

# INSIDE IBEC

The newsletter of the Institute for Bioengineering of Catalonia



Pictures from the 9th Annual IBEC Symposium – page 2



## *INSIDE this issue...*

Showcasing IBEC's new capabilities at the first international 3D printing meeting



page 3

A school visit to IBEC featured on TV

*...and other outreach news*

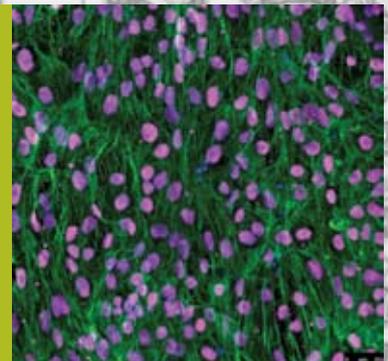
page 7



Heart grafts from human pluripotent stem cells for the first time

*...and other research news*

pages 2-3



# Symp-ly the best



IBEC's ninth annual symposium took place on 29th June at Barcelona's AXA Auditorium, a favourite venue for the event. This year's theme was Bioengineering for Active Ageing, one of the institute's three main areas of application, and the speakers were Josep Samitier, Eduard Torrents and Raimon Jane from IBEC, Paul Verschure from the Universitat Pompeu Fabra, Antoni Bayés-Genís from the Institut del Cor del Germans Trias i Pujol, and International Scientific Committee member Sergio Cerutti from the Politecnico di Milano.

to give a flash presentation of their work. The winners of this year's poster and flash prizes were Patricia Prado Peralta from the iPSCs and Activation of Endogenous Tissue Programs for Organ Regeneration group and Oiane Urrea from Biomedical Signal Processing and Interpretation respectively.

The symposium was kindly supported by Leica, BioLab, Lasing and Isaza Scientific, who also gave a talk.

Next year's symposium, the tenth, will celebrate the end of IBEC's first decade of operation, looking back at ten years of scientific impact and discoveries. //



## LATEST RESEARCH NEWS

# Mycobacteria in olive oil to treat cancer

Researchers at the Autonomous University of Barcelona (UAB) and IBEC have revealed a way to effectively deliver a mycobacterium needed for the treatment of bladder cancer in humans – using a formulation based on olive oil.

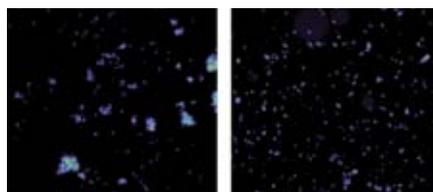
In *Scientific Reports* (E. Noguera-Ortega et al, 2016), the researchers describe a way to reduce the natural clumping that occurs when mycobacteria cells, which possess a high content of lipids in their walls, are introduced to the usual aqueous solutions that are used for intravesical instillation in bladder cancer patients. This clumping may interfere with the interaction of the mycobacteria-host cells and negatively influence their antitumor effects.

After announcing their discovery last year that *Mycobacterium brumae* offers an improved alternative to existing bladder cancer treatments such as BCG, which can cause infections, the collaborators – led by Esther Julián at the UAB – have been looking for ways to improve the immunotherapeutic activity of *M. brumae*. To do this, they've been designing different emulsions that can

increase the homogeneity and stability, and therefore the efficacy, of the mycobacteria solutions when introduced into the body.

“Of the emulsions we tested, the one based on olive oil induce a prominent immune response in both *in vitro* and *in vivo* experiments,” says IBEC's Eduard Torrents, who contributed to the study. “In addition, the characteristics of this emulsion, which preserves the viability of the mycobacteria and provided higher anti-clumping rates, indicates favourable conditions for reaching the bladder epithelium.

The results highlight the potential of this olive oil-based emulsion as a promising delivery vehicle for the mycobacterial treatment of bladder cancer. //



*M. brumae* in PBS (left) and olive oil (right), showing the reduction in clumping

## LATEST RESEARCH NEWS continued

# Heart grafts generated from hPSCs

Scientists from IBEC, in collaboration with the Hospital General Universitario Gregorio Marañón and two groups in the USA, made a big leap in heart regeneration by achieving heart grafts from human pluripotent stem cells for the first time in less than one month.

