau Gorostiza. Control of Brain State Transitions with a Photoswitchable Muscarinic Agonist. (2021). *Advanced Science*. May 21; e2005027

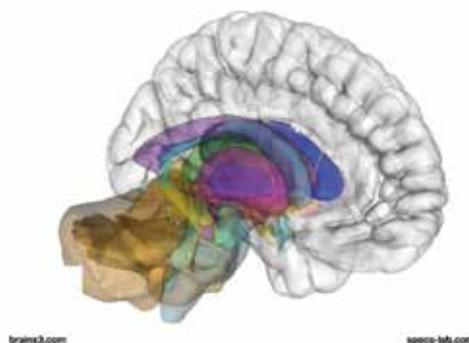
## WILLPOWER IS THE KEY TO ENHANCING LEARNING AND MEMORY: RESEARCHERS UNCOVER THE MECHANISM

An international group of researchers led by ICREA Research Professor Paul Verschure from the SPECS laboratory at the Institute for Bioengineering of Catalonia (IBEC) and Professor Nikolai Axmacher from

the Department of Neuropsychology at Ruhr University Bochum (Germany), in collaboration with Pompeu Fabra University and Dr. Rodrigo Rocamora from Hospital del Mar, identified for the first time in humans, the mechanism responsible for the effectiveness of learning processes based on self-motivation and freedom of choice.

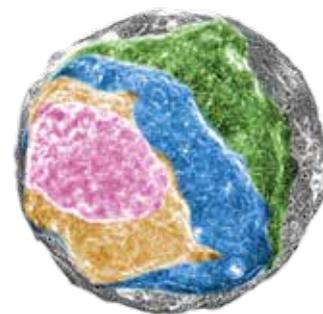
The key lies in the oscillations of theta waves generated by the hippocampus of the human brain, when it is the brain that has control of the learning process.

The work, published in the prestigious scientific journal PNAS (Proceedings of the National Academy of Sciences of the United States of America), was based on an experiment carried out with epilepsy patients. In a virtual reality game, participants navigated a square track, and were asked to recall images of objects presented at different locations on the track.



Daniel Pacheco Estefan, Riccardo Zucca, Xerxes Arsiwalla, Alessandro Principe, Hui Zhang, Rodrigo Rocamora, Nikolai Axmacher, Paul F. M. J. Verschure. "Volitional learning promotes theta phase coding in the human hippocampus". PNAS, 2021.

## RAS GENE AND TISSUE PHYSICS ACT IN TANDEM TO DRIVE CANCER PROCESSES



Researchers from IBEC led by Vito Conte and from UCL (UK), UPC (Spain) and the TU/e (Netherlands) showed that activation of the RAS oncogene (a mutation occurring in approximately 30% of human cancers), induces tumour features in the epithelium, via coordinated physical changes of all cells forming the affected tissue. Published in the scientific journal *Science Advances*, the new work

suggested that future cancer treatments should target both the biological processes underlying the disease and the evolving mechanical structure of the affected tissue.

The researchers grew 2D sheets of epithelial cells in the lab and activated the RAS oncogene in selected samples. Within just 24 hours, oncogene activation induced structural and mechanical instability in the tissues by unbalancing the highly-controlled intercellular forces that give epithelia their barrier function. In less than 48 hours, the RAS-activated tissues had transformed it into a 3D mass, indicative of the onset of tumour growth.

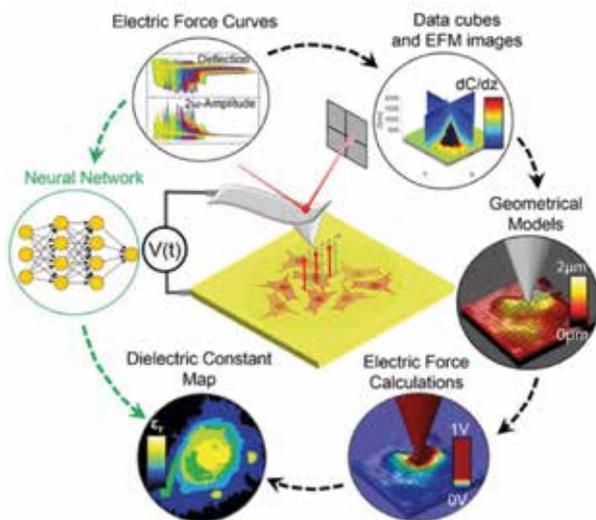
Agata Nyga, Jose J. Muñoz, Suze Dercksen, Giulia Fornabaio, Marina Uroz, Xavier Trepas, Buzz Baum, Helen K. Matthews and Vito Conte. Oncogenic RAS instructs morphological transformation of human epithelia via differential tissue mechanics. *Science Advances*, 2021.

In this study, led by Gabriel Gomila, UB Professor and IBEC Group Leader, and published in the journal *Small Methods*, the researchers used machine learning algorithms to speed up the microscope data processing.

This study can provide an invaluable tool to biologists conducting basic research and it also has the potential to be used in a host of biomedical applications.

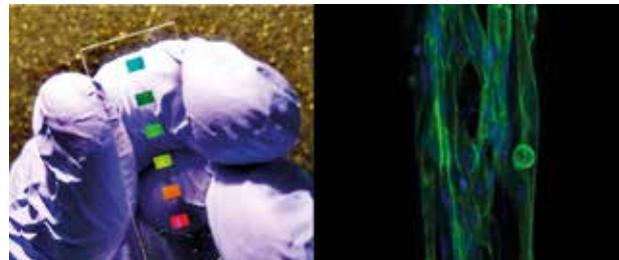
Martí Checa, Ruben Millan-Solsona, Adrianna Glinkowska Mares, Silvia Pujals, and Gabriel Gomila. Fast Label-Free Nanoscale Composition Mapping of Eukaryotic Cells Via Scanning Dielectric Force Volume Microscopy and Machine Learning. *Small Methods*, 2021.

## MACHINE LEARNING REDUCES MICROSCOPE DATA PROCESSING TIME FROM MONTHS TO JUST SECONDS



With a new method that combines high-powered scanning force microscopes and machine learning, IBEC researchers have drastically reduced the processing time required to achieve a nanoscale biochemical compositions map from electric images of eukaryotic cells in just seconds. Using earlier computation methods, processing one image could take even months.

## NEW BIOSENSOR CAN DETECT INFLAMMATORY MARKER IN MUSCLE WITH HIGH SENSITIVITY

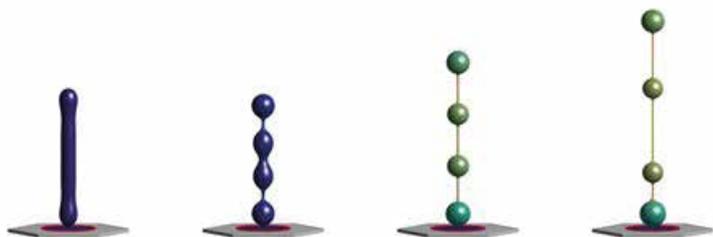


In a publication in the journal *Nanophotonics*, IBEC researchers led by ICREA Research Professor Javier Ramón, present a new biosensor for the direct and sensitive detection of the protein interleukin-6 in muscle, an indicator of inflammation and potential disease, proving the high performance of the device on bioengineered 3D skeletal muscles. This new approach may result in a promising tool for measuring the efficacy of drug candidates for diseases where inflammation is present such as muscular dystrophy.

The approach of IBEC researchers offers a new, direct, label-free and real-time quantification of biomarkers that minimizes set-up complexity. It could be used to measure biomarkers in bioengineered 3D tissues or organoids with applications in the early screening of lead drug candidates for numerous diseases.

Gerardo A Lopez-Muñoz, Juan M Fernández-Costa, María Alejandra Ortega, Jordina Balaguer-Trias, Eduard Martín-Lasierra and Javier Ramón-Azcón. Plasmonic nanocrystals on polycarbonate substrates for direct and label-free biodetection of Interleukin-6 in bioengineered 3D skeletal muscles. *Nanophotonics*, 2021.

## RESEARCHERS DISCOVER HOW CELLULAR MEMBRANES CHANGE CURVATURE DEPENDING ON BAR PROTEINS

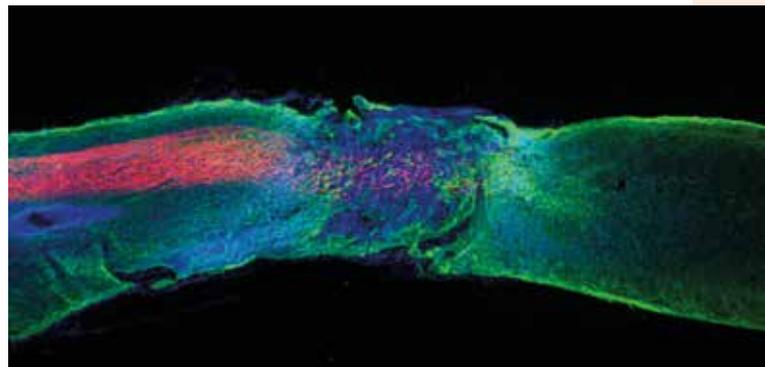


A team of researchers at IBEC and UPC, led by Pere Roca-Cusachs, Associate professor at the Faculty of Medicine of the University of Barcelona (UB) and IBEC Group Leader, and IBEC's Associated Researcher Marino Arroyo (UPC), studied how BAR proteins, a family of molecules that bind curved cellular membranes, reshape these membranes. Scientists reported in the journal *Nature Communications* the dynamics of these membrane reshaping processes that occur both in normal cells and disease scenarios.

Experimentally, researchers developed an *in vitro* system to mechanically deform artificial membranes, expose them to purified BAR proteins, and observe the resulting dynamics by confocal microscopy. In addition, researchers developed theoretical models to understand the process, capturing the dynamics and mechanochemistry of the process. Combining both, experimental and theoretical approaches, researchers also observed that cell membrane deformations depend on initial membrane shape.

Anabel-Lise Le Roux, Caterina Tozzi, Nikhil Walani, Xarxa Quiroga, Dobryna Zalvidea, Xavier Trepas, Margarita Staykova, Marino Arroyo, Pere Roca-Cusachs. Dynamic Mechanochemical feedback between curved membranes and BAR protein self-organization. *Nat Commun* 12, 6550 (2021).

## 'DANCING MOLECULES' REPAIR SEVERE SPINAL CORD INJURIES IN PARALYZED ANIMALS



Researchers from the University of Northwestern, in the United States, and currently at the Institute of Bioengineering of Catalonia (IBEC), develop a pioneering injectable therapy that uses synthetic nanofibers to repair spinal cord lesions. Nanofibers, which contain 'Dancing molecules' effectively stimulate cellular receptors by promoting spinal cord regeneration. After a single injection, paralyzed mice treated with this new therapy were able to walk again in just four weeks. The article was published in the prestigious journal *Science*.

Scientists led by Samuel Stupp, Professor at Northwestern University (US) and Distinguished Professor Severo Ochoa at IBEC, with the participation of Zaida Álvarez Pinto as first author, current researcher of the group "Biomaterials for Regenerative Therapies" at IBEC, developed a new injectable therapy that uses 'Dancing molecules' to reverse paralysis and repair tissue after severe spinal cord injuries.

Zaida Alvarez, Alexandra N. Kolberg-Edelbrock, Ivan R. Sasselli, J.Alberto Ortega, Ruomeng Qiu, Zois Syrgiannis, Peter A. Mirau, Feng Chen, Stacey M. Chin, Steven Weigand, Evangelos Kiskinis, Samuel I. Stupp. *Bioactive scaffolds with enhanced supramolecular motion promote recovery from spinal cord injury*. *Science*, 2021, Vol 374 (6569), pp.848-856.

## IBEC RESEARCHERS PROPOSE A CHEAPER AND MORE ETHICAL MODEL FOR TOXICOLOGICAL STUDIES



A new study led by IBEC researchers shows that larvae of the insect *Galleria mellonella* can be effective to test the toxicity of nanoparticles. This work thus paves the way toward a new animal model for toxicity studies that represent an inexpensive and more ethical alternative to rodent testing. This work was senior authored by Eduard Torrents in collaboration with José Antonio Del Río, Group leaders of IBEC's Bacterial Infections: Antimicrobial Therapies and Molecular and Cellular Neurobiotechnology Groups, respectively. Both researchers are also professors at the University of Barcelona (UB). The results of this work demonstrate that *G. mellonella* larvae can be reliably used as a bridge between *in vitro* and mouse studies. With this invertebrate model, researchers will be able to study a large number of samples simultaneously and therefore make better predictions about their toxic effects on mice.

Laura Moya-Andérico , Marija Vukomanovic , Maria Del Mar Cendra, Miriam Segura-Feliu, Vanessa Gil, José A Del Río, Eduard Torrents. Utility of *Galleria mellonella* larvae for evaluating nanoparticle toxicology. *Chemosphere*, 2021.

## NEXT GENERATION OF SWIMMING LIVING ROBOTS CAN SELF-TRAIN, SHOWING STRIKING SPEED AND STRENGTH

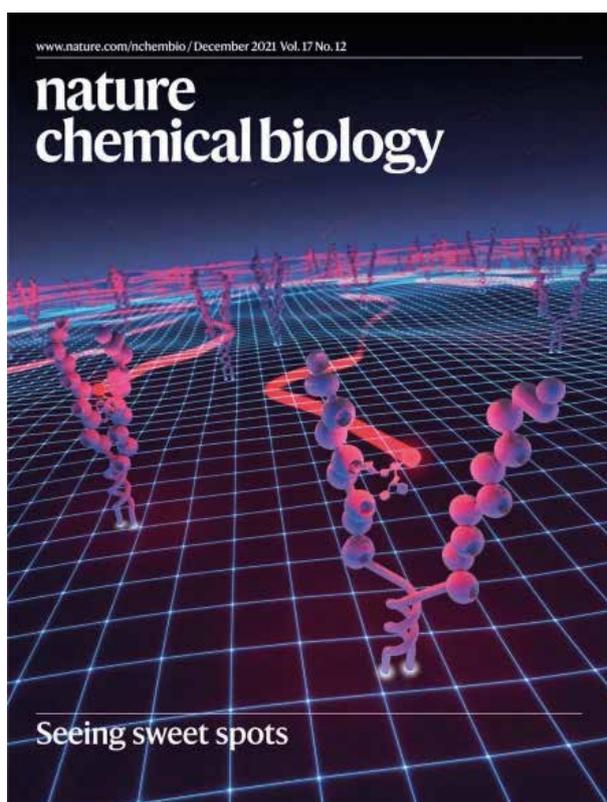


Researchers at the Institute for Bioengineering of Catalonia (IBEC) led by ICREA Research Professor Samuel Sánchez achieved a breakthrough in the field of biobots by using bioengineering tools. Sánchez and his colleagues at IBEC have applied 3D bioprinting and engineering design for the development of biobots at the cm range that can swim and coast like fishes, with unprecedented velocities. The key: to use the spontaneous contraction of muscle cells-based materials with a very special compliant skeleton.

The work of Sánchez, Maria Guix and colleagues at IBEC open the door to a new generation of stronger and faster biological robots based on muscle cells, of interest, both for environmental and drug delivery purposes, but also for the development of bionic prosthetics. In the biomedical field, the possibility of printing such 3D models with human muscles, offers the opportunity to use such highly functional devices for medical platforms of drug testing.

Maria Guix, Rafael Mestre, Tania Patiño, Marco De Corato, Judith Fuentes, Giulia Zarpellon and Samuel Sánchez. *Biohybrid soft robots with self-stimulating skeletons*. *Science Robotics*, Vol 6, Issue 53, 2021.

## UNRAVELING THE CELL'S SWEET SPOT FROM NATURE



In a *Nature Chemical Biology* paper, a team of researchers from ICMS/TUE and IBEC led by Lorenzo Albertazzi, together with researchers from Leiden University, unravel the interactions of individual sugar molecules with cells using super-resolution microscopy. The paper appeared on the cover of the November issue of the journal. Are sugars a candidate to develop more potent vaccines? “We can use sugars to trick the immune system into thinking it’s a danger signal and stimulate an immune response, similar as in vaccines”, explained the authors. However, there is a sweet spot to get it exactly right: “If you use the wrong sugars, the immune response will be very different”, specifies Albertazzi. “Our methods could be used to understand better how immune cells recognize certain sugars over others”, concluded Albertazzi.

Riera, R., Hogervorst, T.P., Doelman, W. et al. Single-molecule imaging of glycan–lectin interactions on cells with Glyco-PAINT. *Nat Chem Biol* 17, 1281–1288 (2021).

## ARTIFICIAL SMELL TO CONTROL FOOD QUALITY



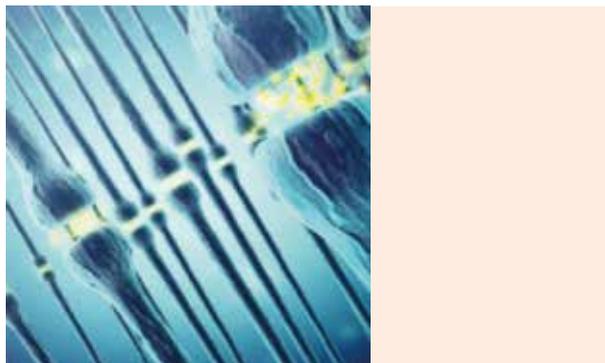
Researchers from IBEC, in collaboration with the University of Cordoba, published a study where they develop protocols that optimize the use of a technique capable of analysing, at the molecular level, substances present in the aroma of food, managing to differentiate samples of ham from Iberian pigs fed with acorn or feed. This new approach, which uses artificial intelligence to analyse the data, will simplify the analysis of aromas, and can be very useful to determine the traceability and quality of food.

Researchers led by Santiago Marco, Group Leader of the Signal and information Processing for Sensing Systems at IBEC and Professor at the University of Barcelona (UB), together with researchers from the University of Córdoba led by Dr. Lourdes Arce, developed new procedures for the analysis of GC-IMS data from aromas in food, opening the possibility to build tailored analysers to check the quality and authenticity of high value food products.

In this work, recently published in the journal *Sensors*, researchers present a methodology going from the processing of raw data to the final characterization of the sample, and to validate the method they have been able to predict the pig feeding regime (acorn or feed) from samples of Iberian ham.

Rafael Freire, Luis Fernandez, Celia Mallafre-Muro, Andrés Martín-Gómez, Francisco Madrid-Gambin, Luciana Oliveira, Antonio Pardo, Lourdes Arce, Santiago Marco. Full Workflows for the Analysis of Gas Chromatography—Ion Mobility Spectrometry in Foodomics: Application to the Analysis of Iberian Ham Aroma. *Sensors*, 2021, 21, 6156.

