Spring 2014 / Issue 7

INSIDE IBEC

The newsletter of the Institute for Bioengineering of Catalonia

Enter our **competition** to design an **IBEC t-shirt!**
page 7


Tasty treats at IBEC's first ever 'Tapas A-War-ds'
page 5

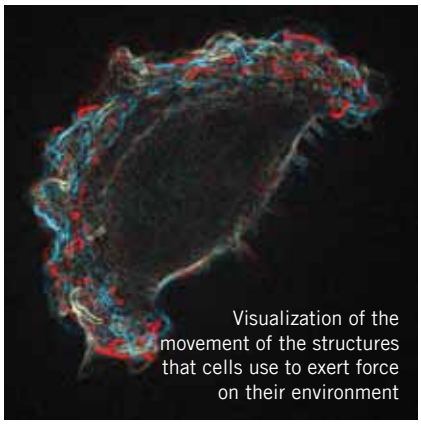
INSIDE this issue...

Crucial mechanism in breast cancer revealed

One of the first signs of tumor development in breast cancer is a lump, signifying an unusual stiffening of the tissue. Tissue stiffness is so crucial that malignant behavior can be caused in healthy breast cells simply by placing them in a stiffer environment. However, how cells could detect tissue stiffness and why they react differently in healthy versus malignant conditions has not been understood until now, when in a study published in *Nature Materials*, researchers at IBEC have demonstrated how the molecules that cells use to attach to their environment, called integrins, allow the cells to detect and adapt to tissue rigidity.

"In healthy breast cells, we have shown that the adhesive properties of integrins lead cells to reduce the force they apply to their environment if the tissue is stiffer than normal," says first author Alberto Elosegui of the Cellular and Respiratory Biomechanics group. "Because reducing force also reduces tissue stiffness, this mechanism can prevent tissue stiffening."

However, cancer cells in the breast express a different type of integrin with different adhesive properties. This other integrin leads cells to apply higher forces as tissue stiffness increases, creating a feedback mechanism that can eventually lead to the hard lumps characteristic of breast tumors. "Our study is the first time ever that a molecular mechanism of rigidity sensing by cells has been described, and it's been demonstrated in healthy and unhealthy human breast cells," says junior group leader Pere Roca-Cusachs. "Fascinatingly, abnormally rigid tissues are found not only in breast tumors but in several other types of cancer, which also express many different types of integrins. This means that mechanical changes induced by altered integrin expression could be key to the onset of other diseases too."



Visualization of the movement of the structures that cells use to exert force on their environment

The work was partly financed by the Obra Social "la Caixa" within the framework of IBEC's project 'Sistemes de diagnòstic i teràpia basats en la integració de noves tecnologies nano bio info i cogno'. //

A career in ERCs

Not only is Integrative Cell and Tissue Dynamics group leader Xavier Trepat one of the youngest researchers in the ICREA programme, he's one of very few researchers to be awarded three European Research Council (ERC) grants. Following on from his Starting Grant in 2010, he was recently announced as a recipient of the new Consolidator grant, as well as gaining a Proof of Concept for some of his more translational research.

He's one of only 20 researchers in Spain to be awarded a Consolidator grant, out of a total of 1203 proposals. He'll receive €1.98m over five years to carry out the project 'TensionControl: Multiscale regulation of epithelial tension', which will aim to reveal the full repertoire of mechanisms that epithelial tissues use to regulate tension and dynamics, shedding light on tissue growth and regeneration processes.

The Proof of Concept grant is for the project 'Micro Gradient Polyacrylamide Gels for High Throughput Electrophoresis Analysis (MICROGRADIENTPAGE)', which aims to develop an improved method to quantify proteins. With countless applications in the life sciences, the proposed method using miniaturized electrophoresis gels could become a standard lab technique for the high-throughput quantification of proteins, revolutionising working practises for countless researchers. //

Meet the new ISC

Last year, the members of the International Scientific Committee (ISC), who oversee and advise on IBEC's strategies and development, stepped down to allow director Josep Samitier to renew the line-up. Now, he's put together a new ISC composed of some existing members and some new ones.

