



**IBEC**<sup>R</sup>  
Institute for Bioengineering of Catalonia

EXCELENCIA  
SEVERO  
OCHOA

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# IBEC PhD International Programme

Training the next generation of experts in bioengineering

A career choice that  
**opens doors**  
to a world of  
**opportunity...**

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## Welcome to the IBEC International PhD Programme

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**Without a doubt, a society can only face the future and improve quality of life by generating new knowledge to develop new solutions or technological improvements to meet the major challenges we all face.**

At IBEC, frontier research is combined with specific transfer targets to produce new applied technologies to be used in life and health sciences. We have the versatility to generate excellent research and, at the same time, work with industry to develop new diagnostic or treatment systems.

We mustn't forget the central role of people, over and above organisations, in processes of creativity and innovation. Our committed and ambitious scientists, both the youngest and the most experienced, wherever they are from in the world, have the freedom to pursue their lines of research in line with the centre's long-term strategies. With the IBEC International PhD Programme, you too can be part of this adventure, and contribute to improve people's health and wellbeing by generating new frontier knowledge.

IBEC has the capacity to write many success stories on early diagnosis, new therapies based on regenerative medicine, better quality of life compatible with an ageing population, and technological advances to increase efficiency and make healthcare sustainable: success stories of which we will all be able to feel proud.

*Josep Samitier, Director*



## About IBEC and our PhD programme

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**The Institute for Bioengineering of Catalonia (IBEC) conducts excellent interdisciplinary research at the frontiers of engineering and life sciences in order to generate new knowledge by putting together fields like nanomedicine, biophysics, biotechnology, tissue engineering and the applications of health information technology.**

Bioengineering means confronting, understanding and solving highly complex problems in biomedicine, bringing together the tools available in the fields of experimental science, life science and engineering in all their facets. The model envisaged by IBEC is inspired by a creative, innovative new ecosystem based on interaction between research experts in different technologies ([nano-bio-info-cogno](#)) to generate new knowledge and engineering solutions in health technology.

The knowledge that exists in the IBEC research groups is structured in three broad avenues of knowledge: [Nanomedicine](#), [Cellular and Tissue Engineering](#) and [ICT for health](#). These are placed at the service of science and society to progress in three major application areas, namely: [Bioengineering for future medicine](#), [Bioengineering for regenerative therapies](#) and [Bioengineering for active ageing](#).

Our laboratory facilities are designed to foster interaction among researchers from different fields of expertise, with open labs and common scientific equipment, and our location in the [Barcelona Science Park](#) means that IBEC's researchers benefit from access to powerful technological facilities. In addition, the research environment in life sciences in Barcelona is of the highest quality, boasting international centers of excellence in biomedical research.

Joining IBEC means joining a young and growing organization with a scientific staff of 250 researchers and expert technicians, with 30% coming from abroad. The institute is in the process of expansion, which ensures opportunities for young researchers, and this has also been boosted by the recent honour of a **Severo Ochoa Excellence Award** that includes several funded actions for predoctoral training. Severo Ochoa awards identify and promote research centers and units in Spain that stand out as international references in their specialized fields in terms of research excellence, technology transfer, training and outreach.