## NEW MOLECULES ALLOW TO SWITCH ON AND OFF NEURONAL CIRCUITS USING LIGHT



Researchers from IBEC, in collaboration with an international team, described the first molecules capable of regulate glycine receptors with light: Glyght and Azo-NZ1. The new molecules are a promising way to study neuronal circuits, to develop drug-based phototherapies non-invasively, and to understand neurological disorders related with the incorrect functioning of glycine receptors, as hyperekplexia, epilepsy and autism.

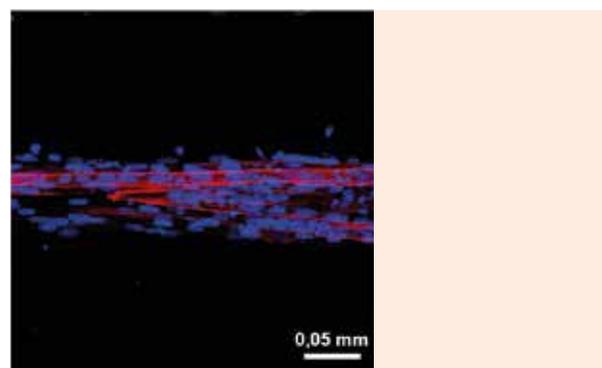
An European consortium (Modulightor) coordinated by ICREA Research Professor Pau Gorostiza, leader of the “Nanoprobes and Nanoswitches” group at IBEC and member of the Biomedical Research Networking Center in Bioengineering, Biomaterials and Nanomedicine (CIBER- BBN), developed organic molecules that convey light sensitivity to GlyRs, named Glyght and Azo-NZ1. The work, published in two papers in *eNeuro* and *Cell Chemical Biology* journals, show an effective and specific control over GlyR activity *in vitro* and *in vivo*. These photochromic organic molecules can be controlled by light in a non-invasive way and allow a precise spatial and temporal selectivity, favouring specific drug action. The other laboratories of the consortium are led by Carme Rovira (University of Barcelona), Piotr Bregestovski (Aix-Marseille University), and Burkhard König (Regensburg University).

Galyna Maleeva, Alba Nin-Hill, Karin Rustler, Elena Petukhova, Daria Ponomareva, Elvira Mukhametova, Alexandre MJ Gomila, Daniel Wutz, Mercedes Alfonso-Prieto, Burkhard König, Pau Gorostiza and Piotr Bregestovski. Subunit-Specific Photocontrol of Glycine Receptors by Azo-benzene-Nitrazepam Photoswitcher. *eNeuro* (2021) 8 (1) 1-17.

Alexandre M.J. Gomila, Karin Rustler, Galyna Maleeva, Alba Nin-Hill, Daniel Wutz, Antoni Bautista-Barrufet, Xavier Rovira, Miquel Bosch, Elvira Mukhametova, Marat Mukhamedyarov, Frank Peiretti, Mercedes Alfonso-Prieto, Carme Rovira, Burkhard König, Piotr Bregestovski, Pau Gorostiza. Photocontrol of endogenous glycine receptors *in vivo*. *Cell Chemical Biology* (2020), 27 (11), 1425-1433.

gestovski, Pau Gorostiza. Photocontrol of endogenous glycine receptors *in vivo*. *Cell Chemical Biology* (2020), 27 (11), 1425-1433.

## TOWARDS A TREATMENT FOR MYOTONIC DYSTROPHY: THE FIRST 3D MODEL WITH PATIENT CELLS



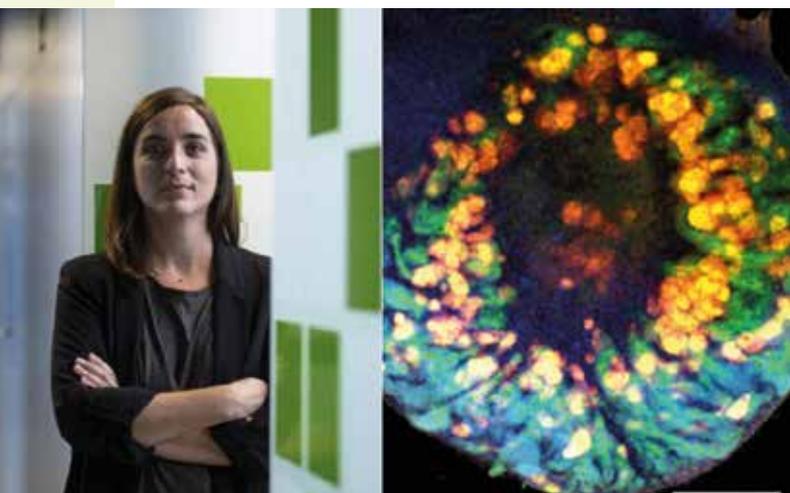
IBEC researchers led by Javier Ramón and Juan M. Fernández developed the first three-dimensional model for myotonic dystrophy, a rare disease that currently has no cure. The model combines patient cells and bioengineering techniques and represents a major advance over the use of animals and cell cultures. This new model will help in the design of personalized and more effective treatments, and for drug testing in a much more efficient way.

The team of researchers, led by the ICREA Research Professor and Group Leader of the Biosensors for Bioengineering group at IBEC Javier Ramón, developed a three-dimensional model for myotonic dystrophy, using bioengineering techniques and patient cells. The work, which is part of the doctoral thesis of the IBEC researcher Xiomara Fernández and has been carried out in collaboration with researchers from the INCLIVA health research institute in Valencia, was published in the journal *Biofabrication*, and opens new avenues for finding personalized and effective treatments against this rare disease, and to date without cure. This work has been funded in part with funds from a fundraising campaign launched by IBEC from late 2017 to late 2019.

Xiomara Fernández-Garibay, María A. Ortega, Estefanía Cerro-Herreros, Jordi Comelles, Elena Martínez, Rubén Artero, Juan M. Fernández-Costa and Javier Ramon. Bioengineered *in vitro* 3D model of myotonic dystrophy type 1 human skeletal muscle. *Biofabrication* (2021), 13 (3), 035035.

# INSTITUTIONAL HIGHLIGHTS

## NURIA MONTSERRAT COORDINATES FROM IBEC THE NEW NATIONAL PLATFORM FOR BIOBANKS AND BIOMODELS



The Carlos III Health Institute granted Nuria Montserrat, ICREA Research Professor and principal investigator at the Institute for Bioengineering of Catalonia (IBEC), the coordination of the National Platform of Biobanks and Biomodels for the next three years.

The newly created Platform will manage biological samples of disease through the coordination of supply services including, also, conventional samples through virtual biobanks. In turn, the Platform will work on the development of services in the field of organoids, animal models and 3D tissue printing.

the Council of Ministers approved in 2020, at the request of the Ministry of Science and Innovation, to authorize the ISCIII to call for grants for the ISCIII Platforms to support R&D&I in Biomedicine and Health Sciences, as part of the development of the Strategic Action in Health 2017-2020.

Among these, the newly created Biobanks and Biomodels Platform will manage, with the coordination of the ICREA Research Professor at IBEC, Nuria Montserrat, biological samples of disease by coordinating the supply and generation of organoids and/or animal models, 3D printing of organs and tissues. The platform will also manage conventional samples thanks to virtual biobanks. As one of the members of the State Research and Innovation Platform, Nuria Montserrat at IBEC has obtained funding of

354.442 euros and, on the other hand, has a budget of 406.500 euros to carry out the coordination of the Platform for Biobanks and Biomodels for the next three years.

## RESEARCHER XAVIER TREPAT WINS THE “CONSTANTES Y VITALES” AWARD FOR HIS PIONEERING CONTRIBUTIONS TO THE MECHANOBIOLOGY FIELD



The ICREA Research Professor at the Institute for Bioengineering of Catalonia (IBEC), Xavier Trepat, was awarded by the Atresmedia group with the “Constantes y Vitales” Prize for the Young Talent in Biomedical Research, for his contributions to the field known as mechanobiology, that studies the effect of physical forces on living systems and their implication in pathologies such as cancer.

The ceremony took place at the *Palacio de las Alhajas Mamen Mendizábal, Madrid*, with the presence of the Minister of Science and Innovation, Diana Morant, and the Chief Executive Officer of Atresmedia, Silvio González.

Trepat, leader of the research group Integrative cell and tissue dynamics at IBEC, and member of CIBER-BBN, is a recognized expert and pioneer, at an international level, in the field known as mechanobiology, which studies the role of physics in biological systems. Trepat and his team have developed several technologies over the past decade that have made it possible to observe, and measure at the nano-scale, the properties of cells.

## THE SPANISH NANOMEDICINE PLATFORM COORDINATED BY IBEC RECEIVES A NEW BOOST



The Spanish Nanomedicine Platform (Nanomed Spain) renewed the “Aid to Technological and Innovation Platforms” for the period 2021-2022 granted by the Ministry of Science and Innovation. Josep Samitier, director of the Institute for Bioengineering of Catalonia, coordinates the Nanomed Spain platform since its foundation in 2005.

The Spanish Nanomedicine Platform brings together the main Spanish actors in research, industry and administration, in order to promote a common strategy in the field of nanomedicine. The Nanomed Spain family has the support of more than 170 institutions with the aim of accelerating the translation of nanomedicine from the first stages of research to its arrival on the market and in the clinic.

## NURIA MONTSERRAT WINS THE NATIONAL RESEARCH AWARD

Nuria Montserrat, ICREA Research Professor and Group Leader at IBEC, has been awarded the National Research Award for Young Talent 2020 by the Catalan

Government and the Catalan Foundation for Research and Innovation (FCRI). This award recognizes the pioneering research of Professor Montserrat in the field of bioengineering of pluripotent cells and generation of organoids, also known as mini-organs, for the study of diseases in humans.

The Catalan Foundation for Research and Innovation (FCRI), and the Catalan Government, promote every year the National Research Awards. These awards recognize not only research activities, but also communication and scientific dissemination, as well as public and private cooperation in R&D projects in Catalonia.

Nuria Montserrat is Group Leader of the “Pluripotency for Organ Regeneration” group and Deputy Director at IBEC. This category rewards young researchers who have stood out in their professional careers for the quality and excellence of their work, with an economic endowment of 10,000 €.

Nuria Montserrat has been selected in the 2020 edition for her pioneering work dedicated to understanding how to control the differentiation of human pluripotent stem cells and the generation of organoids, or three-dimensional renal cultures, with the aim of studying diseases and possible treatments. The jury was chaired by Joan Gómez Pallarès, Director General of Research, on behalf of the former Minister of Business and Knowledge and former President of the FCRI, Ramon Tremosa.



## **IBEC GROUP LEADER SILVIA MURO, ELECTED TO JOIN THE AMERICAN MEDICAL AND BIOLOGICAL ENGINEERING ELITE**

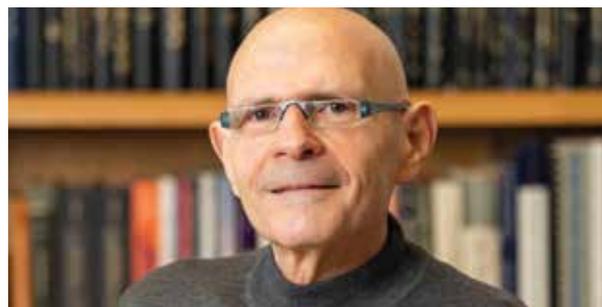


The American Institute for Medical and Biological Engineering (AIMBE) announced in 2021 the election of Professor Silvia Muro as a member of the “College of Fellows” for her achievements on the behavior of nanomedicines at the cellular and molecular levels. The College of Fellows is comprised of the top two percent of medical and biological engineers in the USA. Silvia Muro, Group Leader at Institute for Bioengineering of Catalonia (IBEC) and ICREA Research Professor, has been elected to join the AIMBE. Prof. Muro was nominated, reviewed, and elected by peers and members of the College of Fellows for generating knowledge to advance drug delivery by bridging the gap between molecular-cellular biology and nanotechnology. The College of Fellows is comprised of the top two percent of medical and biological engineers in the country. The most accomplished and distinguished engineering and medical school chairs, research directors, professors, innovators, and successful entrepreneurs comprise the College of Fellows.

## **THE PIONEER IN SUPRAMOLECULAR BIOMATERIALS, SAM STUPP, JOINS IBEC AS SEVERO OCHOA DISTINGUISHED PROFESSOR**

Professor Samuel I. Stupp from the Northwestern University, in USA, joined in 2021 the Institute for Bioengineering of Catalonia (IBEC) as a Visiting Severo Ochoa Research Distinguished Professor. Stupp is a pioneer demonstrating how supramolecular biomaterials can be used to regenerate neural, vascular, and musculoskeletal tissues such as the spinal cord, cartilage, bone, blood vessels, or muscles.

Samuel Stupp has received numerous awards over the course of his career, including the Department of Energy Prize in Materials Chemistry, the Humboldt Award for Senior U.S. Scientists, the Materials Research Society Medal Award and the American Chemical Society Award in Polymer Chemistry. In 2020, Stupp was also awarded the 2020 Nanoscience Prize.



## **IBEC'S DIRECTOR RECEIVES THE NARCÍS MONTURIOL MEDAL FOR HIS CONTRIBUTIONS TO SCIENCE AND TECHNOLOGY**



The Catalan Government awarded the Narcís Monturiol Medal for scientific and technological merit to the Director of the IBEC, Josep Samitier i Martí, for his contributions to the development of the Catalan system of science and technology.

At the ceremony, celebrated in the Auditorium of the Generalitat de Catalunya, Samitier acknowledged during his speech this recognition, and reminded us the fundamental motivation: “Those of us who are here today, have tried to understand and provide solutions to the questions and needs of society”.

In total, ten researchers from the Catalan knowledge system (six men and four women) received yesterday this distinction, as well as a research center that was awarded the Narcís Monturiol Plaque.

Josep Samitier Martí is Director of the Institute for Bioengineering of Catalonia (IBEC), Professor of the Department of Electronic and Biomedical Engineering at the University of Barcelona (UB) and President of the Catalan Association of Research Entities (ACER). He is a promoter of nanobioengineering through the research group he leads at IBEC, which focuses on applying nanotechnology to develop new biomedical systems and devices, mainly for diagnostic purposes, and integrated organ-on-a-chip microfluidic devices, to study diseases and for drug screening.

## BENEDETTA BOLOGNESI WINS COMPETITIVE FUNDING TO JOIN FORCES AGAINST NEURODEGENERATIVE DISEASES



“la Caixa” Foundation funded a large and innovative research project co-led by IBEC’s Junior Group Leader Benedetta Bolognesi and by ICREA research professor Ben Lehner at CRG, which aims to gain a better understanding of the genetic causes leading to neurodegenerative diseases. Researchers will combine deep mutagenesis and machine learning techniques to produce a “map of dementia” as a method to predict whether a person is more susceptible to suffer these diseases.

Researchers observed that certain mutations cause some people to accelerate the formation of protein deposits in the brain, leading them to develop infrequent rare and more aggressive forms of these conditions, but deeper knowledge is needed to develop predictive methods able to identify these mutations and develop efficient therapies.

Bolognesi, Lehner and their teams aim to better understand the variants that cause these neurodegenerative diseases and to develop methods to predict whether a person is more susceptible to dementia. Scientists also want to develop new prevention strategies to prevent or treat dementia. In order to achieve these goals, researchers will combine their expertise in deep mutagenesis and machine learning to produce a map of the causes show all possible mutations in these proteins can leading to dementia.

With a total budget of circa one million euros provided by last call of CaixaResearch for Health 2021 from La Caixa Foundation, IBEC and CRG researchers will join forces against dementia.

## SAMUEL SÁNCHEZ’S NANOROBOTS AGAINST CANCER WILL ACCELERATE THANKS TO THE SUPPORT/OR WITH THE SUPPORT FROM “LA CAIXA” FOUNDATION



Samuel Sánchez and his team at the Institute for Bioengineering of Catalonia (IBEC), earned the competitive call CaixaResearch for Health Research to develop nanorobots against bladder cancer. Sánchez, a pioneer in the field of self-propelled nanorobots, proposes to move in this way towards solutions against one of the most common, recurring and expensive forms of cancer to treat.

Bladder cancer currently represents the second most common malignant neoplasm of the urinary tract, with a worldwide incidence of over half a million new cases, and about 200,000 deaths per year. Due to its high recurrence, and the lack of efficient diagnostic and therapy methods, this type of cancer is also one of the most expensive to treat in the world.

In this context, the use of so-called ‘nanorobots’ or ‘nanobots’, tiny objects manufactured in the laboratory, opens the door to new, more efficient and economic solutions.

Samuel Sánchez, ICREA Research Professor and Principal Investigator of the “Smart Nano-Bio Devices” group at the Bioengineering Institute of Catalonia (IBEC), is a pioneer in this field, having in recent years achieved to develop nanobots driven with the most abundant bladder fuel: urea.

Thanks to studies on the leading edge of knowledge, Sánchez and his team at IBEC receive now extra competitive funding from the “la Caixa” Foundation to advance these innovative solutions to health problems, leading the project BLADDEBOTS (acronym for bladder robots) that has the participation of the Clinic Foundation for Biomedical Research; the Cooperative Research Centre in Biomaterials (CICbioma-GUNE) and the Autonomous University of Barcelona (UAB).

## **GREENER THAN EVER: IBEC LAUNCHES ITS SUSTAINABILITY STRATEGY**



The Institute for Bioengineering of Catalonia (IBEC) presented in 2021 its strategy for sustainability which is committed to promote more sustainable practices in research and administration. With this initiative IBEC, an international excellence center focused on bioengineering solutions for health, takes the lead to fight climate change, pollution and non-sustainable practices with more strategy and actions.

Because green is the colour of IBEC, and it is not casual, since it represents olive tree leaves, part of Catalonia and IBEC history. But even more, green represents global health, not only human but also earth health.

Therefore, at the end of 2020 IBEC created its Sustainability Committee, composed of members of the different profiles of the institute: researchers, technicians, and administration. Since then, the members of the committee have been working on the collection, analysis and suggestion of actions which aim to make our Institute more sustainable. Now, all this work has been compiled in the IBEC Strategy to promote sustainability in Research, approved by IBEC's Board of Trustees on 29 June 2021. This is an evolving working document that will be reviewed and improved upon its implementation.

## **IRENE MARCO, APPOINTED NEW IBEC JUNIOR GROUP LEADER THANKS TO THE/THROUGH NEW CHEMICAL BIOLOGY PROGRAMME**

“la Caixa” Foundation and BIST created the “Chemical biology programme” to promote two new cutting-edge

research groups at IBEC and IRB (both centres are members of BIST). The initiative aims to attract talent from the field of chemical biology, and to create an ecosystem that fosters research excellence in improving health.

Dr. Irene Marco-Rius explained that her group will focus on developing innovative molecular imaging technologies to diagnose diseases and assess early response to treatment. “The cells in our body adapt rapidly to their environment and change the way they get nutrients and energy needed to survive. My group works with technology that allows us to study these chemical reactions inside our bodies (or using tissue bioengineering), and to find markers of disease or drug responses before anatomical changes occur. For example, we can distinguish between cancer cells and healthy cells inside the body using a magnetic resonance imaging device without any pain and without the need for a biopsy.”