Four members of the previous line-up remain: Samuel Stupp (1), Director of the Institute for Bionanotechnology in Medicine, Northwestern University, Chicago, the new ISC president; Günter Fuhr (2), Director of the Fraunhofer Institute for Biomedical Engineering, Germany; Jocelyne Troccaz (3), Director of Research at France's Université Joseph Fourier-CNRS; and Bernat Soria (4), Director of the Departamento de Células Troncales, Centro Andaluz de Biología Molecular (CABIMER).

The new members are Sergio Cerutti (5), Professor in Biomedical Signal and Data Processing, Politecnico di Milano; Charles J. Dorman (6), Chair of Microbiology, Trinity College Dublin; Roger Kamm (7), Cecil and Ida Green Distinguished Professor of Biological and Mechanical Engineering and former Associate Head of the Dept. of Mechanical Engineering at MIT; Lim Chwee Teck (8), Provost's Chair Professor and Deputy Head of the Dept of Biomedical Engineering, National University of Singapore; Krishna Persaud (9), Professor of Chemoreception, University of Manchester; and Molly Stevens (10), Professor of Biomedical Materials and Regenerative Medicine and Research Director for Biomedical Material Sciences at Imperial College's Institute of Biomedical Engineering. //

SCIENTIFIC ROUNDUP


La ciencia avanza hacia fármacos que se activan cuando les da la luz

The light fantastic

In April *El Periódico* devoted almost a whole page to the research of IBEC's Nanoprobes and Nanoswitches group, led by ICREA Research Professor Pau Gorostiza. He and his collaborators in the new pharmacological field of light-controlled drugs – who include Ernest Giralt (IRB), Amadeu Llebaria (CID-CSIC), Jesús Giraldo (UAB) and Francisco Ciruela (UB) – hope that finding out how to regulate their effectiveness and the spatial and temporal distribution of their physiological effects will open up new avenues towards personalised medicine and the development of patient-specific therapies.

Pau's RecerCaixa-funded project to develop light-modulated ligands has just ended, and he and his collaborators filed a patent on their Glutamate Receptor Photomodulators at the end of last year. Previously, Pau's project on neurosecretion by remote control of exocytosis and endocytosis with light was financed by an ERC Starting Grant. //

Malaria hope

Drugs in nanocapsules are significantly more effective when delivered *in vivo* than free (unencapsulated) drugs, 'recognising' infected cells of different types of malaria, according to a study by IBEC and CRESIB collaborators.

The researchers explored the usefulness of two polymeric nanosystems, AGMA1 and ISA23, as carriers for antimalarial drugs that selectively target the pathogen, in their study published in the *Journal of Controlled Release*. They showed that both polymers bind preferentially to *Plasmodium*-infected red blood cells compared to uninfected cells. Moreover, they are capable of recognising widely divergent species, such as *P. falciparum* and *P. yoelii*.

"These polymers have low toxicity, high biodegradability and selectively target infected cells," explains Xavier Fernàndez-Busquets, head of the Nanomalaria joint unit of IBEC/CRESIB. "This means that they're extremely promising candidates as therapeutic antimalarials, and could help curb resistance."