The collaborators describe in the journal *Biomaterials* (E. Garreta *et al*, 2016) how they decellularized human hearts and left the extracellular matrix intact. They then used genome-editing techniques on human pluripotent stem cells (hPSCs) to efficiently produce cardiomyocytes which they used to

repopulate the extracellular matrices of the decellularized human ventricles. Pluripotent stem cells are crucial for this process, as the body is not able to generate new cardiomyocytes after heart attack or other damage.

The cells within decellularized human heart matrices showed a higher degree of physiological and molecular cardiac differentiation compared to those cultured on regular tissue culture plates, which has been the usual method up to now. It took just 24 days for these human cardiac grafts to exhibit the correct electrophysiological responses needed in cardiac function; in

other words, beating in a manner similar to a heart. “Decellularization of a whole heart can lead to hundreds of acellular slices ready to use as scaffolds,” says IBEC’s Nuria Montserrat, one of the leading authors on the paper. “We anticipate that our fast procedure can be immediately applied in laboratories for cardiac engineering and disease modeling applied to humans.”

This type of de- and recellularization of organs represents a promising strategy for the development of biofunctional organs for drug screening and personalized medicine. //

## IBEC’s new capabilities



Technology Transfer head Xavier Rubies (left) and manager Xavier Puñet (centre) at the IN(3D)USTRY meeting

IBEC Director Josep Samitier and the Technology Transfer unit introduced IBEC’s 3D bioprinting capabilities at the first ever international meeting devoted to 3D printing, “IN(3D)USTRY: From Needs to Solutions” in June. The event, which was held in Barcelona, saw leading companies and other organisations showcase the innovations and opportunities that the new technology can offer to countless projects and processes.

IBEC’s 3D bioprinter is the only one offering the level of precision and characteristics required for regenerative medicine purposes in southern Europe, and one of very few on the continent. It promises to put IBEC at the forefront of a new revolution in regenerative medicine by allowing researchers to add biological properties to implanted tissues such as bone, and may

eventually be able to manufacture entire organs for transplantation.

IBEC researchers have been exploring the possibilities of using the new technology to already improve their processes and methods. Published in *Lab on a Chip* (A. Urrios *et al*, 2016), a recent work describes a major improvement in the way microfluidics systems are produced. Using a new biocompatible resin and 3D printing, they avoid the drawbacks of existing devices, which as well as being tedious to make, are prone to assembly failures and difficult to disseminate to research and clinical settings. One of the contributors to the paper, Nanobioengineering group PhD student Luis G. Rigat, did a research internship at the University of Washington to learn from researchers already working with 3D printing and bring his new knowledge back to IBEC. //

## Finding heparin

While Eduard turned to the kitchen for research solutions (opposite), the Nanomalaria joint unit plumbed the depths of the ocean for theirs. In a *Scientific Reports* paper (J. Marques *et al*, 2016) published together with collaborators at IN2UB and the Universidade Federal do Rio de Janeiro, the researchers revealed the discovery in sea cucumbers, red algae and marine sponges of heparin-like molecules with reduced blood-thinning activity that can be used for therapeutic approaches against malaria.

Until now, heparin – which has been shown to have antimalarial activity and specific binding affinity for red blood cells infected with the *Plasmodium* malaria parasite – has not been explored for anti-malarial drug solutions, as owing to its powerful anticoagulating activity, the quantities needed would result in too much blood-thinning and bleeding. “Marine organisms are a rich source of sulfated polysaccharides similar to heparin,” says Joana Marques, first author on the paper. “These molecules have anticoagulant activities sufficiently small to be used in circulating blood at their active concentrations without the risk of internal bleeding.” //

# Welcome to IBEC's first ARs

As part of its strategic aim to expand both in size and in results by recruiting new professionals, IBEC has now added to its faculty a number of professors known collectively as associated researchers.

Associated researchers are university professors seconded to IBEC with an agreement signed between their university and the institute who are based at their university premises and who work on topics that are of interest or complementary to our research areas. They participate in IBEC's scientific strategy, academic activities and support initiatives, and have the option to submit project proposals and papers with IBEC affiliation.