## **MARINO ARROYO, ASSOCIATED RESEARCHER AT IBEC, HONOURED WITH AN ICREA ACADEMIA AWARD**



The Catalan Institution for Research and Advanced Studies (ICREA) recognized the excellent research of Professor Marino Arroyo, who won for the third time the ICREA Academia award. Over the next five years he will receive a grant in recognition of the research excellence done in his laboratory to continue developing research projects on mechanobiology.

Professor Marino Arroyo is an associated researcher at IBEC and member of the Department of Civil and Environmental Engineering and the Mathematics Institute of the Universitat Politècnica de Catalunya (UPC)-BarcelonaTech (IMTech) of the UPC, where he leads the Mechanics of Soft and Living Interfaces laboratory from the Research program on Cell and Tissue Mechanobiology. His research goal is to develop mathematical and computational models to understand the mechanics of biological interfaces, cells and tissues, that is, the small-scale mechanics of materials and biological systems.

## IBEC RECEIVES THE SPANISH MINISTER PEDRO DUQUE INTERESTED IN THE LATEST ADVANCES IN BIOENGINEERING



In February, the Spanish Minister for Science and Innovation, Pedro Duque, visited the Institute for Bioengineering of Catalonia, to know first-hand the latest advances in bioengineering for health.

During his visit to the Pluripotency for organ regeneration lab, led by Nuria Montserrat, ICREA research professor at IBEC, he showed his interest in the research that is being carried out with organoids to fight diseases such as Covid-19, among others. The researchers had the opportunity to show him their advances in the creation of retinal and kidney organoids generated from stem cells, the latter also edited with genetic engineering.

ICREA Professor Nuria Montserrat and David Badia, Managing Director of the institute, had the opportunity to share with the Minister some of the research projects being carried out at the institute. Among them, the coordination of the new “National Platform of biobanks and biomodels” that will manage biological disease samples by coordinating the supply services and the generation of organoids and/or animal models and 3D printing of organs and tissues.

## SAMUEL SÁNCHEZ RECEIVES A MEDAL FROM THE YOUNG ACADEMY OF SPAIN



Samuel Sánchez, group leader at the Institute for Bioengineering of Catalonia (IBEC), received a medal from the Young Academy of Spain as a new full-time academic. The event took place in the Assembly Hall of the Royal National Academy of Pharmacy.

On November 25, the formal act of the “Awarding of Medals” to the new Academic Members of the Young Academy of Spain took place. Since the creation of the Academy in 2019, 30 outstanding researchers in fields that encompass the main branches of knowledge have joined it, among them Samuel Sánchez, group leader of the “Smart Nano-Bio-Devices” group at IBEC.

Amongst many distinctions, Samuel Sánchez has won the MIT Award for Innovators under 35 years old (2014), the Princess of Girona Foundation Award for Scientific Research (2015) and the National Research Prize for Young Talent (2016). In 2019, he was awarded the prestigious European Research Council (ERC) “Consolidator Grant”. With his i-NANOSWARMS project, Sánchez and his team will study the collective behaviour of self-propelling nanorobots and study their possible applications in the administration of drugs and image diagnosis.

Samuel hopes to be able to contribute, for the second year in a row, to the Academy with this international profile, his passion for science, for scientific communication and his determination to develop science of excellence. In addition, he has a great interest in helping young researchers in their scientific career.

## FIONA WATT, MEMBER OF IBEC'S ISC, APPOINTED AS EMBO DIRECTOR



Fiona Watt, Director of the Centre for Stem Cells & Regenerative Medicine at King's College London, and member of IBEC's International Scientific Committee (ISC), has been appointed as new Director of the European Molecular Biology Organization (EMBO). The British cell biologist will take up the appointment in early 2022. She will join EMBO as its sixth director, succeeding Maria Leptin who was recently appointed President of the European Research Council.

Fiona Watt is also executive chair of the Medical Research Council funding agency. Her research interest is the role of stem cells in adult tissue maintenance and how this information can be harnessed for regenerative medicine.

## THE CATALAN MINISTER FOR RESEARCH AND UNIVERSITIES VISITS IBEC



In November 2021, the Catalan Minister for Research and Universities, Gemma Geis, visited IBEC. Together with Joan Gómez Pallarès, General Director for Research, and

Xavier Aldeguer, General Director for Technology Transfer, the Minister received an institutional presentation and visited IBEC laboratories

First, the Catalan Representatives visited the Molecular Imaging for Precision Medicine Lab, led by Junior Group Leader Irene Marco and then the Open Lab Initiative in Bioengineering for Reproductive Health led by Samuel Ojosnegros.

The Minister had the opportunity to know the different actions lines taken at IBEC such as the clinical collaborations, the technology transfer but also the outreach and educational programme carried out at IBEC.

## THE UNIVERSITY OF BARCELONA/ AWARDS A THESIS ON MECHANOBIOLOGY MADE AT IBEC



Roger Oria won the XXIV Doctors' Senate Award of the University of Barcelona (UB) for his thesis on mechanobiology, an emerging discipline that can help identify new tools to stop pathologies associated with tissue stiffness, such as cancer. The award-winning work was directed/tutored by Pere Roca-Cusachs, principal investigator at IBEC, Associate Professor at the UB's Faculty of Medicine and Health Sciences. The doctoral thesis entitled "Cell sensing of the extracellular environment: Roles of matrix rigidity, ligand density and distribution", revolves around a hypothesis on how cells are able to receive spatial and physical data at nanometric scale.

This research line within the innovative discipline of mechanobiology can contribute to identify new tools to stop pathologies that are associated with the rigidity of tissues, such as cancer.

## THE IBEC RESEARCHER, ZAIDA ÁLVAREZ AWARDED THE MIKE LINE SCHOLARSHIP FOR HER PIONEER WORK ON SPINAL INJURIES REGENERATION



The IBEC researcher, Zaida Álvarez, was awarded the 2nd edition of the Mike Lane Scholarship. Dr. Álvarez received the prize for her research in innovative regenerative therapies, with almost €17,000, contributed by more than 75 patrons through a micro-patronage campaign and by the Castelliers de la Vila de Gràcia.

The winning project of the 2nd Mike Lane – Castelliers de la Vila de Gràcia Scholarship was ‘Construction of 3D-printed Extracellular Matrix’ to repair spinal cord injuries”. The project led by Dr. Álvarez Pinto, researcher at the Biomaterials for Regenerative Therapies Group, sought to develop a 3D-printed extracellular matrix of spinal cord cells, in both fetal and adult stages of development, to analyse its effects on promoting the growth of neuron axons, revascularisation and in vivo functional recovery in animals. This research involved the transplantation of bioactive constructions as a bioengineering therapy that offers an intervention for spinal cord damage.

## IBEC ALUMNI ALBERTO ELOSEGUI-ARTOLA, NEW SCIENTIFIC LEADER AT THE FRANCIS CRICK INSTITUTE



Alberto Elosegui-Artola, IBEC alumni and expert in mechanobiology, started his own research group to study cell and tissue mechanics at the Francis Crick Institute, in a joint appointment with the Physics Department at King’s College London. This is another example of great success of IBEC alumni in the international scientific arena.

During its fifteen years of history, IBEC has seen many researchers spend part of their scientific journey in its premises. These very talented people, who form today part of our “alumni family”, participated at IBEC in the forefront of bioengineering research, generating knowledge to develop new solutions and technologies to improve life and health sciences. The last example of success of an IBEC alumni is Alberto Elosegui-Artola, who has joined the Francis Crick Institute in London as a Group Leader.

## IBEC PROMOTES THE DEVELOPMENT OF ADVANCED THERAPIES THANKS TO FEDER FUNDING



Funding from the 2014-2020 Catalan FEDER Operational Program, through the call for institutional projects for R+D infrastructure with a total amount of 700,000€, co-financed the adaptation of new laboratory spaces and the acquisition of scientific equipment for IBEC laboratories. These new infrastructures will be aimed at boosting nanomedicine and tissue engineering research for the development of advanced therapies.

The project is linked to the Strategic Plan of IBEC and aims to provide laboratory spaces, computer resources, laboratory auxiliary equipment and specific scientific equipment to perform research in nanomedicine and tissue engineering applied to the development of advanced therapies. Thus, thanks to the European co-funding, IBEC will be able to continue generating research of excellence and at the same time working with the industrial sector to develop new diagnostic and treatment systems. Early diagnosis, new therapies based on regenerative medicine, improved quality of life with respect to aging population and technological advances to increase efficiency and make health care sustainable, are areas where the Institute for Bioengineering of Catalonia contributes to generating new technological advances.

# CLINICAL COLLABORATIONS

## IBEC AND GUTTMANN INSTITUTE DEVELOP A NEW METHODOLOGY USING SMARTPHONES TO QUANTIFY TRUNK FUNCTION IN PATIENTS WITH SPINAL CORD INJURIES



Researchers from the Institute for Bioengineering of Catalonia (IBEC) and the Institut Guttmann – Neurorehabilitation Hospital, developed a new way of relating the level of spinal cord injury with trunk function, in a quantitative and personalised way.

This advance will make it possible to determine, on an individual basis, the level of chest mobility in patients who have suffered a spinal cord injury and offers a very useful tool which permits objective and quantifiable follow-up during rehabilitation sessions.

A team of researchers led by Raimon Jané, leader of the Biomedical Signal Processing and Interpretation Group (BIOSPIN) at IBEC and Professor at the UPC; and by Hatice Kumru, neurologist and coordinator of Neurophysiology at the Institut Guttmann, and Joan Vidal, teaching director and leader of the Institut Guttmann Neuro-repair and advanced therapies, developed a new methodology that can objectively and quantitatively determine trunk function in patients with a spinal cord injury. The new approach, which was recently published in the *Journal of Neural Engineering*, combines the electromyogram (EMG) with the accelerometer of a smartphone which can complement a clinical evaluation with objective data.

Yolanda Castillo-Escario; Hatice Kumru; Josep Valls-Solé; Loreto García-Alen; Raimon Jané; Joan Vidal. Quantitative evaluation of trunk function and the StartReact effect during reaching in patients with cervical and thoracic spinal cord injury. 2021, *J. Neural Eng.* 18 0460d2.

Yolanda Castillo-Escario; Hatice Kumru; Josep Valls-Solé; Loreto García-Alen; Joan Vidal; Raimon Jané. Assessment of trunk flexion in arm reaching tasks with electromyography and smartphone accelerometry in healthy human subjects. 2021, *Sci Rep* 11, 5363.

## IBEC RESEARCHERS AND THE HOSPITAL IN LONDON CONCLUDE THAT HIGH-INTENSITY REHABILITATION BOOSTS RECOVERY AFTER A STROKE



A retrospective analysis performed by researchers from the Institute for Bioengineering of Catalonia (IBEC) and University College London (UCL), in collaboration with National Hospital for Neurology and Neurosurgery, London, UK, found that high-intensity therapy beginning within 6 months post-stroke offers the best rehabilitation outcomes, suggesting that standards of care offered by many healthcare systems should be re-analysed.

Stroke is one of the leading causes of death and disability in adults worldwide. Rehabilitative therapy is currently one of the best options that patients have to help regain lost motor function. The results of a study published in the *Journal of Neurology, Neurosurgery and Psychiatry* demonstrate the overwhelming benefits of high-intensity —as opposed to low-intensity— rehabilitation, as well as further confirming the known advantages of initiating therapy sooner following a stroke. This work was carried out by ICREA Research Professor Paul Verschure and Belén Rubio Ballester —Group Leader and Postdoctoral Researcher at IBEC's Synthetic, Perceptive, Emotive and Cognitive Systems (SPECS) Group, respectively— in collaboration with Nick S. Ward from UCL.

Belén Rubio Ballester, Nick S. Ward, Fran Brander, Martina Maier, Kate Kelly and Paul F.M.J. Verschure. Relationship between intensity and recovery in post-stroke rehabilitation: a retrospective analysis *J Neurology, Neurosurgery, and Psychiatry*, 2021.

## CLINICAL AND BIOENGINEERING RESEARCHERS ACCELERATE TOGETHER TOWARDS THE MEDICINE OF THE FUTURE



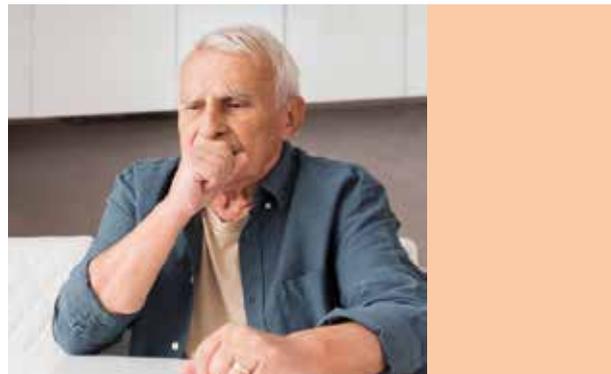
The Vall d'Hebron Research Institute (VHIR) and the Institute for Bioengineering of Catalonia (IBEC) intensified in 2021 their collaboration to face health challenges. With the last translational conferences, both institutions reinforce the alliance signed in 2012 to address, among others, infectious, neurodegenerative diseases, rare diseases, tissue regeneration, pediatric cancer or Parkinson's.

The success of translational biomedical research, which seeks solutions to health problems, requires a combination of scientific, medical and bioengineering knowledge and skills. In this context, and within the common strategies of VHIR and IBEC to strengthen translational and innovation research, both institutions recently made new steps towards a closer collaboration with new translational days. Among the actions that are already being promoted one can find, for example, the creation of mixed units, the sharing of spaces and resources, or the exchange and co-supervision of researchers at different stages of their professional careers, such as resident doctors, pre-doctoral and postdoctoral researchers.

More recently, VHIR and IBEC celebrated their 2nd translational day on May 17th. These conferences have the objective of bringing basic research closer to the clinical practice, by finding out the challenges that clinicians face, as well as to identify those tools and potential solutions that bioengineering can provide. The 1st translational day, held on February 11th, focused on rare diseases and 15 groups from VHIR and IBEC participated, exchanging experiences on the approach to rare neuromuscular and neurodegenerative, fetal, pediatric neurology, endocrine, respiratory, cystic fibrosis diseases, immunodeficiency or mitochondrial diseases.

The second day, held on May 17th, was focused on advanced therapies, with the participation of 15 groups that presented some promising therapies such as gene editing, the use of stem cells, the generation of organoids, advanced therapies of directionally drugs, or regenerative medicine.

## IBEC RESEARCHERS AND HOSPITAL IN BELGIUM DEVELOP A NON-INVASIVE METHOD TO ASSESS PULMONARY DISEASES



A team of researchers led by UPC Professor and Group Leader at IBEC, Raimon Jané, together with international partners at imec in the Netherlands and a Hospital in Belgium, developed an innovative procedure to evaluate pulmonary diseases. This new approach was tested in patients and combines thoracic bioimpedance and electrical and mechanical respiratory muscular signals allowing to measure the level of pulmonary function in a non-invasive and quantitative way, reducing the inconveniences for the patients.

Chronic Obstructive Pulmonary Disease (COPD) is a common disease occurring in adults characterized by breathing problems and poor airflow. It is the fifth leading cause of death worldwide and a major cause of chronic morbidity and mortality.

The team of researchers led by Raimon Jané, Leader of the Biomedical Signal Processing and Interpretation Group (BIOSPIN) at IBEC and UPC Professor, in collaboration with IMEC researchers from The Netherlands and Belgium (prof. Francky Catthoor), and the Ziekenhuis Oost-Limburg Hospital in Belgium, published the work in the *IEEE Transactions on Biomedical Engineering Journal*.

Dolores Blanco-Almazán, Willemijn Groenendaal, Manuel Lozano-García, Luis Estrada-Petrocelli, Lien Lijnen, Christophe Smeets, David Rutten, Francky Catthoor and Raimon Jané. Combining Bioimpedance and Myographic Signals for the Assessment of COPD during Loaded Breathing. *IEEE Transactions on Biomedical Engineering* (2021), 68 (1), 298-307.

## PERSONALISED MEDICINE TO BEAT PEDIATRIC LEUKEMIA



Acute lymphoblastic leukemia (ALL) accounts for one quarter of all cancer cases diagnosed in children and young adults, and also has the highest death toll among these age groups. IBEC researchers have used a state-of-the-art analysis technique to evaluate new drug combinations to successfully treat acute lymphoblastic leukemia. This study brings personalised medicine closer to the clinic for this cancer type.

An IBEC-led publication in the scientific journal *Frontiers in Cell and Developmental Biology* addressed an urgent need to develop more personalised therapies that cater to each patient, while reducing the side effects often brought on by a “one size fits all” approach to treatment. The study was senior-authored by Joan Montero and first-authored by Albert Manzano, Senior Researcher and PhD student in IBEC’s Nanobioengineering group, respectively. Nanobioengineering Group Leader Josep Samitier and Senior Technician Clara Alcon also contributed to the work, as well as researchers from several other institutes including the University of Barcelona.

In this study, the researchers used dynamic BH3 profiling, a novel methodology that measures the capacity of drugs to prime cells to die, to evaluate new treatments that could improve outcomes for B-cell precursor ALL (BCP-ALL) patients, especially those who have relapsed. In this technique, anti-cancer drugs are administered to cells in a laboratory.

Albert Manzano-Muñoz, Clara Alcon, Pablo Menéndez, Manuel Ramírez, Felix Seyfried, Klaus-Michael Debatin, Lüder H. Meyer, Josep Samitier and Joan Montero. MCL-1 Inhibition Overcomes Anti-apoptotic Adaptation to Targeted Therapies in B-Cell Precursor Acute Lymphoblastic Leukemia. 2021, *Front. Cell Dev. Biol.* 9:695225.

## IBEC RESEARCHERS CONTRIBUTE TO DISCOVER THE CAUSE OF EPILEPSY AND NEURODEGENERATION IN LAFORA DISEASE



The accumulation of abnormal glycogen in glial cells of the nervous system causes inflammation and degeneration of the brain.

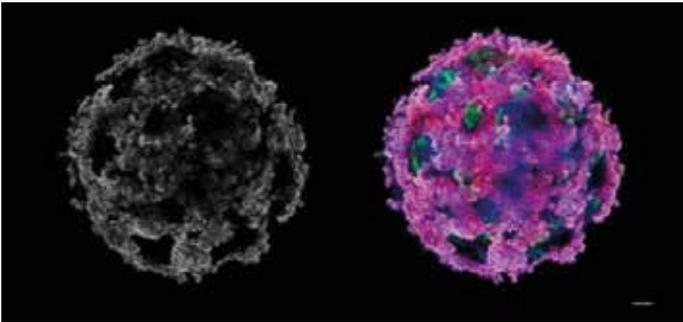
Lafora disease is an inherited neurodegenerative condition that initially develops with seizures in adolescence and evolves with progressive degeneration of the nervous system to death, about ten years after its onset. It is characterized by the accumulation of abnormal glycogen aggregates called Lafora bodies in the brain. There is currently no treatment for this condition, although some therapies are being tested in clinical trials.