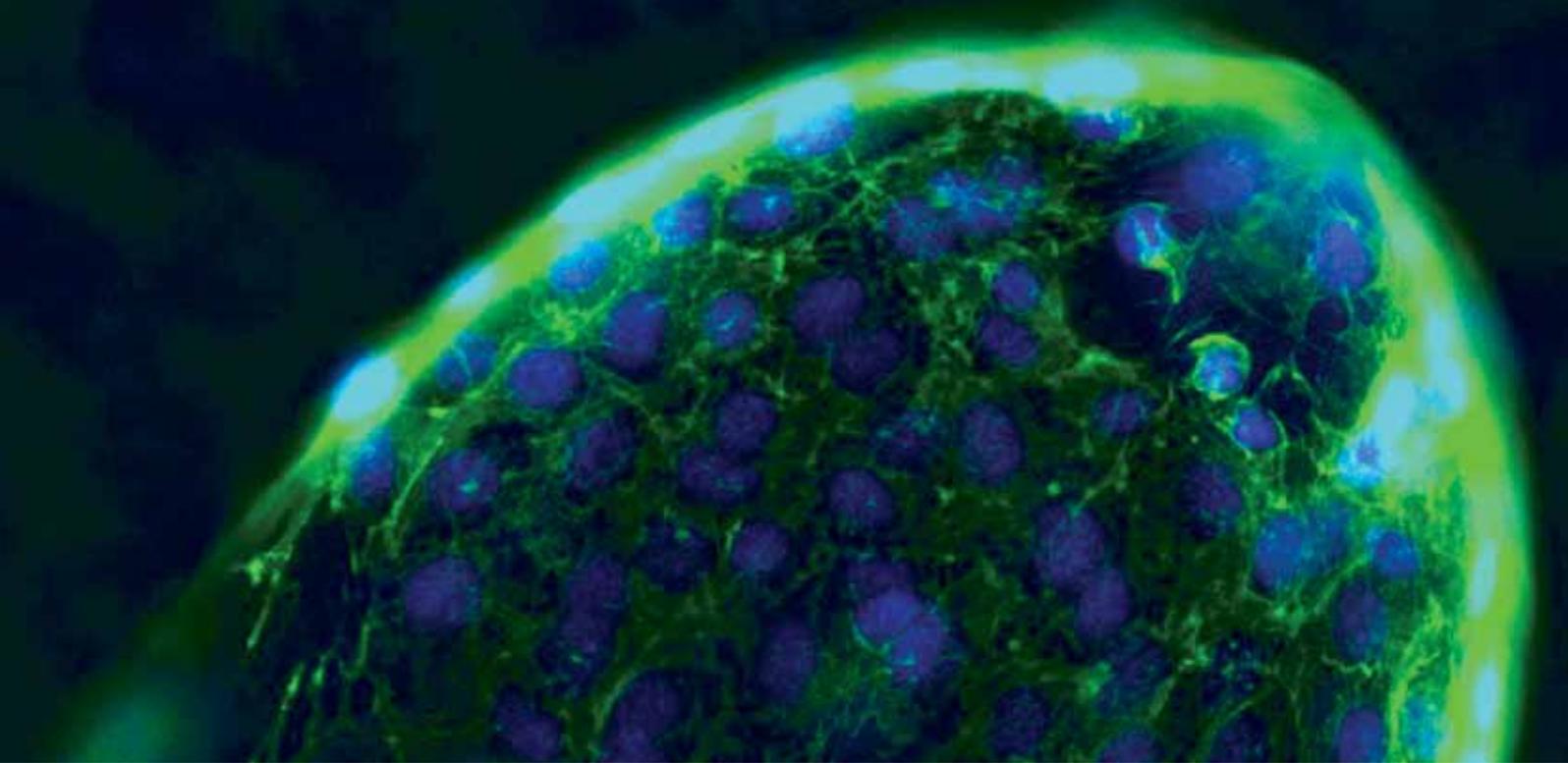
Furthermore, in 2015 IBEC was awarded the **HR Excellence in Research** award from the European Commission. The award reflects our commitment to continuously improve our HR policies in line with The European Charter of Researchers and The Code of Conduct for the Recruitment of Researchers.

Doing a PhD at IBEC brings you the opportunity to start your research career in a stimulating, interdisciplinary and high quality international scientific environment. The IBEC International PhD Programme aims to train the next generation of researchers in bioengineering for future medicine, active ageing, and regenerative therapies.

As a student in one of IBEC's labs, as well as the support of your group leader, you'll benefit from supervision from experienced researchers who will advise you throughout your project.



More than  
**70 theses**  
defended between  
**2009 and 2015**



## Our science

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**When you come to IBEC to do your PhD, you'll join one of our friendly, open-minded and international research groups headed by leading researchers in their field, including five recipients of Catalonia's prestigious ICREA positions and, currently, seven recipients of European Research Council (ERC) grants.**

IBEC's group leaders have been carefully selected by its [International Scientific Committee](#), which is composed of internationally renowned scientists from different bioengineering fields and top professionals from key areas related to IBEC's activities. The rigorous selection process ensures the quality of research conducted at the institute and helps maintain the relevance of its activities to benefit health and society. It also helps to determine that new scientific projects are in alignment with IBEC's goals and mission, ensuring that the institute remains the ideal choice for young researchers looking for a top-quality scientific environment in which to begin their careers.