Recruitment is carried out according to several criteria such as scientific excellence and alignment with IBEC's institutional

strategy. Associated researchers are approved by the International Scientific Committee, which evaluates their performance on a regular basis.

The first four associated researchers are introduced below, and you can find out more about each one on the website at [www.ibecbarcelona.eu/associated-researchers](http://www.ibecbarcelona.eu/associated-researchers).



**Ralph G. Andrzejak** is director of the Nonlinear Time Series Analysis Group at the Dept. of Information and Communication Technologies at the Universitat Pompeu Fabra. He develops innovative nonlinear signal analysis techniques and applies them to real-world biomedical signals. His department has recently been awarded as a "María de Maeztu Unit of Excellence" by MINECO.

From 2008-2015, **Alicia Casals** led the Robotics group at IBEC. While at IBEC she began a spin-off company with the UPC, Rob Surgical Systems, and worked alongside researchers at the Institut de Recerca de l'Hospital de la Santa Creu i Sant Pau and at the UPC on the development of Surgitrainer, a training platform for laparoscopic surgery.



**Maria-Pau Ginebra** is Full Professor in the Dept. of Materials Science and Metallurgy and Director of Biomaterials at the Research Centre for Biomedical Engineering at the UPC, where she leads the Biomaterials, Biomechanics and Tissue Engineering group. She has received numerous awards including ICREA Academia Awards and the Narcís Monruiol Medal from the Generalitat.

From 2007-2015, **Antonio Juárez** led the Microbial Biotechnology and Host-pathogen Interaction group at IBEC. The group's focus was the protein-protein and protein-DNA interactions that play key roles in the ability of virulent bacteria to adapt to the host environment and cause disease, with a particular interest in finding ways to tackle the resistance of bacteria to antibiotics.



## Quick-fire sales patter



IBEC Director Josep Samitier had three minutes to present IBEC at this year's CERCA Conference 2016, the association's annual get-together which invites representatives from all of its research centre members in Catalonia.

Held at Barcelona's CCCB on 8th June, the event was dedicated to highlighting the potential for collaboration between CERCA centres, with the aim of improving the impact and management of research. Forty-one centers presented dynamic 3-minute presentations to highlight their own collaboration opportunities.

During the conference CERCA director Dr. Lluís Rovira also announced some figures about how Catalonia's centres are performing compared to others in the EU; for example, research here received 73% more funds from H2020 than in the first two years of FP7. //

## What's new in Core Facs?

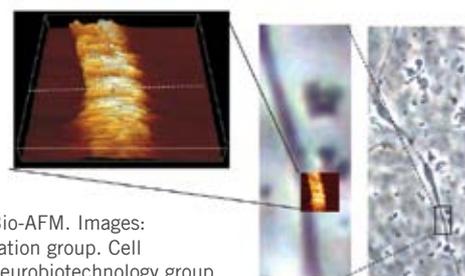
Just when you thought IBEC's facilities couldn't get any better, there's a new piece of equipment available for use by the institute's researchers.

The new Bio-AFM (Bio-Atomic Force Microscope) is one of the most powerful tools for determining surface topography at subnanometer resolution. It's located in the laboratory space of and looked after by Gabriel Gomila's Nanoscale Bioelectrical Characterization group.

The special infrastructure is co-financed by IBEC and some of the institute's research groups, so its usage is subject to particular rules. As with IBEC's other equipment, bookings can be made at [www.ibecbarcelona.eu/services/in-house-equipment](http://www.ibecbarcelona.eu/services/in-house-equipment).

As a result of the new acquisition – as well as that of the 3D bioprinter, and the

creation of new spaces for IBEC's facilities such as BioSpace – a Core Facilities Advisory Committee has been created to monitor and improve the functioning of the labs and infrastructures. The current line-up – researchers Elena Garreta, Marina Gianotti, Miriam Segura and Eduard Torrents, as well as Managing Director David Badia and Head of Core Facilities Isabel Oliveira – will meet periodically to deal with any issues or problems, as well as identifying new requirements and relaying questions, doubts and suggestions from the rest of IBEC's staff regarding the institute's infrastructures. //



Right: living cortical neurons imaged using the Bio-AFM. Images: Martí Checa, Nanoscale bioelectrical characterization group. Cell culture: Miriam Segura, Molecular and cellular neurobiotechnology group

# An unbeatable safety record

Since the creation in January 2015 of IBEC's own Prevention Service, responsible for occupational safety, industrial hygiene, ergonomics and applied social psychology at the institute, we've enjoyed a great achievement: throughout 2015, there were **no accidents at work**. The total prevention of occupational hazards is of course one of our main objectives, if not the most important, so this represents significant progress towards our goals.