Researchers discovered that Lafora bodies that accumulate in astroglial cells, which are essential for the proper functioning of the nervous system, are responsible for the epilepsy and neurodegeneration associated with the disease. IBEC researchers Arnau Hervera and José Antonio del Río; Group Leader of the Molecular and Cellular Neurobiotechnology and full professor of the Department of Cell Biology, Physiology and Immunology of the UB, associated member of the Institute of Neurosciences, and member of CIBERNED, also contributed to this work. The study, with contribution of Arnau Hervera and Jose Antonio del Río, Group Leader at IBEC and UB Professor, was published in the journal *Brain*.

J. Duran, A. Hervera, K. H. Markussen, O. Varea, I. López-Soldado, R. C Sun, J. A. del Río, M.S. Gentry & J. Guinovart.

Astrocytic glycogen accumulation drives the pathophysiology of neurodegeneration in Lafora disease. *Brain*. Volume 144, Issue 8, pages 2349–2360, 2021.

## **BIOENGINEERED MINI ORGANS MOVE TOWARDS THE FIGHT AGAINST CANCER THANKS TO THE AECC**



A 3-years research project led by the ICREA Research Professor at IBEC, Núria Montserrat, finished in 2021, dedicated to study kidney cancer by using laboratory organoids, thanks to the “LAB 2017” grants from the Spanish Association Against Cancer (AECC). Researchers have managed to create the first renal organoid-based animal model for this type of cancer, and to identify early signs of the development of the disease.

Renal cell carcinoma is an aggressive type of cancer, where the clear cell subtype (CcRCC) is the most common. According to data accumulated over the last decade, more than 50% of renal malignant tumours are detected accidentally due to the widespread use of abdominal imaging. Therefore, an early detection method is crucial to be able to treat this type of disease and would facilitate the development of early intervention strategies.

Núria Montserrat and her research group at IBEC, together with her collaborators at Vall d’Hebron Institut d’Oncologia, ICO-IDIBELL and Hospital Clínic de Barcelona, received in 2017, 300,000 euros from the Spanish Association Against Cancer (AECC) for research in kidney cancer using organoids. Kidney organoids are aggregates of cultured cells that constitute tissues of a reduced size (from micrometres to centimetres), endowed with the structural and functional characteristics of the human kidney. This method makes it possible to study the disease more accurately compared to traditional cell cultures. Furthermore, this approach allows the identification of new markers of disease initiation.

## **IBEC AND THE NEN ASSOCIATION JOIN FORCES AGAINST CHILDHOOD NEUROBLASTOMA**



IBEC and the association of “Families and Friends of Children with Neuroblastoma” (NEN) signed a collaboration agreement to search for new therapeutic markers for this type of cancer, through the generation of models based on engineering techniques. The project will be led by Dr. Áranzazu Vilasante, IBEC researcher.

Neuroblastoma is a rare cancer that affects the sympathetic nervous system, the nerve network that sends messages from the brain to the rest of the body. It is the most common tumor during the first 2 years of life. In total, neuroblastoma represents 8-10% of pediatric tumors.

In this context, the IBEC researcher, Dr. Áranzazu Vilasante developed in 2017 the first model of vascularised human neuroblastoma, using cancer engineering techniques, which is capable of recapitulating in vitro vasculogenic mimicry and the presence of a cell type known as TEC.

## IBEC PUBLISHES THE GUIDE “BIOENGINEERING FOR RARE DISEASES”



There are over 300 million people living with one or more of over 6,000 identified rare diseases around the world. In 2021, A new guide summarise IBEC research and efforts against rare diseases

IBEC researchers, in collaboration with international clinical groups and companies, are using their bioengineering expertise to develop novel therapies and diagnostic tools for rare diseases such as cystic fibrosis, muscular dystrophy and lysosomal storage disorders, to name only a few. At an institutional level, IBEC has signed a collaboration agreement with the Federación Española de Enfermedades Raras (FEDER), a non-profit organization that represents the three million people suffering from rare diseases throughout the country.

The aim of this collaboration is to connect the institute with patients' associations to develop projects together that have a direct application according to the needs of sufferers. IBEC has also collaborated with specific patient associations such as the Myotonic Muscular Dystrophy Patients Association, the Catalan Association of Cystic Fibroses and the Spanish Federation of Retinitis Pigmentosa Associations (FARPE). Moreover, as coordinator of the Spanish Platform of Nanomedicine, which gathers universities, research centres, companies and other stakeholders applying bioengineering and nanotechnology to health, IBEC fosters the use of nanomedicine Institute for Bioengineering of Catalonia (IBEC) 7 to tackle rare diseases. Among other initiatives, since 2019, IBEC organizes in collaboration with Hospital Sant Joan de Déu the Nano Rare Diseases Day.

## FASTER FUTURE CAMPAIGN AGAINST PARKINSON'S CULMINATES WITH NEW SCIENTIFIC BREAKTHROUGHS

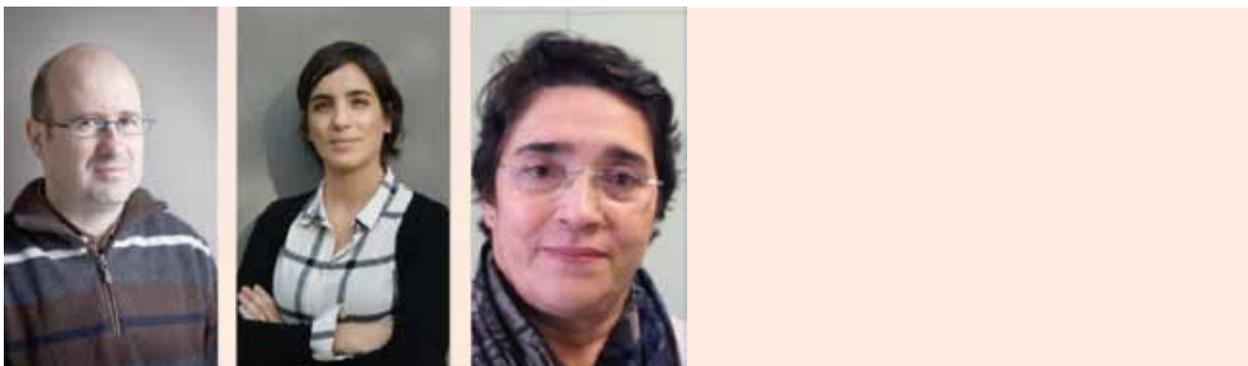


Parkinson's disease is a chronic and incurable neurodegenerative disease that affects among 7 and 10 million patients around the world. IBEC Faster Future program has made possible, over the last two years, and thanks to donor contributions, the study of antibodies as the basis of a therapeutic product for the treatment of Parkinson's. The researchers presented in 2021 the scientific advances.

In this context, the IBEC Faster Future program has made possible that during the last two years, and thanks to the 28.957,20€ raised with donations, ICREA Research Professor at IBEC Silvia Muro led the study that aims to use antibodies as the basis of a therapeutic product that “opens the lock of the blood-brain barrier”, and makes possible the treatment of Parkinson's.

More precisely, Professor Muro's team investigated the possibility of developing a universal antibody that can bind to the endothelial receptor of interest, both in laboratory animals and in humans.

## **BIOENGINEERING AGAINST COVID-19 RECEIVES A NEW BOOST THANKS TO “LA MARATÓ”**



Three projects of IBEC were selected, among a total number of 229 submitted proposals in Catalonia in 2021, to receive funding from “La Marató de TV3” to investigate different aspects of COVID-19. Thanks to the contributions received, IBEC Group Leaders Núria Montserrat and Santiago Marco and senior researcher Beatriz F. Giraldo, will deepen their understanding of the disease and its possible therapeutic solutions, study improvements in patient care processes, develop a system to predict the evolution of the respiratory system, and advance in the treatment of patients with pneumonia derived from COVID19.

Together with Núria Montserrat at IBEC, two international partners are participating in this project; the team led by Josef Penninger from the Institut fuer Molekulare Biotechnologie GmbH (IMBA), Ali Mirazimi, from the Karolinska Institutet, Santiago Marco’s group together with the Fundació Institut Hospital del Mar d’Investigacions Mèdiques (which leads the project).

Beatriz F. Giraldo, from the “Biomedical signal processing and Interpretation” group at IBEC and Professor at the Polytechnic University of Catalonia (UPC) will participate in a coordinated project, led by Dr. Arantxa Mas from IDIBELL and the Integrated Healthcare Consortium

## **ISCI III BIOBANKS AND BIOMODELS PLATFORM (P ISCI III BB)**

In 2020, the Instituto de Salud Carlos III (ISCI III) initiated a pioneering experience by promoting the creation of the ISCI III Biobanks and Biomodels Platform (P\_ISCI III\_BB). Currently, the P\_ISCI III\_BB, coordinated by IBEC, has an exceptional composition that includes the 64 Units that comprise it. For each scientific-technological HUB the composition includes: 57 Units in the Biobanks HUB, 18 Units in the Animal Model HUB, 19 Units in the Organoids HUB and 15 Units in the 3D Printing HUB. These units are distributed throughout Spain, representing 16 Autonomous Communities, including: Andalusia, Aragon, Principality of Asturias, Balearic Islands, Cantabria, Castilla-La Mancha, Castilla y Leon, Catalonia, Community of Valencia, Galicia, Community of Madrid, Region of Murcia, Community of Navarra, Basque Country, Extremadura, and the Canary Islands. In this way, the P\_ISCI III\_BB

offers the highest level of quality and cutting-edge services to facilitate and advance in the definition of the best therapy for the patient and thus close the cycle from basic research to the realization of the clinical application.

It should also be noted that since 2021 the Kingdom of Spain is an associate member of the Biobanks and Biomolecular Resources Research Infrastructure-European Consortium for Research Infrastructures (BBMRI-ERIC), designating the P\_ISCI III\_BB as a National Node. The entry of Spain and the ISCI III in the BBMRI-ERIC is another step toward the consolidation of collaborative research with European and international support. In this way, the ISCI III also promotes and crystallizes its model of cooperative research platforms and the ISCI III\_BB Platform.

# TECHNOLOGY TRANSFER HIGHLIGHTS

## IBEC SUCCESS IN ECONOMIC INCOME DESPITE PANDEMIC

In 2021 IBEC recovered the pre-pandemic level of the amount invoiced to companies for contract research agreements; 1.1 M€ (a 28% more than the amount invoiced last 2020).

In relation to the intellectual property (IP), IBEC maintained the number of patent applications filed in 2020, achieving 6 new filed patents, and 5 patents have entered the Patent Cooperation Treaty (PCT) phase. We are very satisfied because after some years without establishing a new spin-off, in 2021 three researchers of IBEC (Irene Marco, Maria Alejandra Ortega and Javier Ramon) have established a new IBEC Spin-off; Vitala Technologies.

The presence of IBEC in national and international Partnering events has been also relevant as we have presented the IBEC IP opportunities in 6 events where several meetings were established with companies interested in our portfolio of inventions.



## VITALA IS BORN, A SPIN-OFF OF IBEC THAT OFFERS INNOVATIVE AND MORE ETHICAL SOLUTIONS FOR HEALTH RESEARCH



Vitala Technologies, a biotechnology-based company born in the Institute for Bioengineering of Catalonia (IBEC), will offer innovative solutions for the analysis of drugs during their development, as well as the possibility to know in advance and in a personalized way, what will be the response of a patient to a certain treatment. Vitala offers more sensitive, low-cost and bioethical techniques than the existing ones, by combining innovative bioengineering technologies such as organs-on-a-chip and advanced imaging techniques, to offer unprecedented value in pre-clinical therapeutic compound research, as well as in the selection of the best drugs to be used in the clinic.

Together, doctors Irene Marco and Maria Alejandra Ortega, ICREA Research Professor Javier Ramón, and their associates from Lotus Partners, a private entity that accompanies the development of companies, provide technology to help in the selection of the best drugs to bring to the market and offer solutions to health challenges.

The Spin-off, with the participation of IBEC and private partners, meets market needs thanks to more sensitive, low-cost and bioethical techniques than the existing ones. In this way, Vitala Technologies aims to accelerate and optimize the identification of drugs to bring to the market, significantly reducing the number of animals used for this purpose, as well as providing value in the personalized study of treatments for diseases such as cancer, diabetes, or liver diseases, while also exploring entering other markets such as the analysis of biological samples, cosmetics and the agri-food market.

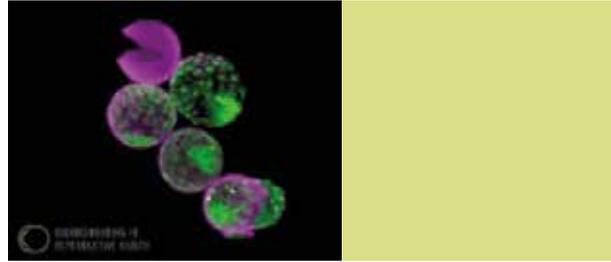
## LEITAT AND IBEC WILL PROMOTE LAST GENERATION BIOTECHNOLOGIES FROM BARCELONA



A recent alliance between the LEITAT Technological Center and the Institute for Bioengineering of Catalonia (IBEC) will give a new impulse in the development and application of cutting-edge technologies that will combine engineering and biology to find solutions to health problems. Both institutions have established a new agreement to promote innovation in different scientific and technological areas, including 3D bioprinting with bioinks.

The new agreement is the result of years of collaboration that combines the leadership of both institutions. LEITAT, as a reference center in the management of technological knowledge generation and with an important commitment to the health area, and IBEC, an international reference in research of excellence in bioengineering aimed at contributing to solutions for health. This agreement aims to offer new solutions and innovative opportunities for the growing needs in different scientific areas.

## IBEC AND OXOLIFE COMPANY COLLABORATE IN REPRODUCTIVE HEALTH

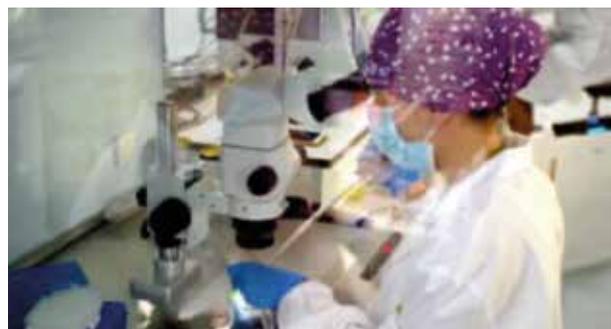


Oxolife, the biotechnological startup focused on the development of drugs to improve female fertility, and the Bioengineering for Reproductive Health laboratory of the Institute for Bioengineering of Catalonia (IBEC), will combine two pioneering technologies for the study and treatment of infertility.

The OXO-001 molecule that increases embryo implantation and is already in the clinical phase, will be studied using an innovative system of synthetic matrices developed by the team of Dr. Samuel Ojosnegros in the Open Innovation Lab at IBEC.

The laboratory of Dr. Samuel Ojosnegros at IBEC is one of the teams that has made the greatest advances in this field, developing an ingenious synthetic system, one of a kind, that allows the study of embryo implantation by using animal models.

On the other hand, Oxolife, under the scientific direction of Dr. Ignasi Canals, is developing the drug OXO-001, also the first and only one of its kind, which seeks to respond to an unmet medical need: increasing embryo implantation and pregnancy rates with a direct action on the endometrium (the uterus tissue where embryos are gestated). Currently, OXO-001 is already in the clinical phase.



## A CHIP AGAINST CHRONIC BACTERIAL INFECTIONS



IBEC researchers developed a device that allows to grow biofilms and analyze their susceptibility to different antibiotics in a simple way and using patient samples. BiofilmChip, a low-cost, easy-to-use diagnostic device, opens the way to finding effective and custom treatments against chronic infections produced by biofilms.

80% of chronic infections are associated with the growth of biofilms. They are bacterial communities of different species that form and live on surfaces of live or inert tissues. These types of infections are complex, difficult to treat and often last for a long period of time, as biofilms are embedded in a matrix that protects bacteria from antimicrobial treatments and the immune system, thus becoming much more resistant to antibiotics.

In 2021, researchers from the Institute for Bioengineering of Catalonia (IBEC), led by Eduard Torrents, leader of the group “bacterial infections and antimicrobial therapies” and professor at the University of Barcelona (UB), in collaboration with Josep Samitier, principal investigator of the group “Nanobioengineering” of IBEC, and Maite Martin, of the Vall d’Hebron Barcelona Hospital, developed a new device, called BiofilmChip, which allows a custom and precise diagnosis of chronic infections. This work has recently been published in the journal of the group *Nature, Biofilms and Microbiomes*, and is supported by “la Caixa” Foundation.

Núria Blanco-Cabra, María José López-Martínez, Betsy Verónica Arévalo-Jaimes, María Teresa Martín-Gómez, Josep Samitier, Eduard Torrents. A new BiofilmChip device for testing biofilm formation and antibiotic susceptibility. *npj Biofilms and Microbiomes* (2021) 7:62.

## A NEW 3D MUSCLE MODEL TO STUDY OF AGING AND THE EVALUATION OF DRUGS AND COSMETICS, IN COLLABORATION WITH LUBRIZOL COMPANY



IBEC researchers develop a three-dimensional model of muscle tissue using bioprinting and tissue bioengineering techniques that allow reproducing their strength, contraction and aging profiles. The new model will have potential applications in fields such as biomedicine, cosmetics and robotics. In addition, it will open the doors to the study of morphological and functional alterations caused by muscle aging.

Studies using *in vitro* models of muscle tissue, whether in biomedicine or in the cosmetic industry, are largely based on 2D models of cell growth, which do not represent what actually occurs in the human body. There is, therefore, a great need for three-dimensional models that allow reliable and reproducible studies in fields such as tissue engineering, disease modelling and testing of new drugs and bio-hybrid robotics (combination of living tissues and robots).

Now, thanks to tissue engineering and 3D bioprinting, researchers from the Institute of Bioengineering of Catalonia (IBEC) led by Samuel Sánchez, ICREA Research Professor and principal investigator of the “Smart Nano-bio-devices” group, have developed a new 3D platform with human skeletal muscles that mimics real tissue. This new approach will allow studying in detail both the development of muscles and the diseases they suffer, as well as allowing a reliable evaluation of drugs and cosmetics. The work has been done in collaboration with the Lubrizol company and has been recently published in the journal *Biofabrication*.

## IBEC AND THE COMPANY DAM DEVELOP A DRONE THAT IMPROVES ODOR MANAGEMENT IN WATER TREATMENT PLANTS



The company Depuración de Aguas del Mediterráneo (DAM) and the Institute for Bioengineering of Catalonia (IBEC) develop a system equipped with chemical sensors that provides information, in real time, on the intensity and location of odor sources in the Waste Water Treatment Plants (WWTP). The system has been calibrated and validated under real operating conditions through several measurement campaigns at the Molina de Segura WWTP (Murcia).