According to current indicators on scientific performance, on the strength of its number of publications, the impact factors of the journals they appear in and its citation record, IBEC displays remarkable results for a young institute. In recent years, IBEC groups have published articles in the [most prestigious scientific publications in the world](#), including *Science*, *Nature* and *Proceedings of the National Academy of Sciences (PNAS)*, among others. With such a record, in just a few years the institute can expect to be positioned among the highest ranked research centers in Europe.

IBEC's aims to work in everything from the most basic research in areas currently associated with nanotechnology applied to medicine, to the most technological applications aimed at diagnosis or robotic and minimally invasive surgery, among others.

**IBEC's research groups are listed on the next three pages.**

## ■ Bacterial infections: antimicrobial therapies

*Principal Investigator: Eduard Torrents*

We investigate **new antimicrobial therapies to combat bacterial infections**.

We aim to: 1. establish the molecular basis for the regulation of RNR genes, their importance in virulence and biofilm formation; 2. identify and screen new molecules for the highly selective inhibition of bacterial RNR; 3. develop nanoparticles to deliver existing antibiotics or anti-microbial drugs; 4. use lab-on-a-chip technology to study the electrical fields in bacterial cell physiology.



## ■ Biomaterials for regenerative therapies

*Principal Investigator: Elisabeth Engel*

The development and knowledge transfer to industry of **innovative biomaterials and scaffolds** for tissue regeneration. We design, fabricate and characterize bioactive and biodegradable materials and investigate their interactions with biological entities, both in terms of their fundamental aspects and with specific applications for tissue engineering in mind. The aim is the **repair and functional restoration of tissues or organs** by means of 3D scaffolds, cells and signals.



## ■ Biomedical signal processing and interpretation

*Principal Investigator: Raimon Jané*

The design and development of **advanced signal processing techniques** and the interpretation of biomedical signals to improve non-invasive monitoring, diagnosis, disease prevention and pathology treatment. Our main objective is to improve diagnosis capability through the characterization of physiological phenomena and to enhance early detection of **major cardiac and respiratory diseases and sleep disorders**.



## ■ Biomimetic systems for cell engineering

*Principal Investigator: Elena Martínez*

The development of **biomimetic systems for cell-based assays** that account for the structural, physiological and biochemical features of the *in vivo* cellular microenvironment. These biomimetic systems will provide the interface between biological questions and engineering tools to (i) develop new insights into environmental regulation of cells, (ii) investigate diseases, and (iii) develop new therapies for regenerative medicine.



## ■ Cellular and molecular mechanobiology

*Principal Investigator: Pere Roca-Cusachs*

Mechanical forces affect the links and conformation of a network of molecules connecting cells to the extra-cellular matrix. We unravel the mechanisms that these molecules use to **detect and respond to mechanical stimuli like forces or tissue rigidity**, triggering downstream cell responses. Ultimately, we want to understand how forces determine development when things go right, and tumor formation when they go wrong.



## ■ Cellular and respiratory biomechanics

*Principal Investigator: Daniel Navajas*

To gain a deeper understanding of cellular and respiratory biomechanics in order to **improve the diagnosis and treatment of respiratory diseases**. At the systemic level, we study the mechanical properties of airways and lung tissues and the mechanical dysfunctions associated with these diseases. At the cellular level, we have developed an AFM technique to probe micro/nanomechanical properties of the extracellular matrix of decellularized tissue scaffolds.





## ■ Integrative cell and tissue dynamics

*Principal Investigator: Xavier Trepal*

Our research focuses on understanding the **fundamental biophysical mechanisms underlying cell migration** both at the single cell level and at the tissue level. When properly regulated, cell migration enables morphogenesis, host defense and tissue healing. When regulation fails, however, cell migration mediates devastating pathologies such as cancer, vascular disease and chronic inflammation.