Another objective that we've been addressing, with the commitment of IBEC's management, is our strategy for **dealing with harassment**. Recent actions have included updating the harassment protocol, creating the CoPTA (Comisión para la Prevención y Tratamiento del Acoso) committee – a working group dedicated to the prevention of and protection against harassment situations – and dissemination of harassment information to the IBEC community in a flyer (right). To raise awareness about harassment at work, a dedicated course was held and



attended by the CoPTA members, as well as other IBEC staff.

At the operational level we are improving **working protocols** to include preventative measures. Training in and monitoring of working protocols is also provided.

In the area of maintenance and ensuring a high level of **cleanliness and hygiene**, several groups have begun to register the cleanups performed on various work areas such as the cabinets and centrifuges.

To make sure that preventive measures are complied with, and to help towards continuous improvement, **safety visits** are carried out periodically. All aspects that could be improved are collected in the good laboratory practices newsletters and shared with everybody working in the environment.

Recognising that

**training in occupational risk prevention** is a key aspect in achieving high standards of prevention, IBEC has decided that all staff undergo training in this area, regardless of the connection of the person to the institute, their length of stay or type of activity. So far, almost 65% of IBEC's students have been trained in the prevention of occupational hazards.

As an additional training resource, the course "**Good Laboratory Practices**", first held in February last year, is open to all, and covers the particular practices required in a multidisciplinary laboratory. Other courses covered more general aspects such as the use of defibrillators. For further information about these courses, please refer to the Training section of the IBEC website.

Finally, we'd like to say thanks for the cooperation of the whole IBEC community in making these significant achievements in risk prevention. We need everyone's help to keep this excellent trend going!

– *Raquel Guillén, Occupational Hazards Prevention Technician; Carol Mari, Head of HR*

## OUTREACH NEWS

### A busy May and June

To coincide with National Cystic Fibrosis Day 2016, IBEC and the Catalan Association of Cystic Fibrosis (ACFQ) organized an event, "The present and future of Cystic Fibrosis", on 27th April. As part of IBEC's new 'Focus on...' series of outreach activities, which will highlight specific diseases, the day raised awareness about and presented results and clinical advances relating to CF. Anna Crespo from the Bacterial Infections: Antimicrobial Therapies group gave a talk for high school students, and group leader Eduard Torrents participated in the round table.

This was followed a week later by the 2016 edition of the reSearch4Talent open day on 5th May, which attracted more than 50 undergraduate students eager to learn more about work opportunities at IBEC.

The 12th May visit to IBEC of the Escola Ausiàs March was featured on the BTV programme CataKrac on 5th June (right),

and Pere Roca-Cusachs took part in Barcelona's Pint of Science festival at a Sant Antoni bar on 23rd May.

The first two weeks of June saw Vanessa Gil and Àgata Mata of the Molecular and cellular neurobiotechnology group lend a hand at the Fundació Catalunya-La Pedrera's Professors i Ciència course for teachers, and a high school student did his research project at IBEC with Mateu Pla as part of their Joves i Ciència programme. On 13th June Ana Solorzano from the Signal and Information Processing for Sensing Systems group was one of the 10 finalists from 300 participants in the "Thesis in 3 Minutes" competition at the 2016 Jornadas de Cooperación CONAcYT-Catalunya.

June visits to IBEC included 16 Ameri-



can biomaterials students from the University of Perpignan, another group from the University of Texas, and twelve students from the UPC's biomedical engineering department. On 19th June Elena Lantero of the Nanomalaria joint unit gave a talk at the Festa de la Ciència, "Nanotecnologia, una nova arma contra la malària", and on 22nd June the young winners of the Robo-Cat competition of the Fundació Princesa de Girona (FPdGi) came to visit IBEC.