The bad odors produced by the Waste Water Treatment Plants, known as WWTPs, have become a growing concern in the cities and towns that host these facilities and are considered by citizens to be the main cause of the perception of pollution, along with the dust and noise.

Now, and thanks to a collaboration between the company Depuración de Aguas del Mediterráneo (DAM) and the Institute for Bioengineering of Catalonia (IBEC), a new way is being opened to detect and treat these odors.

According to the researchers, “the results obtained in the SNIFFDRONE project (Odor monitoring by drones for environmental purposes) are very positive and represent a significant advance in the field of odor management in the WWTP. The new system will help to take appropriate control actions and therefore improve the management of the plant compared to current practices”.

## IBEC RESEARCHERS WIN TWO “BIST IGNITE SEED GRANTS”



The Barcelona Institute of Science and Technology (BIST) announced the five winners of the first phase of this year’s BIST Ignite Programme today. This is the fifth edition of the programme, which promotes multidisciplinary collaborations at the frontiers of knowledge to solve scientific and societal challenges that have yet to be solved by cutting-edge research. IBEC researchers receive two “Ignite Seed Grants” to combine their skills with other BIST members to seek scientific answers to health challenges. Benedetta Bolognesi will study, with the IRB, Huntington’s disease and other neurodegenerative pathologies without treatment. On the other hand, Juan Manuel Fernández-Costa and researchers at ICFO will develop muscles-on-a-chip and biomagnetism sensors to accelerate the design of new treatments for muscular dystrophy.

## “PIONEERS” AWARD FOR RESEARCH AND POTENTIAL APPLICATION OF BIROBOTS



The researcher Rafael Mestre wins the CERCA 2021 Pioneer Award for his doctoral thesis on the development and



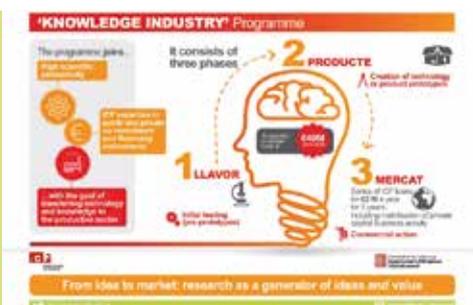
application of bioacoustics biorobots based on muscle tissue, and the improvement of its manufacture using 3D printing technologies. The jury considered that the project, carried out under the supervision of ICREA Professor at IBEC, Samuel Sánchez, could have a great impact and applications, in various fields, such as regenerative medicine.

On December 20th, the winners of the CERCA 2021 Pioneer Awards were announced, these awards recognize recent doctoral theses from CERCA Centers that have shown a clear potential for transfer. In the 2021 edition, the Jury considered that the thesis of the scientist Rafael Mestre, carried out by the Smart Nano-Bio-Devices Group led by Samuel Sánchez at IBEC, could have a great impact on various sectors and applications. The doctoral thesis of Dr. Mestre deals with the development and application of bioactuators and biorobots based on muscle tissue and the improvement of their manufacture using 3D printing technologies.

AGAUR, the Agency for Management of University and Research Grants.



## TWO IBEC PROJECTS GRANTED BY “KNOWLEDGE INDUSTRY CALL” OF THE CATALAN GOVERNMENT

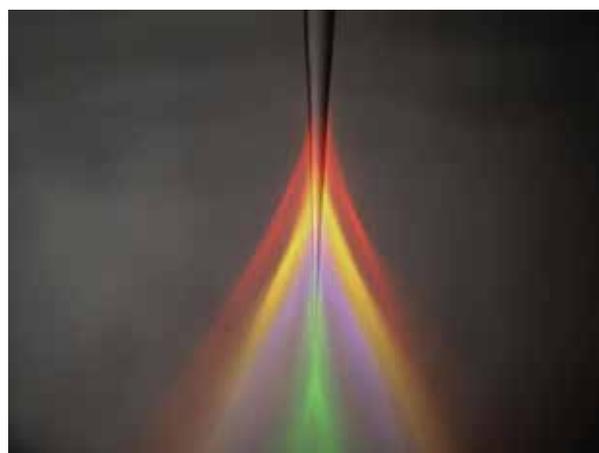


A project led by UPC Professor and Group Leader at IBEC, Elisabeth Engel, aimed to fabricate and test a dressing prototype for wound healing. And another project, led by ICREA Research Professor at IBEC, Javier Ramón, with the goal of developing an artificial liver, have been granted by the *Knowledge Industry* Programme of the Catalan Government.

From idea to the market. The aim of the *Knowledge Industry* Programme is to foster the development of new science-based spin-off companies, derived from the research carried out at universities and research centres, as part of the strategy to transfer the technology and knowledge generated in the academic and scientific sphere to the business sector.

In this context, two projects led by IBEC researchers have been granted by Knowledge Industry Programme of

## IBEC PARTICIPATES IN EUROPEAN PROJECT DEVELOPING NEW TECHNOLOGIES FOR THE STUDY AND TREATMENT OF NEUROLOGICAL DISEASES



Pau Gorostiza and his team at IBEC participates in the DEEPER project which aims at creating new tools for accessing the deep brain with unprecedented precision for the study and treatment of neurological diseases. The project involves 12 partners in 8 countries, and it has been funded by the European Union with approximately 5.7 million euros for the next 4 years.

Understanding and treating brain disorders, such as Alzheimer's disease, addiction, chronic pain, depression and schizophrenia, entails the comprehension of the

alterations that may occur in the deep regions of the gray matter. Thanks to the European-funded project DEEPER, an international research consortium, coordinated by IIT-Instituto Italiano di Tecnologia, will develop new photonic technologies to access those regions and reveal the molecular and cellular dysfunctions underlying the origin of the disorder. The new technological tools are developed with the goal to directly treat the diseases in a minimally invasive and highly effective way. DEEPER will transfer the technological results from laboratory to market, with the ambition of have an impact to strengthen Europe's industrial position in the biophotonics market.

## NURIA MONTSERRAT, INVITED AS A KEY SPEAKER AT THE EUROPEAN RESEARCH AND INNOVATION DAYS



Last 23rd and 24th of June took place the European Research and Innovation Days, where Nuria Montserrat was invited to share her research and personal experiences in a high-level panel about “COVID-19: lessons learnt, preparedness and resilience”. The event was opened by Mariya Gabriel, European Commissioner for Innovation, Research, Culture, Education and Youth and was moderated chaired by Philip Campbell, Editor-in-Chief Springer Nature.

The Commissioner introduced top researchers during Research and Innovation Days, pointing out how research funded by the European Research Council (ERC) delivered breakthrough science advances before and during the pandemic. The event was taking place online and ICREA Research Professor, Group Leader and

Deputy Director for Clinical Innovation and Translation at IBEC, Nuria Montserrat, was one of the voices invited to share her experiences during the session “COVID-19: lessons learnt, preparedness and resilience”, together with other top scientists.

## IBEC PRESENTS ITS “BIOENGINEERING SOLUTIONS FOR HEALTH” AT PUZZLE X



IBEC attended on 16-18 November 2021 the big event Puzzle X the Frontier Materials for a Better World, at Fira Gran Via Hospitalet, in the framework of the Smart City Expo World Congress. Together with the Barcelona Institute of Science and Technology (BIST) and ICN2 and ICFO, as partners and coordinators of GraphCAT, the Graphene community in Catalonia, were pleased to invite IBEC to the event. Within, the booth in the Puzzle X pavilion, where you will see the latest demos and materials related to graphene, 2D materials and beyond and IBEC's Bioengineering were presented by Eduardo Salas, Head of Technology Transfer and his team at IBEC.

## ENTREPRENEURS OF THE FUTURE VISIT IBEC



In October, MBA students visit the Institute for Bioengineering of Catalonia (IBEC) in a conference organized by Barcelona Global. 522 postgraduate students from IESE, ESADE, EADA and UPF-BSM visited reference centers in science and technology such as IBEC, as well as other centers also defined as the main economic hubs of Barcelona.

The students had the opportunity to meet IBEC accompanied by its Head of Technology Transfer, Eduardo Salas, and were guided through the IBEC facilities by Samuel Ojosnegros, head of the Bioengineering in Reproductive Health group at IBEC, who also presented some of the main scientific innovations.



# 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 23 research groups, 320 researchers and 55 administrative staff. IBEC's headquarters and most of its labs are located in the Barcelona Science Park, which offers a highly stimulating 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 UB Clinic Campus and the UPC 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 Departments of Health, Research and Universities, the UB and the UPC.

 <p>UNIVERSITAT DE BARCELONA</p>	<p>UNIVERSITY OF BARCELONA (UB)</p>
 <p>UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH</p>	<p>TECHNICAL UNIVERSITY OF CATALONIA (UPC)</p>
 <p>Generalitat de Catalunya Departament de Salut</p>	<p>DEPARTMENT OF HEALTH, GENERALITAT DE CATALUNYA</p>
 <p>Generalitat de Catalunya Departament de Recerca i Universitats</p>	<p>DEPARTMENT OF RESEARCH AND UNIVERSITIES GENERALITAT DE CATALUNYA</p>

## 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.

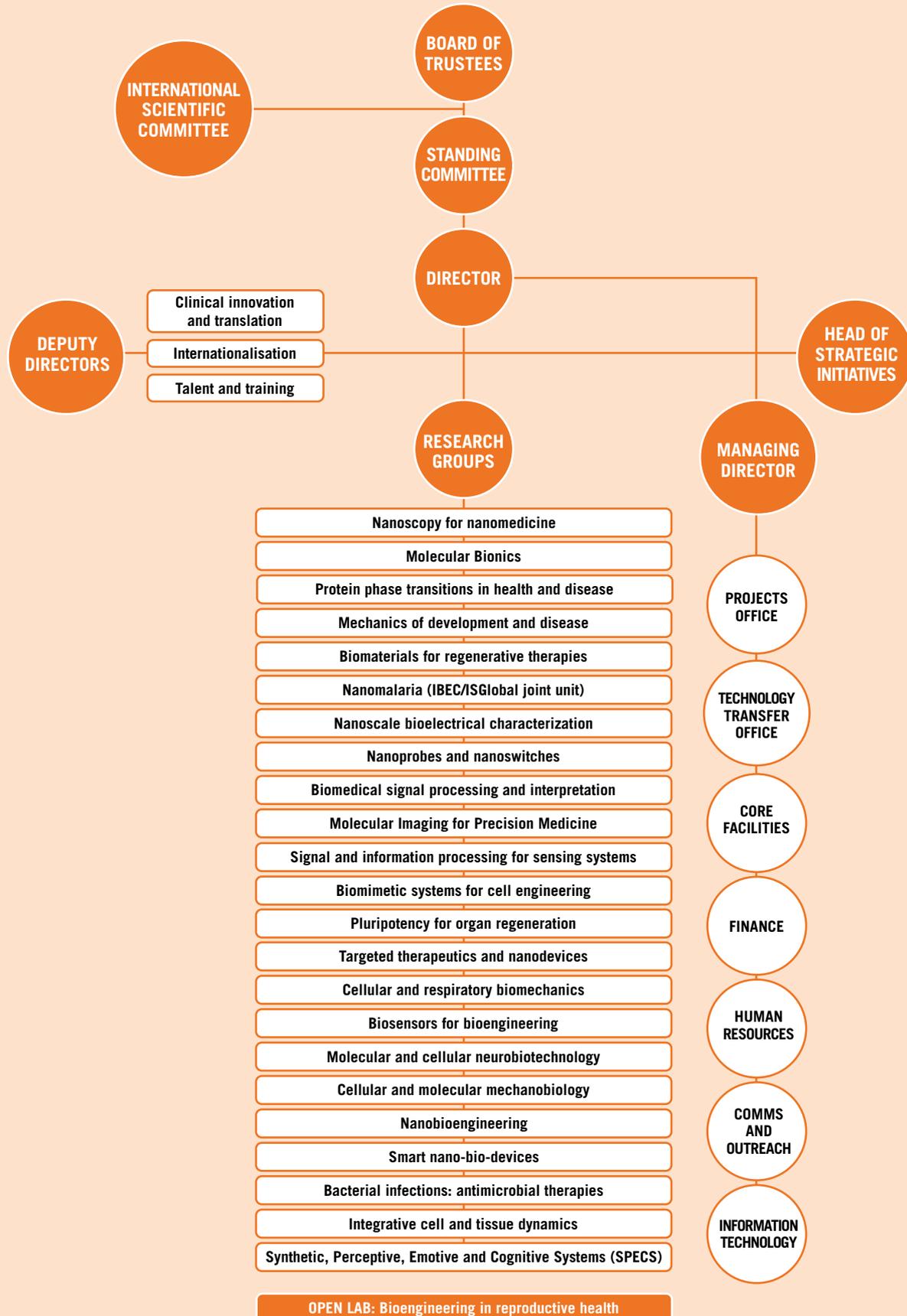
<b>PRESIDENT</b>	Hble. Sr. Josep Maria Argimon i Pallàs	Minister of Health, Generalitat de Catalunya
<b>FIRST VICE PRESIDENT</b>	Hble. Sra. Gemma Geis i Carreras	Minister of Research and Universities, Generalitat de Catalunya
<b>SECOND VICE PRESIDENT</b>	Excm. i Mgfc. Sr. Joan Guàrdia Olmos	Rector, University of Barcelona
<b>SECOND VICE PRESIDENT</b>	Excm. i Mgfc. Sr. Daniel Crespo Artiaga	Rector, Technical University of Catalonia
<b>MEMBERS</b>	Sr. Joan Gomez i Pallarés	Director General for Research, Department of Research and Universities, Generalitat de Catalunya
	Sra. Aina Plaza i Tesías	Director General of Health Planning, Ministry of Health, Generalitat de Catalunya
	Sra. Montserrat Llavayol i Giralt	Deputy Director General for Research and Innovation, Ministry of Health, Generalitat de Catalunya
	Sr. Lluís Rovira	Director de la Fundació Institut dels Centres de Recerca de Catalunya (CERCA)
	Dr. Jordi García Fernández	Vice-Rector of Research, University of Barcelona
	Sr. Jordi Llorca	Vice-Rector of Research Policies, Technical University of Catalonia
	Prof. Maria Pau Ginebra Molins	Full Professor, Technical University of Catalonia
	Dr. José Navarro Cid	Full Professor, University of Barcelona
<b>SECRETARY</b>	Sr. Josep Maria Alcoberro Pericay	CERCA, Legal Department

# 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.

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

# ORGANIGRAM



# 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	ECONOMICS AND FINANCES
<p><b>ORGANIZATIONAL AND OPERATIONAL STRUCTURE</b></p> <ul style="list-style-type: none"> <li>■ Government organs</li> <li>■ Organization charts</li> <li>■ Agreements for the creation and operation of public sector entities</li> <li>■ Lists and catalogues of services</li> <li>■ Catalogue of procedures</li> </ul> <p><b>SENIOR POSITIONS AND MANAGERS</b></p> <ul style="list-style-type: none"> <li>■ List of senior positions and managers</li> <li>■ Incompatibilities</li> <li>■ Activities, goods and interests</li> <li>■ Remuneration, compensation and subsistence allowance</li> <li>■ Code of good practices for posts of the Generalitat of Catalonia</li> </ul> <p><b>PUBLIC EMPLOYEES</b></p> <ul style="list-style-type: none"> <li>■ List of jobs in the public sector</li> <li>■ Staff assigned by contract bidding agreed with the Administration</li> <li>■ Remuneration, compensation and subsistence allowances</li> </ul> <p><b>CALLS: ACCESS AND RESOLUTION</b></p> <ul style="list-style-type: none"> <li>■ Calls for work staff, specific groups and promotion training</li> </ul> <p><b>UNION REPRESENTATION</b></p> <ul style="list-style-type: none"> <li>■ Number and cost of full-time union representatives</li> </ul>	<p><b>BUDGETS</b></p> <ul style="list-style-type: none"> <li>■ Approved budgets; executed; liquidated</li> <li>■ Annual accounts</li> </ul> <p><b>AUDITING AND AUDITING REPORTS</b></p> <ul style="list-style-type: none"> <li>■ Auditing and auditing reports (years 2014-2017)</li> </ul> <p><b>PATRIMONY OF THE GENERALITAT OF CATALONIA</b></p> <ul style="list-style-type: none"> <li>■ Inventory of real estate</li> <li>■ Movable assets of special value</li> <li>■ Assets management</li> <li>■ Patrimonial management and contracting</li> </ul> <p><b>SUBSIDIES AND GRANTS</b></p> <ul style="list-style-type: none"> <li>■ Subsidies and public aid (planned and awarded)</li> <li>■ Financial monitoring of subsidies and aid</li> </ul>
PROCEDURES AND LEGAL ACTIONS	CONTRACTING
<p><b>REGULATIONS</b></p> <ul style="list-style-type: none"> <li>■ Sectoral regulations</li> <li>■ Directives, instructions and memos</li> <li>■ Regulations in process</li> </ul> <p><b>ADMINISTRATIVE INTERVENTION RULES</b></p> <p><b>REVIEW OF ADMINISTRATIVE ACTS</b></p> <p><b>ADMINISTRATIVE AND JUDICIAL RESOLUTIONS WITH PUBLIC RELEVANCE</b></p> <p><b>OPINIONS</b></p>	<p><b>CONTRACTS</b></p> <ul style="list-style-type: none"> <li>■ Bidding and related procedures</li> </ul> <p><b>AGREEMENTS</b></p> <ul style="list-style-type: none"> <li>■ Registration of collaboration agreements</li> <li>■ Other agreements</li> </ul>
LINES OF ACTION	TERRITORY
<p><b>GENERAL AND SECTORAL PLANS AND PROGRAMS, AUDITS, AND STATISTICAL INFORMATION</b></p> <ul style="list-style-type: none"> <li>■ IBEC Annual Report (years 2007 to 2018)</li> <li>■ IBEC Strategic Plan 2014-2017</li> <li>■ Human resources strategy for researchers</li> </ul>	<p><b>SECTORAL TERRITORIAL PLANS</b></p> <p><b>CARTOGRAPHIC INFORMATION</b></p>
	HEALTH AND SAFETY AT WORK
	<p><b>RISK PREVENTION AND SAFETY AND HEALTH OF EMPLOYEES AT WORK</b></p> <ul style="list-style-type: none"> <li>■ Report of the Prevention Service 2017</li> <li>■ Occupational risks prevention audit certificate</li> <li>■ Rights and responsibilities of personnel</li> </ul>



# IBEC ADMINISTRATION



## DIRECTORATE

**Director** Josep Samitier  
**Managing Director** David Badia  
**Assistant to the Director** Ester Sánchez  
**Executive Assistant** Patricia González  
**Administrative Assistant** Marta Gómez Saavedra



## PROJECTS OFFICE

**Interim Head of Projects Office** Rosa Miralles  
**Team members:**  
Marina Badia, Daniel Caudepón, David Faulon, Judith Forné, Esther Gallardo, Raquel Garrido, Isabel Saez, María Soria, Sara Vicente



## INFORMATION TECHNOLOGY

**IT Manager** Julio Bafaluy  
**Team members:** Axel Conill, Alejandro Silverio,



## FINANCE

**Head of Finance** Ana María González  
**Team members:**  
Anabel Alemany, Laura Casas, Victòria López, Meritxell Macías, Toni Martín, Mayte Muñoz, Berta Pla, Marina Redondo



## HUMAN RESOURCES

**Head of Human Resources** Carolina Mari  
**Team members:**  
Ciara Boter, Karem García, Geraldine Gaspar, Raquel Guillén, Anke Kleff, Neus Vilalta



**COMMUNICATIONS**

**Head of Communications and Public Relations**  
Guillermo Orts

**Team members:**  
Clara Civit, Àngels López, Lara López, Bea Moreno



**STRATEGIC INITIATIVES**

**Head of Strategic Initiatives** Teresa Sanchis

**Team members:**  
Cristina Arimany, Fidel Bellmunt, Pilar Jiménez (until March 2021 at the Communications dep.)



**CORE FACILITIES**

**Head of Core Facilities** Isabel Oliveira

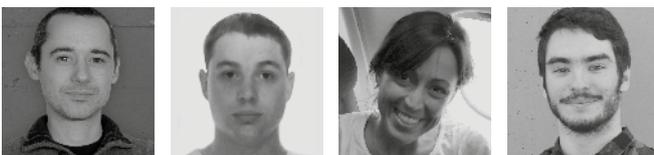
**Team members:**  
Ramona Bravo, Esther Campanales, Teresa Galan, Laura Gómez, David Izquierdo, Judit Linacero, Inma Moreno, Albert Rigat, Sandra Segura



**TECHNOLOGY TRANSFER**

**Head of Tech Transfer Office** Eduardo Salas

**Team members:**  
Martina Giovannella, Diana M<sup>a</sup> González



**INTEGRATED MANAGEMENT SYSTEMS**

**Team members:**  
Carles Ortega, David Lapena, Aida Arcalís, Marc Purgimon.

# IBEC IN FIGURES

In 2021, the total number of IBEC's staff (including administration personnel as well as researchers, students and technicians) was **375**. Of this total, **236** were hired by IBEC, while the rest are seconded, affiliated, externals, visitors or other status. The following statistics reflect the situation on 31st December 2021.