## ■ Mechanics of development and disease

*Principal Investigator: Vito Conte*

Deciphering the **physical mechanisms of development and disease** in biological organisms by studying how cell and tissue mechanics determine structure and function in these organisms. We develop biophysical tools to compute cell and tissue forces in arbitrary 3D environments with realistic geometries and material properties, such as anisotropy, heterogeneity, poro-elasticity, and non-linear viscoelasticity.



## ■ Molecular and cellular neurobiotechnology

*Principal Investigator: José A. del Río*

We focus on four main aspects of **developmental neurobiology and regeneration**:  
1) Analysis of cell migration and functions of Cajal-Retzius cells during cortical development. 2) Cell therapy and pharmacological treatment to potentiate axon regeneration in lesioned central nervous system. 3) Neurodegenerative diseases. 4) Development of new lab on a chip devices for neurobiological research.



## ■ Molecular dynamics at cell-biomaterial interface

*Principal Investigator: George Altankov*

**Understanding cell-biomaterials interaction**, specifically on the dynamic formation of the provisional extracellular matrix (ECM) – the thin protein layer that cells recognize, produce, and remodel at the materials interface. We aim to learn **how this process affects the biocompatibility of materials**, and if it can be controlled by engineering the surface properties of materials.



## ■ Nanobioengineering

*Principal Investigator: Josep Samitier*

Nanotechnology for the development of **biomedical systems and devices for diagnostic purposes and integrated microfluidic devices for organ-on-chip**. We carry out surface functionalization of materials integrated with micro-fluidics systems for the study of biomolecule and cell interactions. The goal is to fabricate micro-systems containing living cells that recapitulate tissue and organ-level functions *in vitro* and new portable diagnosis devices as Point-of-Care systems.



## ■ Nanomalaria joint unit IBEC/ISGlobal

*Principal Investigator: Xavier Fernández-Busquets*

The development of **nanomedicine-based systems for malaria prophylaxis, diagnosis and therapy**. The long sought-after magic bullet against malaria could take the form of a nanovector for the targeted delivery of antimalarial drugs exclusively to infected cells. Nanotechnology can also be applied to the discovery of new antimalarials through single-molecule manipulation approaches for the identification of drugs targeting molecular components of the parasite.

## ■ Nanoprobes and nanoswitches

*Principal Investigators: Fausto Sanz and Pau Gorostiza*

Developing **nanoscale tools to study biological systems**, including instrumentation based on proximity probes, such as electrochemical tunneling microscopy and spectroscopy, that we apply to investigate electron transfer in metal oxides and individual redox proteins. One set of nanotools is based on **molecular actuators that can be switched with light**, which can be chemically attached to biomolecules in order to optically control their activity.

## ■ Nanoscale bioelectrical characterization

*Principal Investigator: Gabriel Gomila*

Developing new experimental setups based on atomic force microscopy and theoretical frameworks enabling the measurement of the **electrical properties of biological samples at the nanoscale** (for example, biomembranes, single viruses or single bacteria). Our main objective is to contribute to develop new **label-free biological characterization methods and new electronic biosensors**.

## ■ Nanoscopy for nanomedicine

*Principal Investigator: Lorenzo Albertazzi*

Using **Super Resolution Microscopy (nanoscopy)** to visualize and track in living cells and tissues self-assembled nanomaterials with therapeutic potential (nanomedicine). The understanding of materials-cell interactions is the key towards the development of novel nanotechnology-based therapies for treatment of cancer and infectious diseases.

## ■ iPSCs & activation of endogenous tissue programs

*Principal Investigator: Núria Montserrat*

To generate and correct **disease-specific hiPSCs for disease modeling and drug screening**. We are particularly interested in generation of transgene-free and disease free patient derived hiPSCs for disease modeling and the discovery of novel therapeutic targets. We take advantage of organ-isms that possess the ability to regenerate such as zebrafish, in order to understand which molecular and cellular pathways lead to organ regeneration.