This exciting potential has been boosted by funding for the Nanomalaria joint unit from Italy's Fondazione Cariplo to develop the polymeric prototypes. //

First functional human 'splenon-on-a-chip'

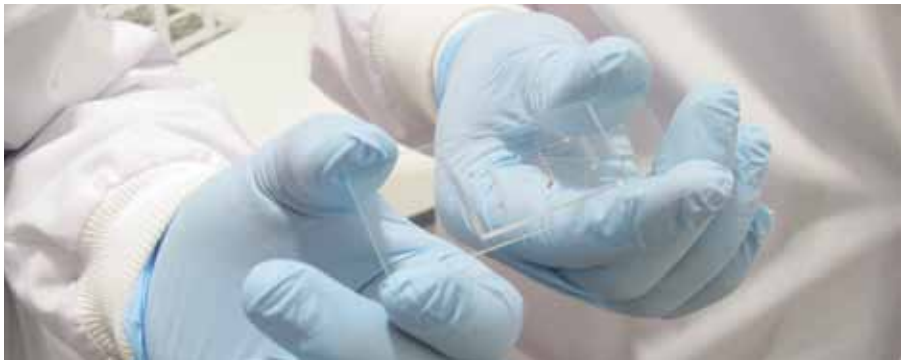
IBEC scientists and their collaborators at CRESIB have designed the first-ever functional 3D splenon capable of reproducing the function of the spleen: the filtering of red blood cells.

The CRESIB group had been studying the role of the spleen in malaria, while IBEC's Nanobioengineering group had been investigating the rheological properties of blood, including malaria-infected blood, to develop diagnostic systems. As IBEC researcher and co-author Antoni Homs explains, "the complex fluidic system in the spleen has adapted to selectively filter and destroy old red blood cells, microorganisms, and malaria-infected cells. The spleen filters blood using a unique method, making it 'microcirculate' through filtration beds made of splenic red pulp in a special compartment where the hematocrit (percentage of red blood cells) is increased. This facilitates the recognition and destruction of unhealthy cells by specialised macrophages."

Not only that, the blood in the compartment is only able to travel in one direction and has to pass through interendothelial slits to reach the circulatory system, which constitutes a second, rigorous control point to ensure the removal of old or unhealthy cells.

As reported in *Lab on a Chip* in February, the researchers mimicked these two test conditions on a microscale platform that reproduces the physical and hydrodynamic properties of the functional unit of the splenon. The device has been tested with healthy and malaria-infected human red blood cells in studies conducted by predocs Luis G. Rigat-Brugarolas (IBEC) and Aleix Elizalde-Torrent (CRESIB), co-authors on the paper.

The device represents a major breakthrough in the field of microengineered organs on chips and may serve to investigate potential drugs for malaria and other blood disorders. //



Strategic planning underway

Once IBEC's new Director was appointed in mid 2013, one of the first actions was to push forward a collaborative exercise to define IBEC's Strategic Plan with the participation of all the institute's key players. This will help draw up guidelines for the period 2014-2017.

During the first weeks of 2014, we initiated a strategic reflection by asking some of IBEC's external stakeholders – such as the trustees, ISC members and customers – for their opinions and insights. Then it was time to ask for opinions in-house. All staff had the opportunity to respond via an anonymous survey, and we really appreciate the valuable feedback we received from almost 70 people. In addition, specific meetings with Group Leaders took place to discuss the institute's strategy.

IBEC's model coincides with the nano-bio-info-cogno approach: a creative and innovative ecosystem based on the coalescence of research experts in different technologies. IBEC's Plan will consolidate and accelerate this unique model in which frontier research and targeted approaches combine to yield new technologies for the life and health sciences. It will increase IBEC's visibility, its ability to attract talent, and its internationalization and training capacities.

These are the areas, in brief, which will be addressed by the Plan:

Research Programme (RP14-17)

The knowledge and technology used by IBEC can be grouped into: Nanomedicine, Cell Engineering and ICT for Health. These are our current flagships. In addition, IBEC's Research Programme can be explained by the different applications of bioengineering:
- Bioengineering for future medicine
- Bioengineering for regenerative therapies
- Bioengineering for active aging

Tech Transfer and Clinical Translation

A technology transfer and clinical translation strategy will be deployed for the RP14-17 and specifically for every ARI.

Training

Doctoral, postdoctoral, masters and undergraduate training.