01

Age of all IBEC scientific Staff

**63%**  
OF SCIENTIFIC  
STAFF **2021** WERE UNDER **35**

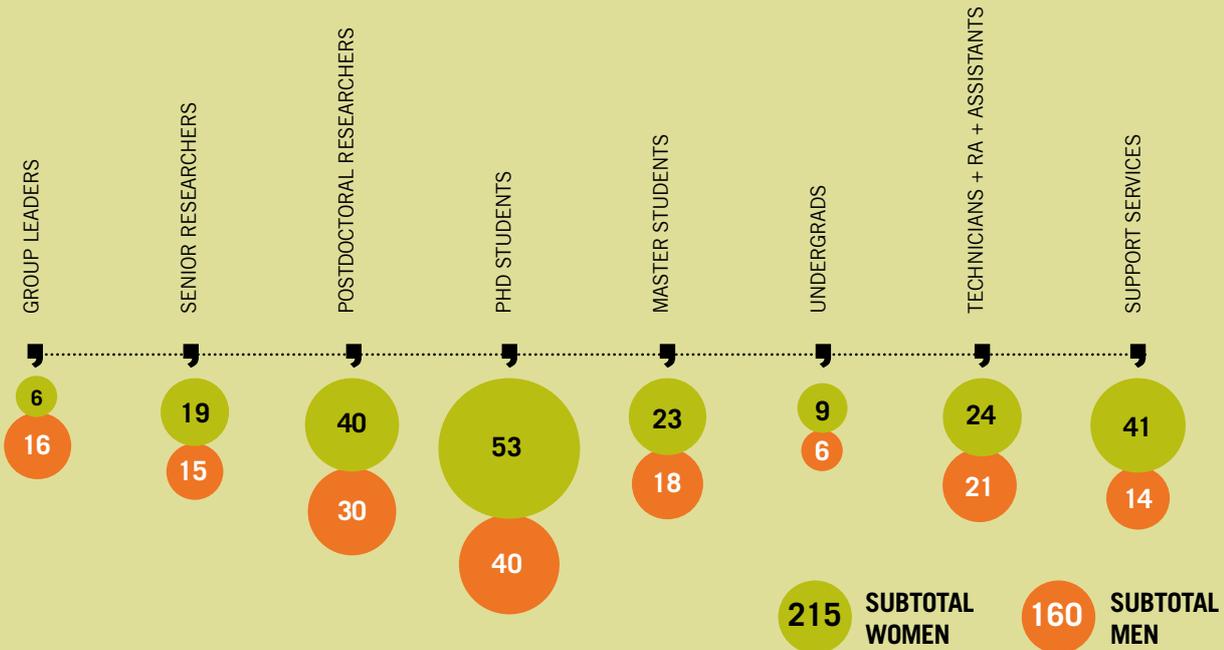
02

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

**55%**  
OF SCIENTIFIC  
STAFF **2021** WERE **FEMALE**

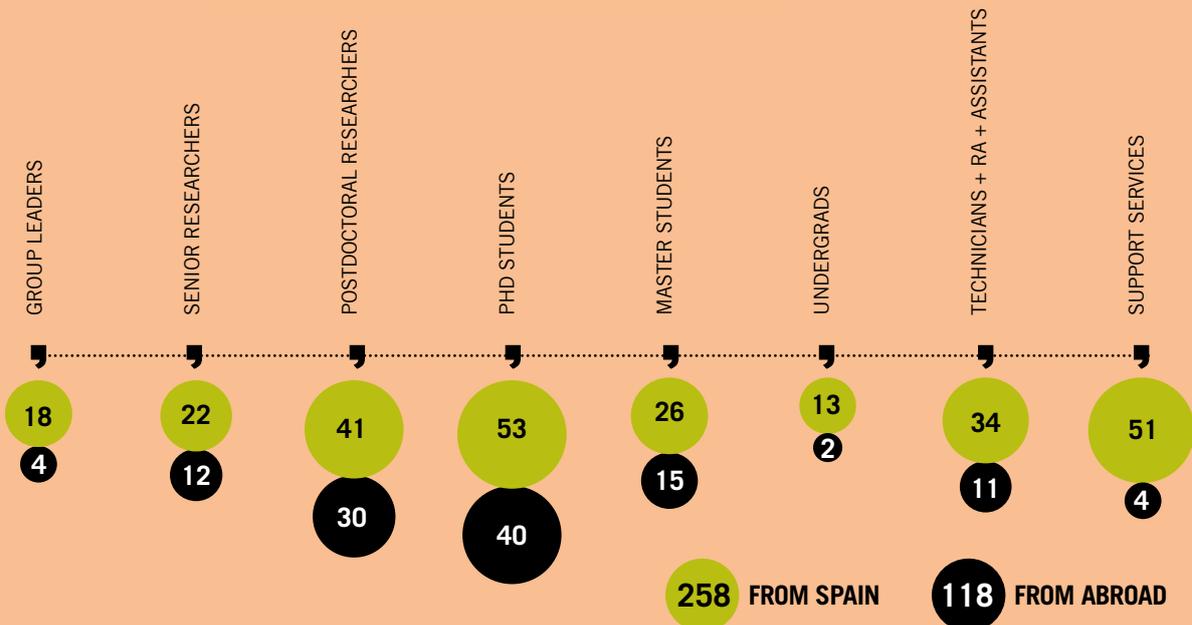
# 03

## All Staff by gender and job category



# 04

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



05

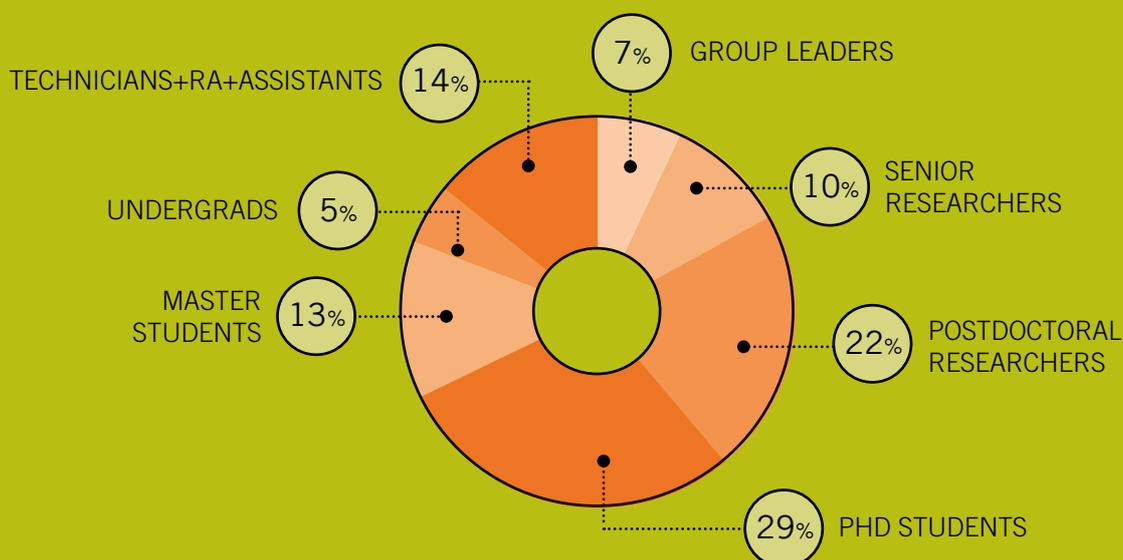
## All IBEC by Nationality (map)

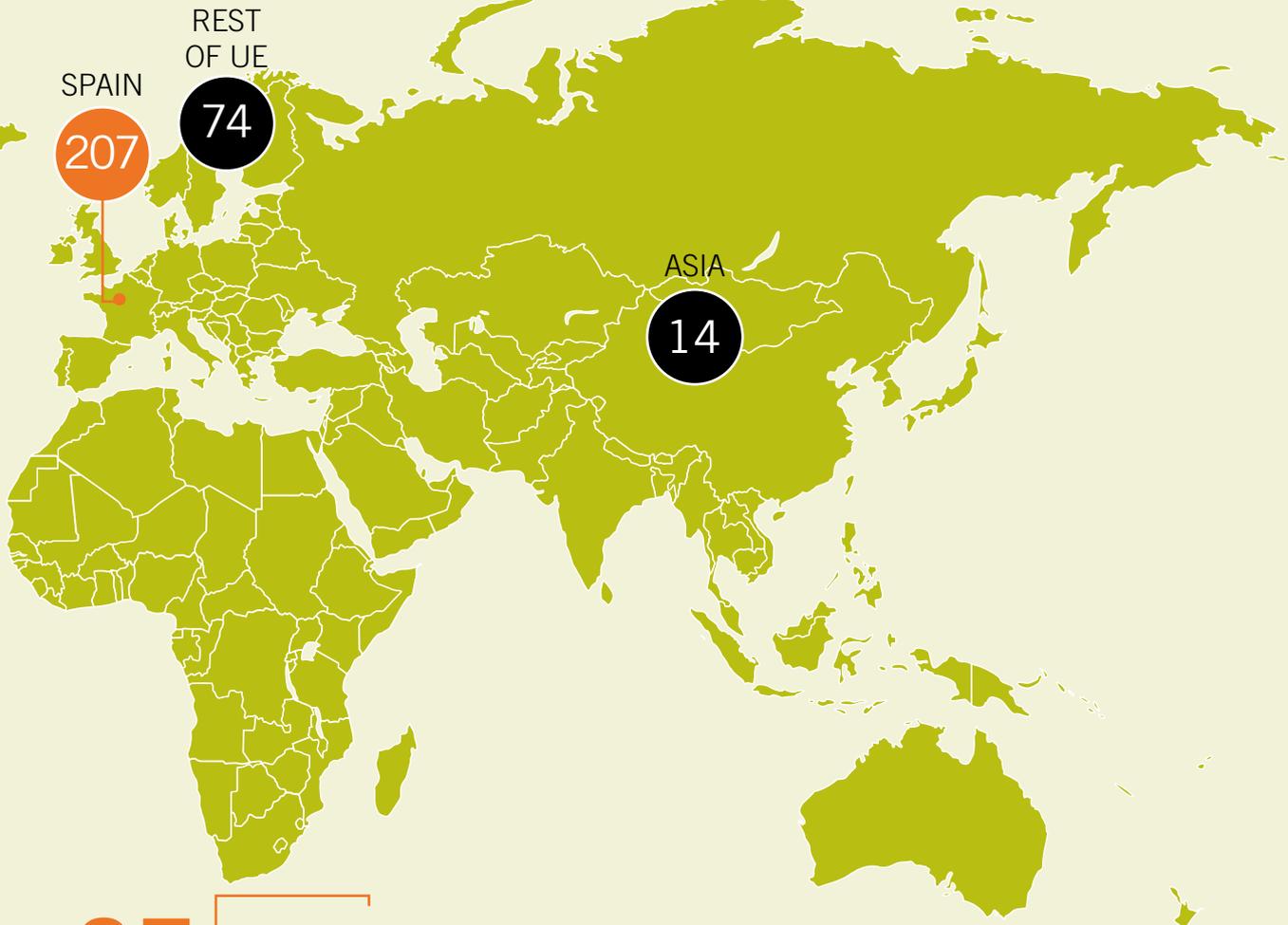
ALL 315  
OF SCIENTIFIC  
PERSONNEL AT  
IBEC IN 2021 ARE  
REPRESENTED  
(NOT INCLUDING  
ADMINISTRATION STAFF)



06

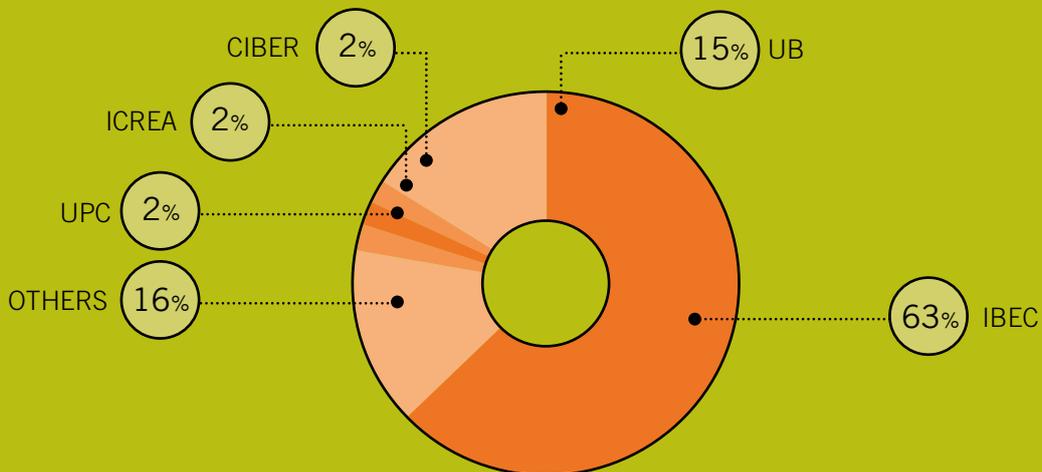
## IBEC researchers and technicians by job category