## ■ Signal and information processing for sensing systems

*Principal Investigator: Santiago Marco*

**Intelligent chemical instruments for the detection of volatile compounds and smells**. These systems can be based on an array of nonspecific chemical sensors with a pattern recognition system, taking inspiration from the olfactory system. Our group develops algorithmic solutions for the automatic processing of Gas Sensor Array, Ion Mobility Spectrometry (IMS) and Gas Chromatography-Mass Spectrometry (GC-MS) data for metabolomics and food samples.

## ■ Smart nano-bio-devices

*Principal Investigator: Samuel Sánchez*

**Miniaturized devices that bridge functional materials and bio-related applications**. Self-propelled micro-nanorobots, compact on-chip electrochemical (bio)sensors and biophysics of cells in confined spaces. Part of our activities are based on the shrinkage of “Lab-on-a-chip” to “Lab-in-a-tube” micro-analytical systems which can delicately control the positioning of single cells inside micro-tubular structures integrated on-chip.

## ■ New groups coming in 2017

**Manuel Salmerón** works on material-based strategies to engineer tissue repair and regeneration, and to understand pathological conditions such as cancer; **Javier Ramón's** group will aim to design a innovative new multi-organ-on-a-chip device to test drugs for diabetes.



“I came to IBEC for a visit,  
and it opened my eyes to  
**a new  
dimension”**

*Maria Valls, PhD student, Biomimetic  
Systems for Cell Engineering group*



## Life at IBEC: Training, mobility and social activities

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**IBEC encourages its PhD students to participate in various activities, such as workshops, discussions and outreach events, in order to develop themselves as international researchers.**

### **IBEC Seminars and PhD Discussions**

Our regular IBEC Seminars invite **top names in bioengineering and nanomedicine** from all over the world to help keep us up-to-date on the state-of-the-art of research in the field. IBEC seminars also offer the opportunity to network and discuss recent developments, fostering internal and external interaction and opening doors to future collaborations.

IBEC researchers also have the chance to learn from their colleagues at the PhD Discussions series of talks and skills sessions. These provide a **forum for PhD students to present the results of their research** and discuss them with each other, as well as with more experienced researchers. Outside speakers are also invited to help IBEC's students in their career development by delivering talks on complementary skills such as entrepreneurship and career mobility.

The institute also holds an **annual symposium** on bioengineering and nanomedicine, as well as hosting and organizing several project-based or general scientific meetings and workshops throughout the year.

### **Practical training**

Thanks to IBEC's interdisciplinarity, the most recent technical and technological approaches developed for research in biology and the biomedical sciences are available at the institute. PhD students can acquire experience and practical training in both the **classical approaches and new methodologies** in imaging techniques, nanomaterials technology, nanofabrication, biosensors, biosignal interpretation, lab-on-a-chip approaches, and many more.

## Complementary skills training

Besides the mandatory doctoral courses offered by the universities, IBEC offers **several training courses specifically devoted to PhD students and early postdocs**, covering such topics as scientific writing, effective communication, leadership, guidance for women in their research, how to publish in high ranking journals, preparing a PhD thesis, presentation skills in English, career development, diversity and cross-cultural awareness in research, entrepreneurship, and technology transfer.

All courses in complementary and transferrable skills are designed to enhance future employability and career progress.

## Outreach activities

As part of its mission, IBEC aims to **inform society about the research being carried by its scientists** in bioengineering and nanomedicine, both to help citizens understand the importance of research and make informed decisions, and to encourage young people to consider scientific careers.

To do this, the institute organizes or takes part in a range of outreach activities throughout the year. IBEC's PhD students are required to volunteer for these activities, as they offer the perfect opportunity to gain experience in explaining your research in terms that a lay audience can understand, a skill that is essential for your career in areas such as achieving funding for projects.

IBEC's outreach activities include group visits from schools, universities and other organizations, one-on-one mentoring, workshops for teachers, science fairs and festivals, talks in public spaces, Open Doors days, and many more.



## Research Placements

As part of their training, young researchers are encouraged to take up research placements in other centres. Thanks to these stays, students benefit from intense transnational and multidisciplinary mobility, as well as the **expertise and facilities of the best institutions worldwide**. Such mobility provides them with multicultural skills, including languages, and proves highly beneficial in crossing cultural borders and enhancing their future employability in a globalised job market.