Human Resources

Attraction of talent; professional development.

Positioning

International position; industry and academic alliances.

Funding

To increase and diversify IBEC's funding sources.

Management

To roll out an integrated management system.

Communication

This area is being covered by the Strategic Communications Plan 2014-2017, which is being put together by the Communications and Outreach Department with input from others both inside IBEC and outside. We are in the process of establishing communications actions to help with the following cross-cutting objectives: 1. To communicate the services and products IBEC has to offer to industry and hospitals, with an emphasis on 'problem solving'; 2. To demonstrate that IBEC is an attractive destination for the best researchers at all career stages from all over the world; 3. To improve internal communication at a scientific and social level; 4. To achieve more visibility in the media, both at home and abroad, to contribute to establishing IBEC as a strong bioengineering brand; and 5. To identify and approach foundations and other independent sources of funding.

The next steps will be to elaborate the final Strategic Plan document, after which the Directorate will submit it for the approval of the Board of Trustees and the ISC. With their go-ahead, we will communicate the Plan to everyone and implement it, with the objective of strengthening IBEC's research capabilities and improving our international scientific leadership in bioengineering and nanomedicine.

– David Badia, Managing Director

IBEC advice to Horizon 2020

On 2nd April the European Commission's RO-cKETs study rounded up its activities with a high-level conference in Brussels. Head of Knowledge Exchange Arantxa Sanz presented the study's findings in the area of health and healthcare at the two-day event, which welcomed 180 stakeholders.

In its leading role in RO-cKETs, IBEC helped identify innovative products in the pharmaceutical and medical technology sectors that may be supported by the integration of Key Enabling Technologies (KETs), such as nanotechnology.

All the findings of the different RO-cKETs working groups, which as well as health covered areas such as energy, environment and agriculture and involved experts from all over Europe, will provide a crucial roadmap for the EC's new funding instrument Horizon 2020, the successor to FP7. //

Great Danes

We may not have any Danish researchers – yet – but as far as outreach goes, IBEC continues to be extremely popular with visitors from this northerly land.

When fifty more biotechnology and chemistry students from Copenhagen came on 20th March for a morning of talks and tours (thanks to all who helped out, by the way!), we asked their teacher, Morten Eskildsen, how he'd found out about IBEC. Was he in contact with another teacher who's brought a group here before? "No, I just did a search on the web to find the centre that looked most interesting," he said.

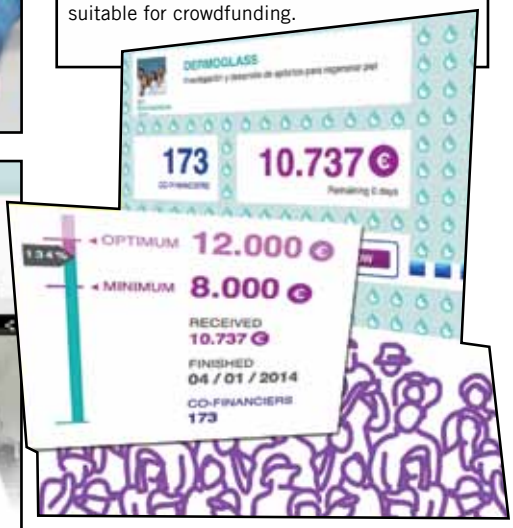
With all the centres in Barcelona that he could've chosen, that must mean we're pretty special! //

The Biomechanics and Mechanobiology group's Carlos Ruiz talks about his PhD work

1. Dermoglass, a wound dressing which accelerates skin regeneration in hard-to-heal ulcers, is developed by IBEC's Biomaterials for Regenerative Therapies group and the UPC. It is announced as one of the first projects to be chosen by the UPC's new SUMA initiative as suitable for crowdfunding.

2. IBEC's Communications and Outreach unit leaps into action to make an explanatory video for crowdfunding website www.goteo.org, with the help of Catalan actor and musician Andreu Rifé, who played doctor Josep in the TV3/ Antena3 series 'Pulseras rojas'.