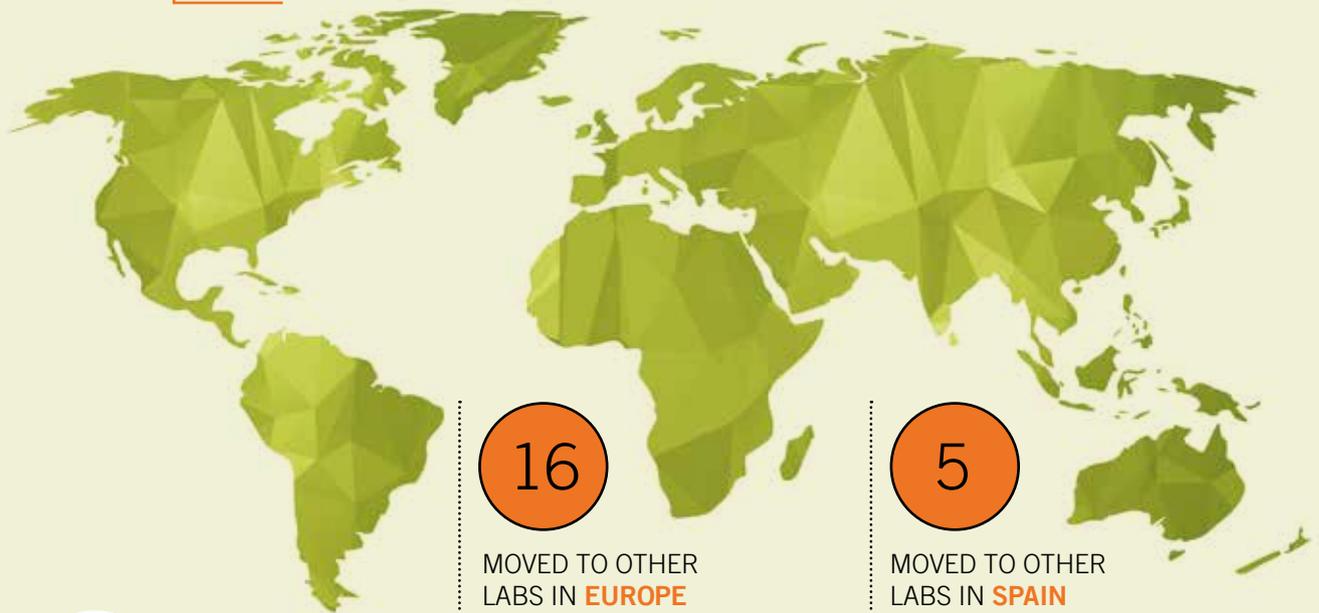
07

## IBEC researchers and technicians by associated or contracting institution



08

## Mobility in 2021

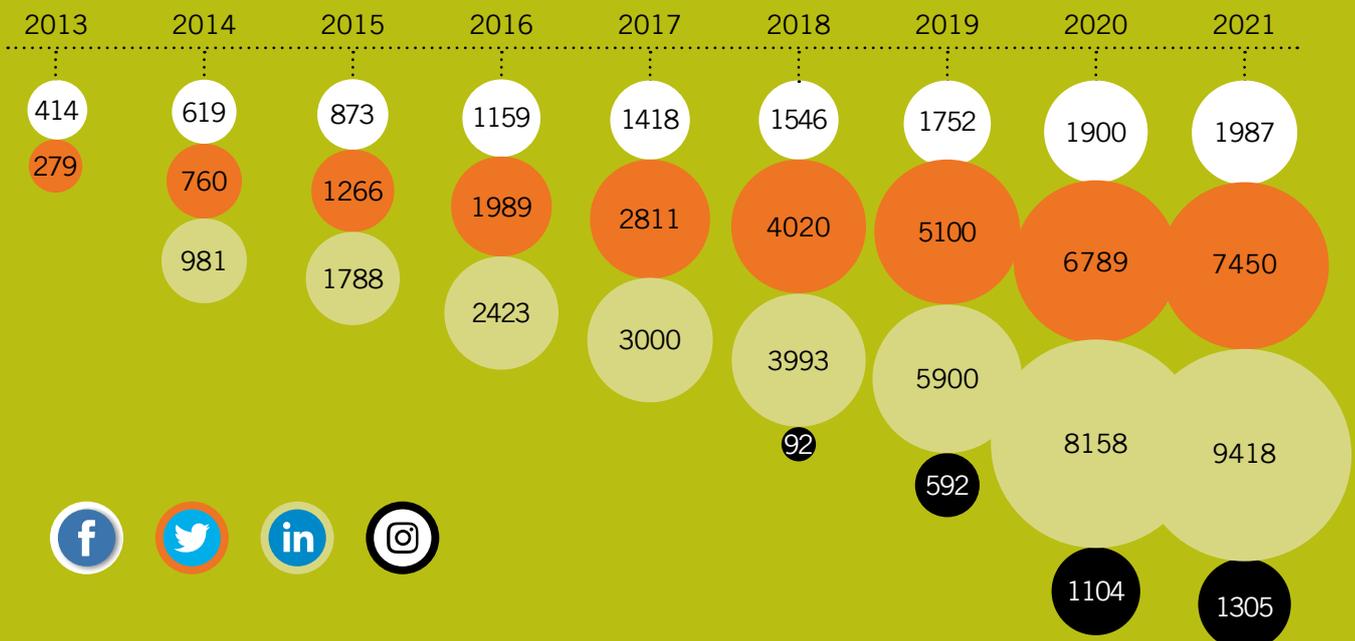


21

NUMBER OF RESEARCHERS WHO SPENT TIME ELSEWHERE IN 2021

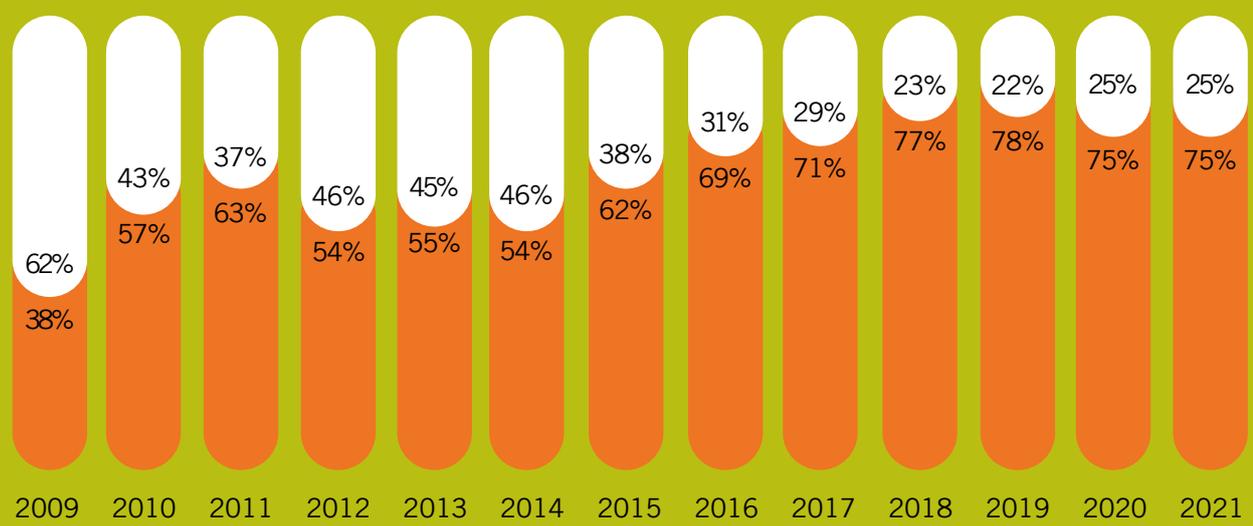
09

## Number of followers on social media 2013-2021



# 10

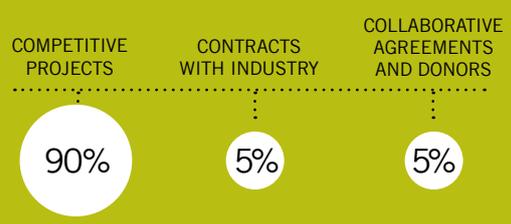
## Funding sources 2009-2021



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 for Science and Innovation and the Catalan Ministry of Research), industry contracts, funding from private institutions.

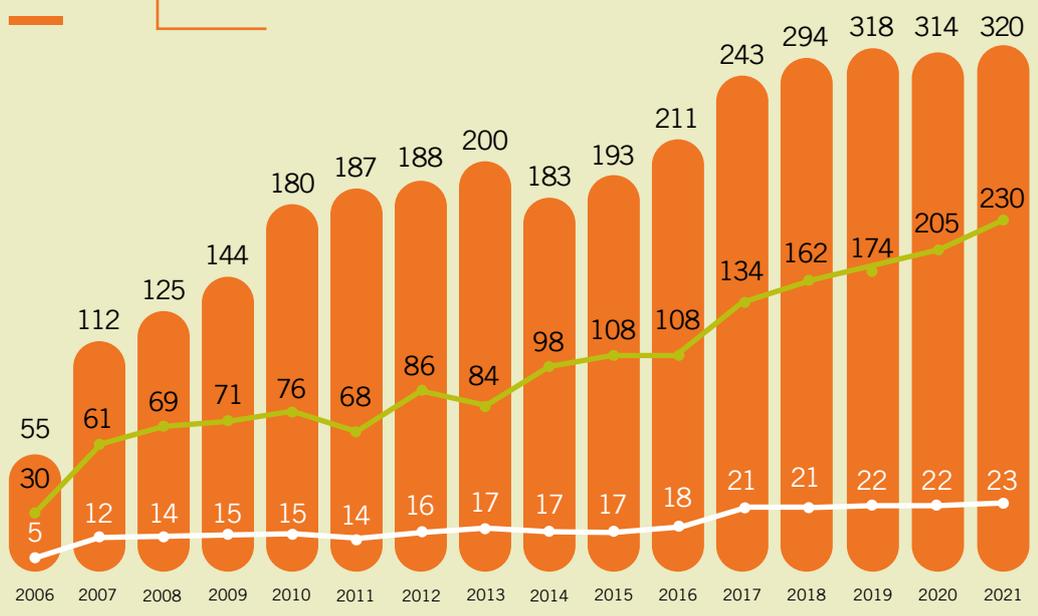
CORE FUNDING ● SOFT FUNDING ●

### DIFFERENT RESOURCES OF FUNDING IN 2021, BROKEN DOWN INTO TYPES



# 11

## Evolution of IBEC



RESEARCHERS ●  
PUBLICATIONS ●  
*Indexed journal articles and reviews only, not including conference proceedings, etc.*

**85%** OF IBEC'S INDEXED JOURNAL PAPERS IN 2021 WERE IN THE FIRST QUARTILE

NUMBER OF GROUPS **23**





Josep Samitier, Nuria Montserrat and Samuel Sánchez's biobots appear in the National Geographic documentary "Ciencias de la vida: Trasplantes" for scientific innovation that addresses the growing demand for organs.



**sinc** INNOVACIÓN

Ciencias | Salud | Tierra | Tecnología | Innovación | Sociedad | Opinión | Agenda | Visual

**INNOVACIÓN**

## Nuevo 'biofilmchip' contra las infecciones bacterianas crónicas

Investigadores del Instituto de Bioingeniería de Cataluña han desarrollado un chip que, a partir de muestras de pacientes, permite crecer biopelículas bacterianas y analizar su susceptibilidad frente a diferentes antibióticos. Este dispositivo de diagnóstico sencillo y barato puede ayudar a encontrar tratamientos efectivos y personalizados contra infecciones de larga duración.

17/5/2021 09:13 CEST

Las investigadoras muestran el chip que permite crear biopelículas bacterianas a partir de muestras de pacientes para analizar luego su susceptibilidad frente a diferentes antibióticos. / IBEC

Researchers from the Institute for Bioengineering of Catalonia (**IBEC**), led by **Eduard Torrents**, leader of the group "bacterial infections and antimicrobial therapies" and professor at the University of Barcelona (**UB**), in collaboration with Josep Samitier, principal investigator of the group "**Nanobioengineering**" of **IBEC**, and **Maite Martin**, of the Vall d'Hebron Barcelona Hospital appear in the media for the new device, called BiofilmChip, which allows a custom and precise diagnosis of chronic infections.



The Institute for Bioengineering of Catalonia will lead a project that aspires to the Next Generation funds to invest in personalized medicine.

As Josep Samitier, director of IBEC, finding new personalized therapies or developing biomodels, reproductions of parts or organs of the human body will lead to great scientific and medical advances. For example, at IBEC, we develop organoids, made of pluripotent human stem cells that have the same characteristics and functionalities of a kidney, or a heart. Having these mini-organs can lead to the development and study of drugs faster and more efficiently.



Nùria Montserrat, IBEC group leader and ICREA research professor, appears in the media for winning the "Premi Nacional de Recerca al Talent Jove" thanks to her pioneering work with mini-organs.





Núria Montserrat, group leader at IBEC is interviewed in El Punt avui, to explain her research in organoids to study and treat covid19. They have developed a technique to obtain kidney organoids in only 16 days. Thanks to this organoids, they can study in a very realistic and reliable way, the functioning of this organoids and how the coronavirus infects and reproduces in this structures. Thanks to this, they identified how the virus enters and infects this organ and also, they have been studying the interaction between diabetes and coronavirus infection and they have seen how this diabeti environment impacts and results in a greater susceptibility for the virus to replicate.

The ICREA Research Professor at the Institute for Bioengineering of Catalonia (IBEC), **Xavier Trepat**, has been awarded with the “Constantes y Vitales” Award for Talent in Biomedical Research, awarded by the Atresmedia group, for his contributions to the field known as mechanobiology, that studies the effect of physical forces on living systems and their implication in pathologies such as cancer.



# TOP EVENTS

## 14TH IBEC SYMPOSIUM BRINGS INTERNATIONAL EXPERTS AND 300 ATTENDEES TOGETHER



International experts and three hundred registered attendees met in the 14th IBEC Symposium, dedicated to regenerative therapies. Organised by the Institute for Bioengineering of Catalonia (IBEC), speakers presented the latest advances in mini-organs, organs on a chip, 3D bioprinting and tissue engineering, among others.

The event, which took place on October the 27th and 28th, was opened by the Director of IBEC, Josep Samitier, representatives of the Catalan Government and universities, as well as of other leading institutions, such as the Director of the Carlos III Health Institute, Cristóbal Belda, who highlighted the value of research for health, as well as the crucial role of IBEC in the biomedical ecosystem in our country.

Afterwards, international speakers from IBEC and institutions from the USA, the Netherlands and the United Kingdom took the floor. Among others, the expert in 3D bioprinting from the Wyss Institute in Harvard, Jennifer Lewis, the organoid expert from IBEC, Nuria Montserrat, the expert in cardiac regeneration from the Hubercht Institute in the Netherlands, Eva van Rooij, the expert in Reproductive Health from the IBEC Open Innovation Laboratory, Samuel Ojosnegros, the researcher Alberto Elosegui-Artola from the Crick Institute in London, or Professor Frank P. Luyt from the Netherlands.

## IBEC AND EMBL ORGANISE A SUCCESSFUL WORKSHOP ABOUT ENGINEERED LIVING SYSTEMS



Last June 4th, IBEC and EMBL did it again: they joined forces to organize a successful workshop about the challenges and opportunities of multi-cellular engineered living systems (M-CELS). More than a 100 people attended this online event, which was a satellite session of a bigger virtual event held during the previous days in the Boston, the M-CELS Workshop 2021.

The main workshop, held during the 1st and 3rd June, was organised by the NSF Center for Emergent Behaviors of Integrated Cellular Systems, at the MIT. Roger Dale Kamm, EBICS Director, attended the opening ceremony of the M-CELS Workshop organised by EMBL and IBEC, together with Josep Samitier, IBEC Director and James Sharpe, EMBL Barcelona Director.

The session was chaired by Xavier Trepas, Group leader at IBEC, and Miky Ebisuya, Group leader at EMBL Barcelona, who was also one of the main lecturers. The speakers were Elena Martínez, Javier Ramón and Josep Samitier from IBEC, Kristina Haase from EMBL Barcelona and Alfonso Martínez from UPF Barcelona.

From Barcelona, EMBL and IBEC aimed to contribute to the discussion on challenges and opportunities in the expanding field of Multi-cellular engineered living systems (M-CELS). The MCELS are purpose-driven living systems with multiple interacting living components. They are engineered for specific goals or functions but take emergence into account during the design process, allowing the final system to emerge through natural and non-natural biological processes. M-CELS research is intended to provide a fundamental engineering understanding that enables a quantitative approach bridging between single cells and organs or organisms.

This satellite session to the main M-CELS Workshop 2021 organized by the EBICS was an appetizer to the 2nd EMBL-IBEC Winter Conference on Engineering Multicellular Systems that is to be held in 2022 in Barcelona.

## NANO RARE DISEASES DAY 2021



Rare diseases are pathologies or disorders that affect a small part of the population, which is why they are also known as orphan diseases. However, due to the number of pathologies, it is estimated that currently 8% of the world population suffer from some type of rare or minority disease. Translated into absolute numbers, some 350 million people around the world suffer from some type of rare disease. In this context, nanomedicine can provide solutions for the diagnosis and treatment of these patients. Nanomedicine is a translational

science whose objective is to obtain new therapies and diagnostic tools using the capabilities available in nanotechnology applied to medicine. This ambition is based on the fact that nanotechnologies provide the tools that allow the analysis and manipulation of biological processes at the nanoscale, where diseases have their origin. The result is a growing understanding of the molecular biology of diseases, highlighting the appearance of new targets that allow more specific diagnoses and therapeutic treatments and in earlier stages.

The NanoRare Diseases Day is an event organized by NANOMED Spain and the Sant Joan de Déu Research Institute within the framework of the World Day for Minority Diseases. During the day organized in February, experts in Nanomedicine from different fields -research, business, clinical practice, health authorities, patients, etc.- presented the latest advances and offer the opportunity to discover the generator of progress that Nanomedicine means for health as a creator of new opportunities in the diagnosis and treatment of rare diseases.

Among others, participated Rafa Artuch, deputy director of the Santo Joan de Déu Research Institute (IRSJD), Regina Rodrigo of the Principe Felipe Research Center, Samuel Sánchez of the IBEC, Pilar Pizcueta of the Minoryx company, or Paqui Ruiz Moreno of the association of patients AGLUT1nate and Nuria Alvargonzález Tremols from the patients association asGLUTdiece.

## IBEC EXPERTS PARTICIPATE IN THE XIV ANNUAL CONFERENCE OF BIOMEDICAL RESEARCH TECHNOLOGY PLATFORMS

IBEC experts participate in the XIV Annual Conference of Biomedical Research Technology Platforms, focusing on research opportunities following the pandemic caused by COVID19. Josep Samitier, Teresa Sanchís and Nuria Montserrat highlight the advances made in nanomedicine and bioengineering for health and join the voices that recommend increasing resources for the entire sector of basic and clinical research. The conference was held on 11 and 12 May, with the presence of relevant public and private sector actors, and more than 700 registered participants. During the opening ceremony, which was opened, among others, by the Minister of Science and Innovation, Pedro Duque, and the Coordinator of the Nanomedicine Platform (NanoMed) and



Director of IBEC, Josep Samitier, it was precisely emphasized the importance of investment in science and technology. In the words of Samitier: “The health area is experiencing a paradigm shift towards predictive, preventive, personalized, participatory, precision medicine and integrated healthcare. This change cannot be achieved without the different medical technologies, with special importance of nanomedicine, which will offer new opportunities to face the challenge by increasing the efficiency of health systems, while reducing costs”. Samitier also reminded that two of the vaccines currently administered in Spain are based on nanotechnology.



## NANO CANCER DAY BRINGS TOGETHER HUNDRED EXPERTS

Within the framework of the Nanomed Platform actions, on February 4th, the sixth edition of the “World Nanoday

Against Cancer” took place virtually, organized together with the Germans Trias i Pujol Research Institute (IGTP).

Once again, researchers, businessmen, doctors and members of patient associations, unveiled the latest innovations in the field of nanomedicine against cancer, addressing issues ranging from early diagnosis, controlled release of drugs or radiotherapy with nanoparticles, exposing the latest advances and news. In addition, this year the event featured two patient associations that were able to expose what the patient’s needs are as well as provide information on the aid they offer for translational research, innovation and clinical research in cancer. The event included, among others, the participation of María de la Fuente Freire from the Sanitary Research Institute of Santiago de Compostela (IDIS), Silvia Comas from the IGTP-ICO Badalona, Rubén Ventura from the Fundació FERO, Miguel Abal from the Nasasbiotech company, Vanesa Abón, from the Spanish Association Against Cancer (AECC) or Elena Martínez, from the Institute of Bioengineering of Catalonia (IBEC).



## IBEC'S “RESEARCH FOR TALENT” OPENS THE DOOR TO STUDENTS

On Friday 21st May IBEC opened its doors virtually to UNDERGRADUATE & MASTER’s students interested in a research career. We welcomed the students with a presentation about the institute from IBEC’s talent and education deputy and Group Leader Elena Martínez, followed by specific information about applications and admissions from Ciara Boter of the HR department. To finish with the presentations, PhD researchers at IBEC, shared his expe-

rience as doctoral student and did a brief presentation of the PhD Committee, which was set up in 2013 to enable students to have a voice in the running of the institute and to organize events of their own.

After that, five parallel sessions took place, in each session five IBEC research groups had the opportunity to explain their research and answer the participant’s questions. Each session lasted for half an hour and a total of 24 groups had chance to participate in these sessions. The participants could choose which meetings to attend and could jump from one session to the other freely. Attendees had also the opportunity to visit IBEC labs.

# EDUCATION AND OUTREACH

The **Institute for Bioengineering of Catalonia** organizes or takes part in a range of science outreach and education activities throughout the year. These activities are coordinated by the **Communications Unit and the Strategic Initiatives Unit** at **IBEC**, in direct collaboration with researchers from all groups. Together, **IBEC** experts work 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 schools visits.