Placements take place in any of the many institutions with which our researchers collaborate, including but not restricted to centres linked to IBEC by strategic research agreements or funded exchange programmes such as Marie Curie or the Networks of Excellence. These stays have the added value of enabling PhD students to obtain an international PhD, a recognised distinction which significantly improves their chances of a successful career.

## IBEC PhD Students' Committee

The PhD Students' Committee is a group of highly motivated representatives of different research groups at IBEC, mainly graduate students, that work voluntarily with two major aims: **to be the voice of the PhD students inside the institute, and to improve the PhD experience**. The Committee works jointly with IBEC's support service units to organize workshops, courses and seminars in response to the PhD community's needs and requests. Social and sports activities where students can relax and mingle with others, such as bowling, tennis table and beach volley, are held frequently too. The representatives of the Committee convene regularly with Human Resources and the Directorate to organize all these activities, as well as to pass on ideas and suggestions from the young IBEC community.





“I’m very  
happy in my group.  
My colleagues are  
great, and the  
**atmosphere**  
is unbeatable”

*Jesus Ordoño, PhD student,  
Biomaterials for Regenerative  
Therapies group*

## Doing your PhD at IBEC: Useful Information

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### **When do I need to submit my application?**

There are different ways to apply for a PhD position at IBEC:

- By applying online to the International PhD Programme, which is launched every year. Details on our website at <http://www.ibeccbarcelona.eu/phd>
- By applying to the open positions that are published regularly on our website at <http://www.ibeccbarcelona.eu/category/jobs>
- By sending a spontaneous candidacy to [phd@ibeccbarcelona.eu](mailto:phd@ibeccbarcelona.eu)
- By contacting any of our group leaders to discuss your ideas (their contact information can be found on IBEC’s website)

### **What are the eligibility requirements?**

You must have obtained a university degree and a master’s degree; or you must hold an official university qualification from a country of the European Higher Education Area with a minimum of 300 ECTS of official university studies, of which at least 60 are at master’s level.

### **What type of degree do I need to have?**

As IBEC is an interdisciplinary research centre, we encourage applications from many different disciplines such as biology, biotechnology, medicine, chemistry, physics and engineering.

### **How long will it take to complete my PhD?**

The duration of study for a PhD at IBEC is usually three to four years.

### **Does IBEC award its own PhD degree?**

No. IBEC doesn't grant the doctorate degree; instead, it provides the experimental experience – the research part of your doctoral studies – during your doctorate programme. The awarding body of your PhD will be the university at which you are enrolled as a doctoral student.

Doctoral programmes in Spain are managed administratively by universities, which establish specific agreements with research centres in order to allow students to carry out their Research Periods there. IBEC is currently recognized as one of these centres by the University of Barcelona (UB) and the Polytechnic University of Catalonia-BarcelonaTech (UPC), which are also two of its founding members. All senior researchers at IBEC are recognized as potential thesis supervisors within the doctoral programmes of these universities that are linked to IBEC's research activities.