3. The web page goes live in October. Now it's a race against time to raise between €8000 and €12000 in just 80 days!



4. People are feeling generous. At the end of the first round of 40 days, Dermoglass has exceeded its minimum target, with €8007. By close of play, 173 donors have raised a grand total of €10737!

5. "The money we raise from crowdfunding will ensure that our dressing can proceed to preclinical testing to demonstrate the safety and efficacy of Dermoglass," says junior group leader Elisabeth Engel. "After that it might be only a matter of a year before it can be brought to market."

THE END

NEWS from the PhD COMMITTEE

...and the winner is...

Thirteen teams showed off their culinary skills at the first ever Tapas A-War-ds, organised by the PhD Student Committee, on 21st February. The PCB's Fifteen restaurant provided the location and equipment for the researchers to whip up some original and amazing dishes, which included 'Ibiquitos', 'Saltimbocca alla Romana', 'Cellular Eggs' and 'Mixed functionalization of fungus campinolus with lactatus formatus and camba porkus', and then the even more fun part was tasting them all.

The overall winners of the Best Tapa Award were Luca Liverani, Carlos Ruiz and Themis Toumanidou from the Biomechanics and Mechanobiology group with their tapa 'Boca del Sur' that was a mixture of flavours from their three origin countries. There were runners-up prizes for the Best Tasting Tapa, Best Looking Tapa, and Best Name Tapa as well.

In March there was another first with the PhD Committee's Calçotada held in Merendero Les Planes, a fun and sunny day in which around 25 people participated.

The next Phd Student Committee-organised event will be the 'IBEC's Labs Tour', which will take place on Friday 9th May from 17:00 and will provide an opportunity for everybody to find out more about what their neighbours in other IBEC labs are doing, followed by bowling and beers. Hope to see you there!

– IBEC PhD Students Committee

What Research Affairs can do for you

We talked to Teresa Sanchis, Head of Research Affairs, about the new scope of the support services unit formerly known as General Projects

Teresa, why has the name changed to Research Affairs?

It was felt that 'General Projects' didn't make it clear that our remit is research projects, and also it wasn't really sufficient to explain the other things the unit does. We have many responsibilities, such as the IBEC seminars, collecting the data to measure IBEC's annual scientific output, or supporting the directorate in everything related to research management. We have also merged with the Funding Unit (Esther Gallardo), so that every step of the scientific project process is the responsibility of a single unit. Judith Forné has also joined as assistant.

There have been quite a few changes on the project management side of things, haven't there?

Yes. We've separated that side off into a sub-unit called the Project Management Office. Javier Adrián is the coordinator, and the other project managers are Ester Rodríguez and newcomers Guillermo Talavera and Javier Selva.

Do you still manage any groups yourself?

No, this reshuffle means that I can devote my time to helping the directors to set priorities, providing feedback and supporting IBEC's development as an organisation.

So, to sum up, what are the support services that you offer to researchers?

All aspects related to the management of their scientific activities, from looking for funding opportunities – for both projects and individuals – to writing proposals for competitive calls, comprehensively managing the research portfolio of the groups, managing their finance, and so on. We work closely with the rest of IBEC's support units to coordinate all these aspects. In addition, the unit organizes and coordinates IBEC's internal research activities, training and events such as the programme of IBEC Seminars and PhD Discussions sessions, and acts as scientific organizer for major events such as the IBEC Symposium on Bioengineering and Nanomedicine and the Advanced Summer School. We also coordinate the annual collection and analysis of scientific dissemination – the numbers of papers, patents and other output – to record and measure our academic impact. Finally, the unit also leads any internal and cross-cutting support projects related to IBEC's Corporate Development.