For more information about all these events and more, check out IBEC's outreach blog at <http://divulga.ibecbarcelona.eu>. //

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## The chosen few Excellent candidates from the first call



The best-ranked candidates for the first IBEC International PhD Programme "la Caixa" · Severo Ochoa fellowships were:

1. **Maria Arista Romero** (Spain)
2. **Rafael Mestre Castillo** (Spain)
3. **Luisa María Martínez Sánchez** (Spain)
4. **Xiomara Gislen** (Mexico)
5. **Sabrina Wistorf** (Germany)
6. **Marina Zimina** (Russia)
7. **Kohar Annie Kissoyan** (Lebanon)
8. **Andrés Marco Giménez** (Spain)

### 9. **Alejandra Laguillo Diego** (Spain)

The ones that will finally join IBEC will depend on resignations and the reserve list, but these nine are the students initially chosen by the selection committee from the more than 150 candidates who applied for this call's nine positions, of which 27 were selected for interview in April (pictured above), representing twelve countries.

According to a survey carried out during the interviews, more than half of the candi-

dates found out about the IBEC International PhD Programme "la Caixa" · Severo Ochoa fellowships via the website, with 14% finding out about it thanks to the ad in *Nature Jobs* and 28% through word-of-mouth: friends, lab mates or supervisors.

Their comments about why they wanted to come to IBEC referred to the institute's "extraordinary research groups...that are well clustered" and the "great opportunities" that the centre offers. One mentioned its "strong, well-built facilities" and another the fact that it is doing "research on real-world requirements". "I'd like to come to IBEC because it's an inspiring international environment. I really liked the way all the research fields are connected via the interdisciplinary approach", said one. "IBEC is the best place to study different disciplines and the only place I would feel comfortable doing a PhD," said another. //

## NEWS from the PhD COMMITTEE



The committee at IBEC's 9th Annual Symposium

## Rounding off the season

The activities of IBEC's PhD committee since the last edition of InsideIBEC began with our first ever Table Tennis Tournament. Held during lunchtime on 23rd-27th May at the ping-pong tables in the street outside IBEC, the tournament saw Jesús Ordoño (Biomaterials for Regenerative Therapies group) storm to victory.

Next up was the 4th IBEC Beach Volleyball tournament on Friday 17th June at Nova Icaria beach, when it was the Integratives Cell and Tissue Dynamics group's turn to bask in the glory of winning, but

everyone enjoyed the food, drink and party.

As well as having our usual slot on the programme of the 9th IBEC Symposium (Wednesday 29th June), we also enjoyed the Post-Symposium get-together at Plaça Concòrdia afterwards, something that's becoming quite an annual tradition.

To round off our programme, we went to Sala Montjuic outdoor cinema on 8th July to watch 'Interstellar' under the stars. Now we just have to make the most of summer until our activities kick off again in September!

– IBEC PhD Committee

## ews in brief • News in brief • News

// IBEC participated in the thirtieth edition of the seminar series "**Aspectes generals i d'investigació bàsica en càncer de mama**" organized by the multidisciplinary group for the study of breast cancer at the Autonomous University of Barcelona (UAB). Josep Samitier gave a talk on nanotechnology and nanopharma applied to this variant of cancer, while Pau Gorostiza spoke about the development of light-regulated drugs for the remote control of biological activity and their ap-

plication in breast cancer.

// Bacterial Infections: Antimicrobial therapies group leader Eduard Torrents was the co-organizer, along with AGAUR Director Jordi Mas-Catallà, of the **first Jornada de Microbiology of the Societat Catalana de Biologia**. Held at the IEC on 26th April, the event aimed in its first edition to connect all groups and researchers working in microbiology and infectious diseases in Catalonia, and to integrate their different areas of knowledge.

// IBEC Managing Director David Badia and Communications and Outreach staff Àngels Lopez and Pilar Jiménez were in Madrid on 6th July to collect the second prize for "Reconciliation of Working Life, Family and Personal and Social Responsibility" from the **Alares Foundation**. IBEC was one of 39 winners from 392 candidates for the awards, which recognise the efforts of companies and organizations to improve workers' lives.