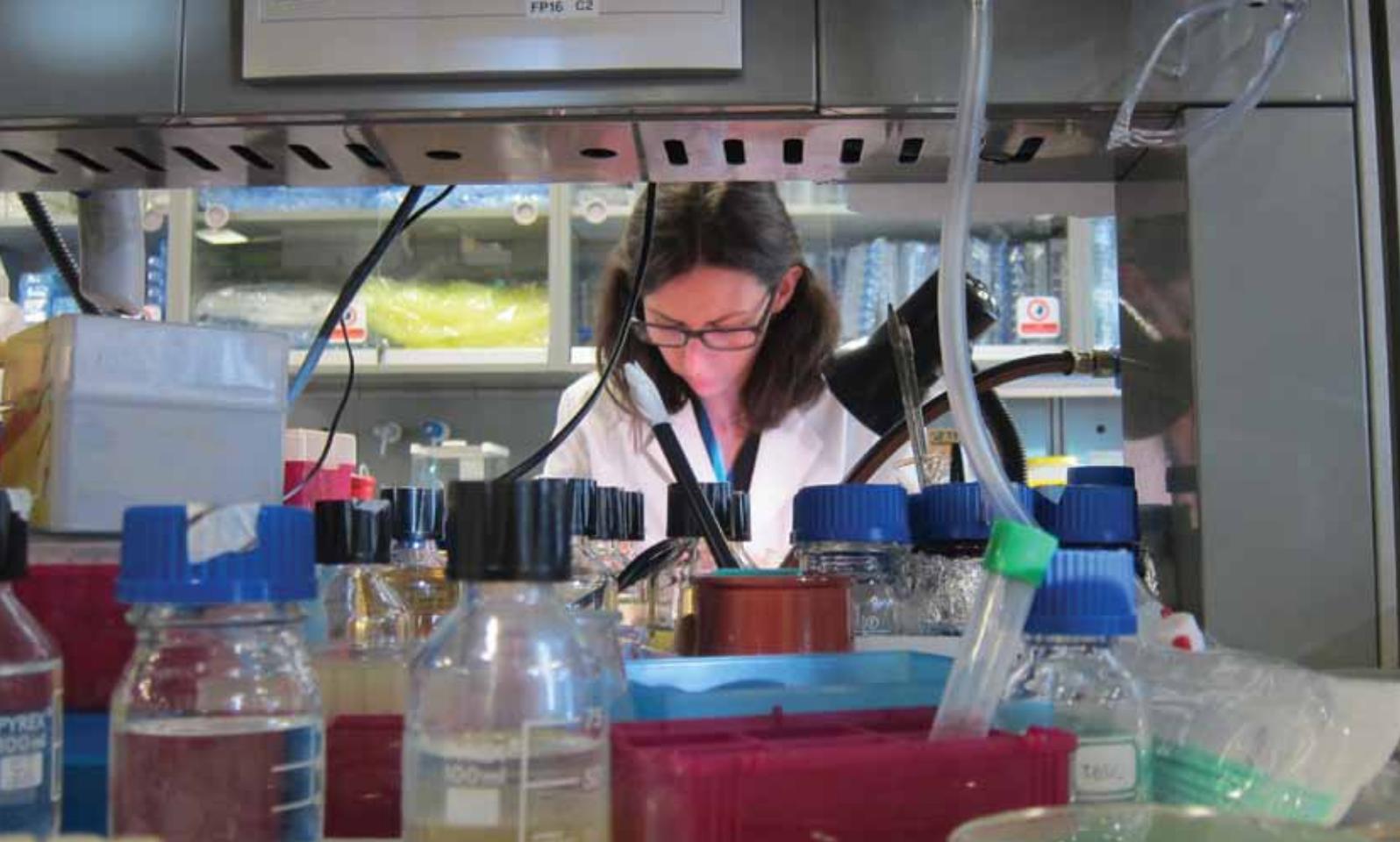
### **Are only students from EU member states eligible to apply? What about students from non-member states?**

Highly qualified students of all nationalities may apply for any PhD position at IBEC.



“Here at IBEC, I have the chance to work with people from very different disciplines”

*Martí Checa, PhD student, Nanoscale Bioelectrical Characterization group*



### **How will my PhD studies be financed?**

There are different funding options. Apart from IBEC's yearly International PhD Programme, there are several competitive PhD fellowships funded by the Spanish and Catalan governments or the Fundació "La Caixa", among others. Research groups can also allocate funds from their research grants to hire PhD students.

When submitting your application, you will be informed of the different options available.

At IBEC there is a competitive salary guaranteed for all PhD students aligned with fellowships' salaries established by the Spanish Ministry, MINECO.

In all cases, IBEC's PhD salary includes social health benefits, pension access, training development, and a competitive salary to live in Barcelona.

### **Will IBEC help me find accommodation and deal with paperwork?**

IBEC's Human Resources Unit provides advice, support and assistance to national and international candidates who are relocating to Barcelona, including finding temporary and long-term accommodation, opening a bank account, applying for health insurance, obtaining a Spanish identity number (NIE), and paperwork related to work permits and any necessary visas.

IBEC has a partnership with Barcelona Centre Universitari, BCU (<http://bcu.cat/welcome>), as well as with other freelance experts who can help with finding suitable accommodation and other relocation services prior to your arrival in Barcelona.