## IBBI, THE FIRST BIOENGINEERING SUPERHERO, IS BORN

On the International Day of Women and Girls in Science, the Institute for Bioengineering of Catalonia (IBEC) presents this February the 11th a female superhero figure which aims to reach out to the general public, in a popular way, one of the disciplines that are called to impact the medicine of the future: bioengineering.

Through a series of comics, animations and other resources with the superhero IBBI as the protagonist, IBEC will present stories about organoids, organ regeneration or nanobiomedicine that are already impacting fields such as the fight against COVID, cancer or Alzheimer's.

A superhero with the powers of bioengineering has just been born. Her name is IBBI and she has a goal: to explain in a entertaining way and close way, the powers of bioengineering and its applications, those that are called to transform the medicine of the future.

Under the motto "Bioengineering is powerful" and with the appearance of a scientist, IBEC will use this figure to achieve three objectives: to break gender roles in science, to promote scientific vocations among the younger population and to publicize the applications in bioengineering for health. Bioengineering, the discipline that combines engineering with other fields of knowledge such as biology, chemistry or physics applied to biological systems with the aim of finding solutions to health problems, is beginning to impact the clinical practices. In this way, medicine begins to incorporate elements that until now seemed scien-



ce fiction and that are already a reality: patches with stem cells for infarcted hearts, nano capsules to deliver drugs to COVID or Alzheimer's patients, or smart plasters to regenerate chronic wounds.

In this context, superhero IBBI will show how bioengineering and its superpowers are changing the way we conceive medicine, with examples such as tissue regeneration (self-repair), nano microscopy (supervision) or 3D bioprinting (ability to print tissues and organs with living cells).

The Superhero IBBI wants to communicate to people of any age interested in science and in bioengineering. From school and college teachers, to families and patients, IBBI wants to help discover how bioengineering contributes to providing solutions to real problems related to our health.

## IBEC BECOMES A BENCHMARK COMMUNICATING BIOENGINEERING ON SOCIAL MEDIA



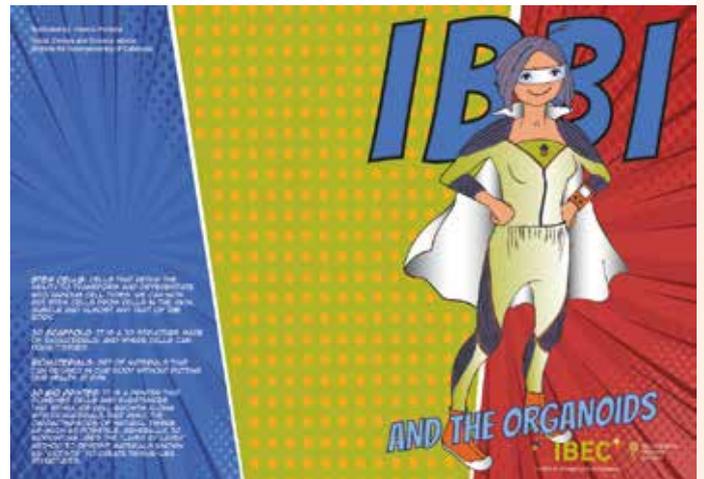
The Institute for Bioengineering of Catalonia (IBEC) doubles its number of followers in the last two years, reaching the number of 20.000. With this achievement, IBEC ranks not only as a center of excellence in bioengineering research at an international level, but also as a benchmark in communicating bioengineering on social networks.

IBEC communication social media: the commitment to a diverse, attractive and inclusive model

Beyond the activities of a press office or corporate communication, IBEC has developed from very early on, a whole series of communication activities with the aim of bringing research in bioengineering not only to the sectors that can directly benefit from it, such as academics, medical doctors or industry partners, but also to young students, curious people, patients, and society in general.

That is why, among the many communicative activities of IBEC, the presence in social networks has been diversifying and growing. The result of this is the fact that between 2019 and 2021 the number of IBEC followers on social networks has doubled in number, reaching today 20.000.

## FIRST COMIC OF IBBI, THE SUPERHEROINE OF BIOENGINEERING, COMES FOR "SANT JORDI"



Coinciding with International Book Day and Sant Jordi, the Institute for Bioengineering of Catalonia (IBEC) launches the first IBBI comic strip, the first Bioengineering superhero. In this first adventure, IBBI will use its superpowers to generate kidney organoids. This character aims to bring closer bioengineering to the non-scientific public, in an understandable and fun way, one of the disciplines that will mark the medicine of the future.

In this first comic strip, the superheroine IBBI shows how bioengineering makes it possible to obtain organoids, laboratory mini-organs that are used to carry out health research, using the patient's own stem cells.

Nowadays, it is possible to create miniorgans of the kidney, heart, lung and almost any organ in the laboratory. The development of organoids still has some limitations, but it is already helping us not only to test drugs but also to understand the mechanisms of infection and spread of some diseases, such as Covid-19.

In this first adventure where IBBI will obtain organoids, the reader will be able to understand concepts such as 3D bioprinting, stem cells or biomaterials.

## **FOURTH EDITION OF CRAZY ABOUT BIOENGINEERING**



IBEC celebrated in 2021 the fourth 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 had the opportunity to see how researchers work in an international reference research center and were able to learn different bioengineering disciplines with the aim to help solving health challenges. In total, 14 of the 22 IBEC research groups participated in the 2021 edition of the “Crazy about Science” program, that counted with 16 theoretical and practical sessions on bioengineering.

In 2021, IBEC continued with the implementation of the new activities launched in 2020 with the aim of promoting and consolidating the scientific vocation among young students. Specifically, this year’s IBEC course included sessions on the main bioengineering research areas applied to health: diseases related to the aging of the population, the study of cancer and the study of rare diseases. To all this, we must add the traditional sessions on good laboratory practices, learn about ethical issues related to research field and on how to communicate science.

## **SCIENCE MEETS ARTS: IBEC RESEARCHERS PARTICIPATED IN AN EPIC EVENT**

IBEC researchers Laura Clua and Xavier Arqué participated as actors and co-creators in an event organised by the Èpica Foundation (a part of international recognised “la Fura dels Baus” Theatre company) within the framework of the European Project “European Science Performing Night (ESPN) 2021”

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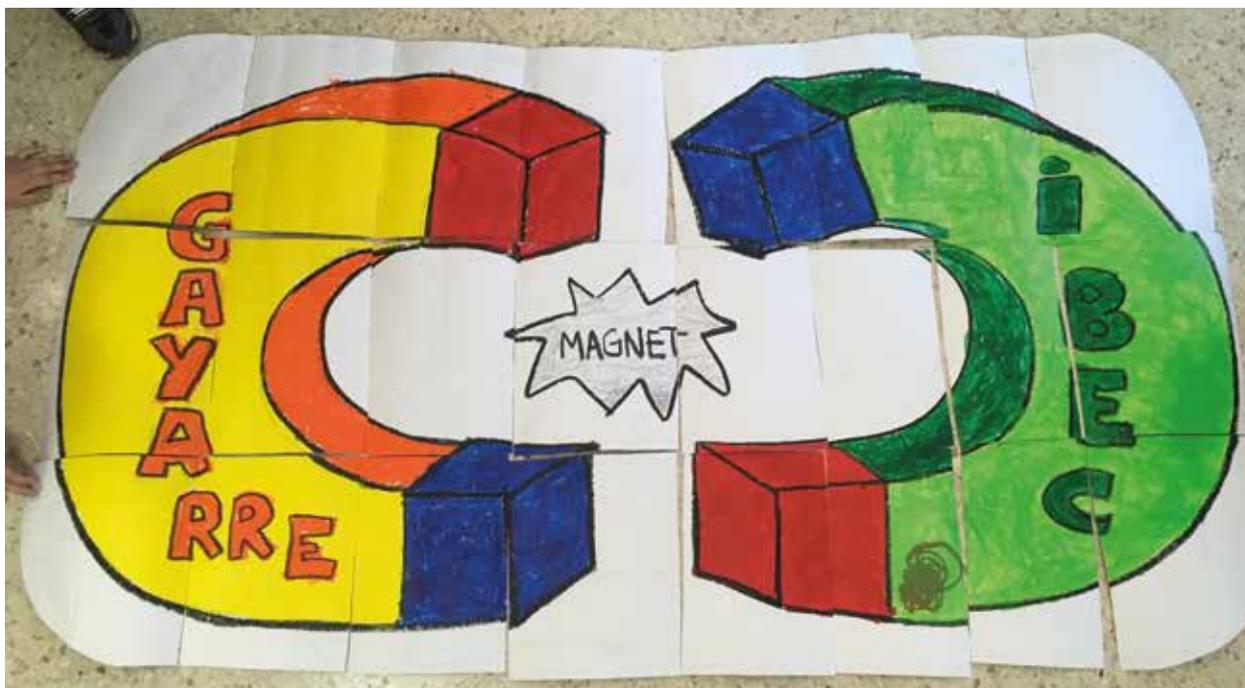
The main objective of Èpica Foundation workshops is to bring researchers closer to the public and encourage their



recognition, their value and how their work contributes to society. To carry out these objectives, the project led by Èpica Foundation proposes different actions that combine science, art and technology.

“Science can dangerously become an only-scientist area, as well as art be limited by the novelty of its own sector. The intercommunication between fields makes an explosive combination that effectively produces disruptive and relevant messages. That’s what we could closely see through this experience.” adds Xavier Arqué.

## MAGNET ALLIANCE



In 2021 IBEC continued 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. This year, we have incorporated the figure of the “expert friend” where an IBEC researcher becomes their role model in the science field. The students establish a fluent and close relationship throughout the year with the researcher, that will allow them to dive into the scientific topics of their interest and will help them in processes of inquiry, creativity and reflection.



## IBECER LAURA GÓMEZ WINS PHOTO CONTEST

*by Laura Gómez, winner of 2021 PCB photo contest.*

In November 2021, the Barcelona Science Parc (PCB) launched again its photography contest “Un dia al PCB!”. As in previous editions, candidates presented research images, but also pictures depicting people and spaces of the PCB, both indoor and outdoor, of everyday situations in the day to day of your work in the facilities, or photographs that link the PCB and sustainability.

Candidates posted their photos on Instagram using the hashtag #undiaalpcb2021. The winning proposal was announced last December 16th through the PCB newsletter.

In this 7th Edition, the 1st prize was awarded to Laura Gómez Rubio, member of IBEC's Core Facilities Unit, for the picture "When you do what you love, your dreams come true", featuring Trinidad Sanmartín Olmo, laboratory technician at the Research Group Protein phase transitions in health and disease. In 2019, Rubio was already selected as a finalist of the photo contest. In 2021, the jury also made a special mention to the picture 'Green splash', by Clara Borràs,

## **IBEC PARTICIPATES FOR THE SECOND TIME IN THE INITIATIVE "CREATIVE TALENT AND BUSINESS"**



The Institute for Bioengineering of Catalonia (IBEC) participates for the second consecutive time in the initiative "Creative Talent and Business" promoted by the Generalitat of Catalonia. IBEC, which is the first research centre to participate in this program, plans to annually renew its participation in this initiative, posing a different challenge for each academic year.

Thanks to the first participation in the "Creative Talent and Company" program, a new superhero was born: IBBI, the bioengineering superhero. After this great success, the IBEC has once again presented a challenge to plastic art students, to continue promoting the dissemination of science.

A total of 4 art and design schools from all over Catalonia participated in the challenge: EA Vilanova, EA Leandre Cristofol, EA Groc and EA Arsenal. Four different proposals were presented, one for each participating school, since the animations were the fruit of group work. Finally, the selected video was that of Jara González and Roger Melero from the Arsenal Municipal School of Art in Vilafranca del Penedès.

Through their animation, the students wanted to convey what IBEC is, what are some of our research lines and how, in the future, thanks to our research of excellence we can contribute to solving health challenges. Once again, art and science come together to explain bioengineering research through images.

## **IBEC RESEARCHERS PARTICIPATE IN THE "EUROPEAN RESEARCHERS' NIGHT"**



In September 24, the "European Researchers' Night" took place, an event that is held on a European scale in more than 300 cities in 30 different countries. The objective of this event is to publicize the diversity of science and its impact on the daily lives of citizens in a close and inspiring way. For yet another year, IBEC has not wanted to miss it and has been present at various activities. With the aim of bringing research and its protagonists, the scientists, to the public, several IBEC representatives participated in the Researchs' Night, in different activities promoted by "La Caixa Foundation" that took place at CosmoCaixa in Barcelona. ->

Researchers Daniel González from the group “Molecular Bionics” and group leader Irene Marco together with Marc Azagra and Alba Herrero from the group “Molecular Imaging for Precision Medicine” participated in the “Research Fair” where a total of 100 participants could experience science in first-hand, thanks to activities and live demonstrations by our scientists.

On the other hand, in the “Face to face: micro-talks in English” activity, several IBEC researchers gave talks to an audience of 45 people. Among them, Mohit Kumar with a talk on “Molecular machines for next generation medicines”, Zarina Naurgaliyeva who spoke on “Human kidney organoids in biomedical research”, and Veronika Magdanz speaking on “Microrobotics: How to shrink a surgeon?”

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## **BIOENGINEERING EXPERTS, KEY PLAYERS OF THE BIENNIAL CITY AND SCIENCE 2021**



Between the 8th and 13th June, the second edition of the “Barcelona City and Science Biennial” took place, and IBEC was one of the centers that contributed with its experts and the commissioner Nuria Montserrat. In addition, this Biennial culminated with the 14th edition of the Science Festival, with many proposals to live science in first person.

The commissioner of the “Barcelona City and Science Biennial 2021”, Nuria Montserrat, with the Mayor of Barcelona, Ada Colau, and participants in the event “100tífiques”.

Science invaded Barcelona, and bioengineering was one of the protagonists. Under the slogan “Come closer to science and make it yours!”, the Barcelona City and Science Biennial, an initiative promoted by the Barcelona City Council through the area of Culture, Science, Education and Community, and by the Institute of Culture from Barcelona (ICUB), is organized by a committee of nine commissioners, among whom is the ICREA Research Professor and Group Leader at IBEC, Nuria Montserrat. This year, Professor Montserrat commissioned and participated in more than 20 activities within the framework of the Biennial 2021.

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## **GREAT SUCCESS OF THE 100TÍFIQUES EVENT WITH RECORD PARTICIPATION FROM IBEC**



On February 11, on the occasion of the International Day of Women and Girls in Science, more than 20 IBEC researchers gave talks in different schools around Catalonia. The objective of the meetings between researchers and students was to bring science closer to schools and to vindicate female scientific talent.

A total of 21 IBEC researchers participated in the #100tífiques event, which tripled the participation of both researchers and schools involved.

In addition, 6 more researchers gave talks at the Gayerre School, where students from P3 to sixth grade enjoyed presentations by Irene Marco, Marta Badia, Alba Herrero, Silvia Pujals, Yolanda Castillo and Bia Moreno.

The Gayarre School and IBEC collaborate thanks to the Magnet program, an initiative promoted by the Jaume Bofill Foundation, the Department of Education, the Barcelona Provincial Council, the Barcelona Education Consortium and the UAB Institute of Education Sciences.

The objective of “100científiques” is to bring the research carried out by the researchers to the students from the 6th year in primary school to the 1st year in secondary school, and to highlight the work of women in science and thus generate new reference models so that young girls decide to study STEAM careers. In fact, the motto of this third edition of #100tífiques is “STEAMem la Ciència” (we love science) and it is expected that, thanks to the online format, more than 16,000 girls and boys will be able to enjoy this initiative.



# PHD THESES IN 2021

■ **AIDA BAELO ÁLVAREZ**

Bacterial Infections: Antimicrobial Therapies  
UB  
**New antimicrobial strategies against bacterial infections**

■ **ADRIANNA GLINKOWSKA MARES**

Nanoscopy for Nanomedicine  
UB  
**Formulation and Screening of Drug Delivery Nanocarriers using Microfluidic Technology**

■ **ALEXANDRE GOMILA JUANEDA**

Nanoprobes and Nanoswitches  
UB  
**Development and characterization of in vivo models for Photopharmacology**

■ **ANA CANDIDA LOPES HORTELAO**

Smart Nano-Bio-Devices  
UB  
**Enzyme Powered Nanomotors Towards Biomedical Applications**

■ **DAVIA PRISCHICH**

Nanoprobes and Nanoswitches  
UB  
**Development and applications of photoswitchable small molecules and peptides to control protein-protein interactions and GPCR activity**

■ **ENARA LARRAÑAGA CARRICAJO**

Biomimetic Systems for Cell Engineering  
UB  
**Effects of substrate-derived cues in driving the self-organization of organoid-derived intestinal epithelia**

■ **FERRAN VELASCO MALLORQUÍ**

Biosensors for bioengineering  
UB  
**Carboxymethyl cellulose-based cryogels as a scaffold for pancreatic and skeletal muscle tissue engineering**

■ **HARISHANKAR BALAKRISHNAN**

Nanoscale Bioelectrical Characterization  
UB  
**Nanoscale Tomography Based in Electrostatic Force Microscopy**

■ **IGNASI FERRER LUIS**

Biomedical Signal Processing and Interpretation  
UPC  
**Novel mHealth and multimodal physiological biomarkers for non-invasive monitoring and home healthcare of obstructive sleep apnea and COPD patients with comorbidities**

■ **LAURA MOYA ANDÉRICO**

Bacterial Infections: Antimicrobial Therapies  
UB  
**Deciphering the utility of *Galleria mellonella* as an infection and toxicity in vivo model**

■ **MARIA ARISTA ROMERO**

Nanoscopy for Nanomedicine  
UB  
**Unveiling viral structures by single-molecule localization microscopy**

■ **MAIDER BADIOLA MATEOS**

Nanobioengineering  
UB  
**Compartmentalised microfluidic culture systems for in vitro modelling of neurological and neuromuscular microenvironments**

■ **MARÍA BLANCAS MUÑOZ**

Synthetic, Perceptive, Emotive and Cognitive Systems (SPECS)  
UPF  
**Knowing what you know. A pedagogical model based on learners' metacognitive abilities.**

■ **MARTINA DI MUZIO**

Nanoscale Bioelectrical Characterization  
UB  
**Nanoscale dielectric mapping of bio-membranes with in-liquid Scanning Dielectric Microscopy**

■ **NURIA BLANCO CABRA**

Bacterial Infections: Antimicrobial Therapies  
UB  
**Noves metodologies per al tractament de bacteris creixent en forma de biofilm**

■ **PATRICIA KATHERINE PRADO PERALTA**

Pluripotency for Organ Regeneration  
UPF  
**Developing new strategies to understand human kidney development and target human disease**

■ **XIOMARA GISLEN FERNÁNDEZ GARIBAY**

Biosensors for bioengineering  
UB  
**Engineered functional skeletal muscle tissues for in vitro studies**

■ **XARXA QUIROGA ÁLVAREZ**

Cellular and Molecular Mechanobiology  
UB  
**Plasma membrane mechanosensing upon stretch-induced topography remodelling**



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