## IBEC PEOPLE

**Neus Vilalta** joins IBEC as a new Human Resources Technician. She has more than ten years' experience in recruitment, training and development, several of those in international environments. She has a degree in psychology and postgraduate degrees in HR Management, giving her a solid overview of the employee life cycle and key aspects of talent management. Prior to coming to IBEC she was Senior HR Professional in the telecommunications industry – GyD Ibérica and Giesecke&Devrient Group GmbH – and at pharmaceutical company Merck.



### Other newcomers, May-June 2016:

Vanessa Fernández, Biomimetic Systems for Cell Engineering, Postdoc, Spain; Mario Mancino, Pluripotent Stem Cells and Activation of Endogenous Tissue Programs for Organ Regeneration, Postdoc, Italy; Vicky Lopez, Support Admon- Finances, Accountant Technician, Spain; Ariadna Marin, Integrative cell and tissue dynamics, Master Student, Spain; Maria del Mar Contreras, Signal and information Processing for Sensing Systems, Postdoc, Spain; Gertrudis Perea, Nanoprobes and Nanoswitches, Postdoc, Spain; Neus Vilalta, Human Resources, HR Technician, Spain; Sergi Rey, Biomaterials for Regenerative Therapies, Master Student, Spain; Laura Clua, Pluripotent Stem Cells and Activation of Endogenous Tissue Programs for Organ Regeneration, Research Assistant, Spain.

## AWARDS AND HONOURS

**Eulàlia Elisenda Violant Binimelis**, a student of **Beatriz Giraldo**, Senior Researcher in the Biomedical Signal Processing and Interpretation group, won the prize for best undergraduate project, “Desenvolupament d'un dispositiu per a l'automatització d'ajusts i verificació de plaques electròniques”, from the Col·legi d'Enginyers Graduats i Enginyers Tècnics Industrials de Barcelona at their event on 17th June.



Head of Nanomalaria Joint Unit **Xavier Fernández Busquets** has won the Inspiraciencia award for the third time in its six editions. He won first prize in the adult category of the competition, which rewards the best creative writing inspired by science. His winning submission, “Tectònica fàcil per a sentimentals” can be found on the competition's website at <http://inspiraciencia.es>.

Nanoprobes and Nanoswitches postdoc **Miquel Bosch** was featured as the Marie Skłodowska-Curie Actions fellow of the week on their Facebook page in June. Miquel is carrying out his Optofrax research project to develop light-regulated drugs to treat neurological disorders.



Photo © Casa de S.M. el Rey

## UPCOMING EVENTS

*Thursday 6th–Friday 7th October*  
**“Mechanobiology across networks”**  
Joint Meeting of the Spanish Network of Excellence in Mechanobiology and the European Innovative Training Network BIOPOL  
*Auditori Antoni Caparrós, PCB*

*Friday 7th October*  
**IBEC Seminar**  
“Generation of insulin-producing cells from human fibroblasts”. Rosa Gasa, Associate Investigator, Diabetes and Obesity Research Laboratory, IDIBAPS  
*IBEC, Tower I, 11th floor*

**More events at [www.ibecbarcelona.eu](http://www.ibecbarcelona.eu)**

### More news on the web...

You can keep up-to-date with the latest news and events at IBEC by visiting [www.ibecbarcelona.eu](http://www.ibecbarcelona.eu)



### Articles or ideas, please!

Is your group starting a new project? Perhaps something interesting has happened in your research area, or you've had an interesting visitor. Is there an important change that people should know about, or a deadline coming up? Maybe you'd just like to find out what the IBEC community thinks about something, or you have a request. If you have an idea for *InsideIBEC* or would like to write an article yourself, contact [leigh@ibecbarcelona.eu](mailto:leigh@ibecbarcelona.eu).



## IBEC in pictures - royalty special!

IBEC director **Josep Samitier**, along with other leading lights from Severo Ochoa and María de Maeztu centres – the highest institutional recognition of scientific research in Spain – was received by Their Majesties the King and Queen at Madrid's Palacio de la Zarzuela on 6th June (left). And **Samuel Sánchez** reunited with the king at this year's Princess of Girona Foundation (FPdGi) Awards ceremony in Girona on 1st July (right), after being awarded the prestigious FPdGi Award for Scientific Research by him last year. Samuel took part in a debate between former winners at this year's celebration.



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