L-r: Ester Rodríguez, Judith Forné, Javier Adrián, Teresa Sanchis, Guillermo Talavera, Javier Selva, and Susanna Traver, maternity cover for Esther Gallardo

When should people contact you?

When you're thinking about applying for funding – or even before, in case we can find a call you don't know about! We can help you with the entire process. Also, if you'd like to suggest a speaker for an IBEC seminar, symposium or other event, or have any other research-related suggestions or comments, please get in touch. //

IBEC hosts Gencat educators

IBEC welcomed members of the Generalitat's Department of Education and about 150 teachers on 7th April, when the Department held its event 'Presentació del Programa de Competències Científiques' in a research institute for the first time. The visitors, who included the Consellera d'Ensenyament Irene Rigau (pictured talking to the press who attended), enjoyed demonstrations and explanations about IBEC's research in biomaterials and robotics and the Nanotechnology Platform at a 'mini-fair' of stands manned by IBEC researchers, as well as visits to the labs in the Hélix. Afterwards they headed into the PCB's Auditori Antoni Caparrós for the conference, during which IBEC Director Josep Samitier presented 'La nanotecnologia aplicada a la medicina'.

RecerCaixa success

Elisabeth Engel presented BIOTENDON, one of two IBEC projects to achieve funding in the latest RecerCaixa round, at the ceremony at La Pedrera on 28th March. BIOTENDON aims to improve healing in shoulder injuries, while Alícia Casals' proposal, "Desenvolupament d un sistema robòtic de baix cost d ajut a la rehabilitació de la marxa per a nens amb transtorns motors greus", will work on a system to aid rehabilitation in children. They were among just 26 successful proposals chosen from a total 362 applications submitted to the 2013 call.

COMPETITION

Design a new t-shirt for IBEC!

Many newer IBECers may not be aware that we have an 'official' IBEC t-shirt. Most people who've been here for years have got one tucked away in a drawer somewhere, but they only ever seem to see the light when someone is moving house. Let's face it – they're just not very inspiring.

The old t-shirt: 'Not very inspiring'

That's where you come in! We'd like to have your design ideas for a fabulous new top that anyone would be proud to sport about town. You can use words, pictures, abstract art – anything. The only requirement is that the IBEC logo appears somewhere fairly noticeable.

So, next time you're stuck late in the lab waiting for an experiment to finish, give Facebook a miss and do something creative instead. Have a doodle on our handy templates – both front and back are provided, for your convenience – and then scan your finished artwork and send it to us at ibeccommunications@ibecbarcelona.eu, or rip this page out and bring it to Communications on Planta 10, or send it to us by internal mail. Or ignore the template, if you prefer, and send your own sketch or jpeg.

We're looking forward to receiving your submissions!

Closing date: 20th June 2014.

Name: .....

Group: .....

News in brief • News in brief • News in brief • News in brief • News in brief • News in brief • New

// IBEC's director Josep Samitier and Robotics group leader Alícia Casals are on the scientific committee of one of the main events of the Generalitat's Tercentenary celebrations.The "**Next World International Futures Studies Congress**" will take place in late October 2014 and will bring together the world's leading experts in future studies, a discipline that analyses and forecasts technological, political and economic changes and their impact on society. Josep and Alicia are among the representatives on the sciences side of the committee, which also includes the UB's Enric Canela and Ramon Gomis de Barbarà, Director of IDIBAPS.

// IBEC is in a consortium, along with Biocat and other organisations and with the support of the Government of Catalonia and Barcelona City Council, involved in the Catalan proposal to run the Knowledge and Innovation Communities (KIC) in the area of healthy living and active ageing. Created by the European Institute of Innovation and Technology (EIT), KICs are supra-national spaces that coordinate efforts to achieve greater competitiveness and sustainable economic growth in response to major social challenges. The announcement of the new KICs will take place later in 2014, and if the Catalan proposal – **Innolife** – is successful, Barcelona will act as the collocation centre.