# Where are they now?

Some of IBEC's PhD success stories



## **Riccardo**

**Levato** had cause to celebrate in 2016: he was awarded the prestigious Wake Forest Institute for Regenerative Medicine (WFIRM) Young Investigator Award for his work in biofabrication and 3D bioprinting. He recognises that his achievement is thanks in part to the

time he spent at IBEC. "Doing your PhD training at IBEC is a good basis for well-recognized research. It was the ideal place to develop my passion, and offered me a research group that fulfilled my wish to explore regenerative medicine, stem cells and biomaterials," he says. "Not only that, but the possibility to work with many professionals in the multidisciplinary environment made it possible to stay in touch with recent innovations in bioengineering."

Now he's at the University Medical Center Utrecht, developing new biofabrication and 3D printing approaches for regenerative medicine and tissue engineering, with a strong focus on the translation of bioprinting technologies towards clinical practice. He's also teaching in the masters degree in biofabrication there. "I'll always remember IBEC for the pleasant environment and the access to state-of-the-art facilities," he says. "Doing research there was not only exciting and rewarding, but it also offered a great opportunity to meet many lifelong friends."

## Riccardo Levato

**Nationality:** Italian

*Riccardo was in the Biomaterials for Regenerative Therapies group at IBEC from 2010 to 2015. Now he's a postdoc at the University Medical Center Utrecht in The Netherlands.*

**Arlyng González** found out about IBEC at the 'Become a researcher!' open day in 2008. "I talked with Miguel Timoneda, who was representing the Biomaterials for Regenerative Therapies group, about the work being done by Prof. Elisabeth Engel, which aimed at understanding the biological mechanisms that govern the behaviour of stem cells and their interactions with scaffolds," she says. "This was a revolutionary approach in tissue engineering at the time, as until then most projects were focused on applications rather than the understanding of mechanisms."



She soon found that IBEC was a good choice for her PhD. "I really benefitted from the cutting-edge research being carried out by researchers from a myriad of scientific backgrounds and nationalities," she says. "The open lab structure where several teams share spaces and equipment allows interaction between groups and increases the chance of scientific collaborations. Also, there are plenty of free personal development courses such as scientific writing, English and scientific presentations."

Now, Arlyng is leading two national research projects at RCSI with the common aim of identifying molecular mechanisms involved in the understanding of the biological response of stem cells to biophysical and biochemical cues provided by scaffolds. Despite her exciting new challenges, she has fond memories of IBEC and its people. "In terms of infrastructure, technical and administrative support, IBEC is superior to any other institution I have ever worked in."

## Arlyng González Vázquez

**Nationality:** Venezuelan

*Arlyng was in the Biomaterials for Regenerative Therapies group at IBEC from 2008 to 2014. Now she's a postdoc at the Royal College of Surgeons (RCSI) in Dublin, Ireland.*

## Anita Joanna Kosmalska

**Nationality:** Polish

*Anita was in the Cellular and Molecular Mechanobiology group at IBEC from 2012 to 2016. Now she's a Junior Strategic Projects Manager at the Institute of Photonic Science (ICFO) in Barcelona.*



"I've always been very ambitious, wanting to challenge myself to new heights or achieve difficult goals," says **Anita Kosmalska**, who started her scientific career with a biotechnology degree at the Technical University of Lodz in Poland. "During my PhD interview at IBEC I got a feeling that I could be surrounded by amazing people with a strong desire for challenging assumptions in their fields; that unless it breaks a thermodynamic law, they believe it's possible!"

Anita wasn't disappointed. During her time at IBEC she published a *Nature Communications* paper as first author. "The very nature of the degree taught me to be a team player, a problem solver, and helped me gain great presentation and communication skills, apart from having an analytical mind and perseverance."

Anita has now branched off away from research, but her PhD was essential for such a move. "Doing my PhD at IBEC helped me develop valuable transferrable skills, which are held in high regard by employers," she says. "In the next few years I hope to master my management skills and take the most profit from all of the amazing possibilities that my new position gives me to continually step into unknown territories."

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<http://www.ibeccbarcelona.eu/phd>