// The **Annual Report 2013** is now available online at www.ibecbarcelona.eu/documents or as a hard copy from the Communications and Outreach Unit. A new section this year covers clinical translation.

AWARDS AND HONOURS

More news on the web...

You can keep up-to-date with news and events at IBEC by visiting www.ibecbarcelona.eu

// **Jérôme Noailly** of the Biomechanics and Mechanobiology group has won a visiting researcher position at the Université de Technologie Compiègne in France, under the framework of the 'Laboratories of Excellence' programme. His work while in France will look at linking MRI to image constitutive modeling through descriptions of cartilage tissue composition-based multiphysics.

// An IBEC alumnus has won a Bayer Early Excellence in Science Award. **Javier Fernandez** (below right), now Associate Researcher at the Wyss Institute of Harvard University, Boston, was awarded the prize in the field of "Materials" for shrilk, a new material that replicates the exceptional strength, toughness and versatility of one of nature's more extraordinary substances: insect cuticle. Javier completed his PhD in IBEC's Nanobioengineering group in 2008.

Photo: Harvard

// High school student Irene Campo i Prieto (right), who carried out a research project at IBEC within the Recerca a Secundària programme under the supervision of the Nanobioengineering group's **Rossella Zaffino** (left), was one of three prize winners for Best Project at the Recerca a Secundària awards ceremony at La Pedrera on 19th March. Irene, from l'Institut Jaume Salvador i Pedrol, carried out her project 'Tècniques de fabricació i caracterització, a la micro i nano escala, per a l'aplicació en productes biomèdics' with the help of Rossella during the summer of 2013. Recerca a Secundària enables students to carry out the practical part of their research in real labs at the PCB institutions, supervised and supported by a researcher.

Want to get involved?

If you have an idea for an article for *InsideIBEC* or would like to write one yourself, please contact us. Is your group starting or finishing a project? Is there an important change in procedure that people should know about, or a deadline coming up? Perhaps something interesting has happened in your area of research, or perhaps you've had an interesting visitor. Maybe you'd just like to find out what the IBEC community thinks about something, or you have a request for help.

Send your ideas to vleigh@ibecbarcelona.eu.

UPCOMING EVENTS

Tuesday 6th May, 11:00
PhD thesis defense: Mercè Izquierdo
Sala d'actes (Edifici nou de l'aluari), Bellvitge campus

Wednesday 21st-Thursday 22nd May
MIHealth Forum 2014
(IBEC sponsored event)
Fira de Barcelona

Friday 23rd May, 10:00
IBEC Seminar
Title to be confirmed
Dr. Jordi Alcaraz, UB

Friday 13th June, 10:00
IBEC Seminar
Title to be confirmed
Prof. Conxita Solans, Grup Química Col·loidal e Interfacial, IQAC-CSIC

Monday 30th June-Thursday 3rd July
4th Interrogations at the Biointerface Advanced Summer School: The self-renewal/differentiation interface
IBEC/PCB

Monday 29th September
7th IBEC Symposium on Bioengineering and Nanomedicine
UPC, Vertex Building

Wednesday 29th October
NextWorld 2014: International Futures Studies Congress
Barcelona

For more events, please visit www.ibecbarcelona.eu

IBEC in pictures

In just a single day, members of the **Nanobioengineering group** – including **David, Juan Pablo, Gizem, Teresa and Miriam**, above – moved 250 boxes and three pallets of equipment to their new home in the PCB's Hélix building. The group was previously divided between the Clúster, the UB and the Hélix, but after the move in March, they're all happy to be together and closer to the other IBEC groups.

ibec Institute for bioengineering of Catalonia

InsideIBEC issue 7, Spring 2014.
Published at IBEC, Baldiri Reixac 10-12, 08028 Barcelona, Spain.
Available online: www.ibecbarcelona.eu/documents.
Editor: Vienna Leigh. Please send contributions to vleigh@ibecbarcelona.eu