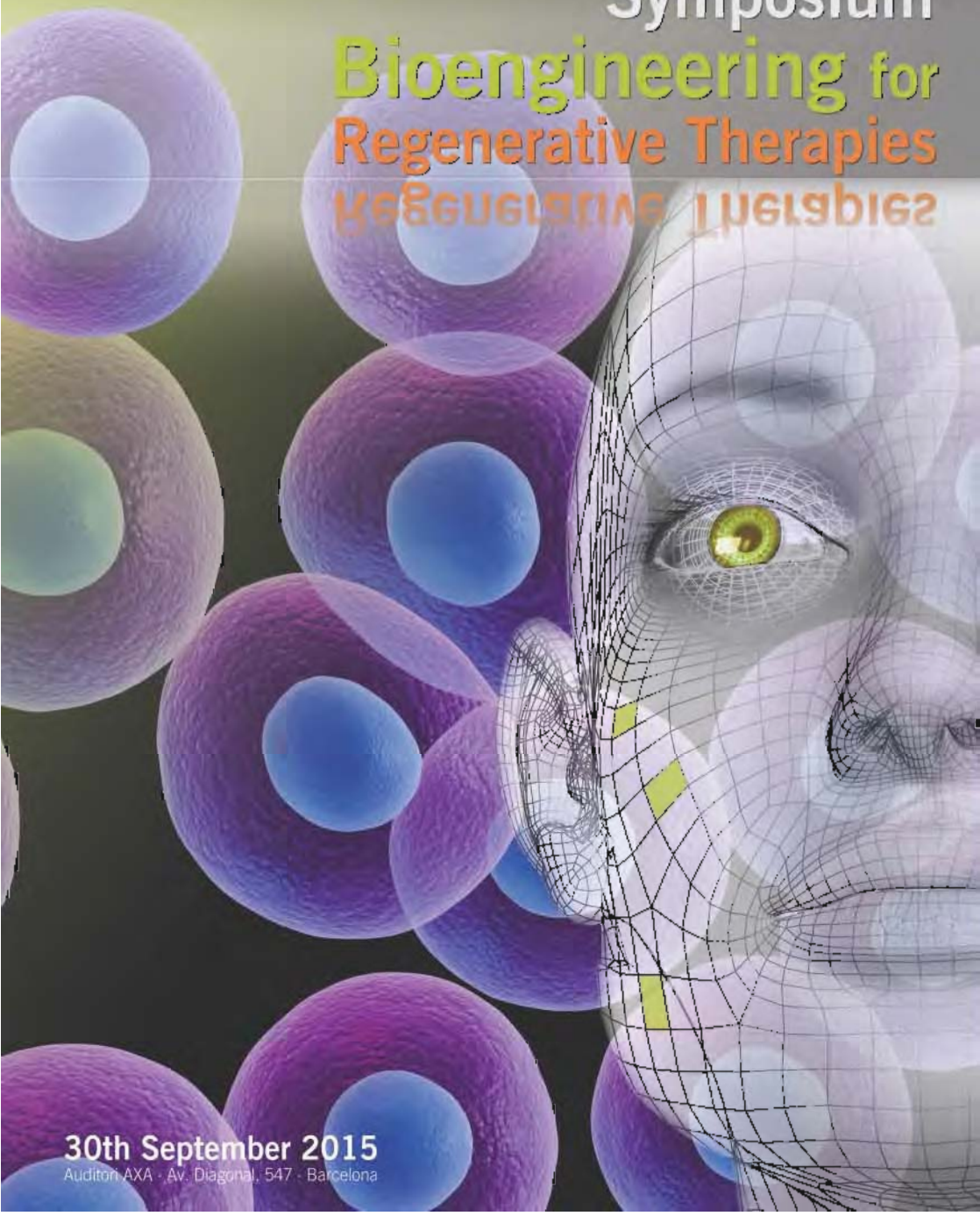
IBEC

Institute for Bioengineering of Catalonia

8th IBEC Symposium

Bioengineering for Regenerative Therapies

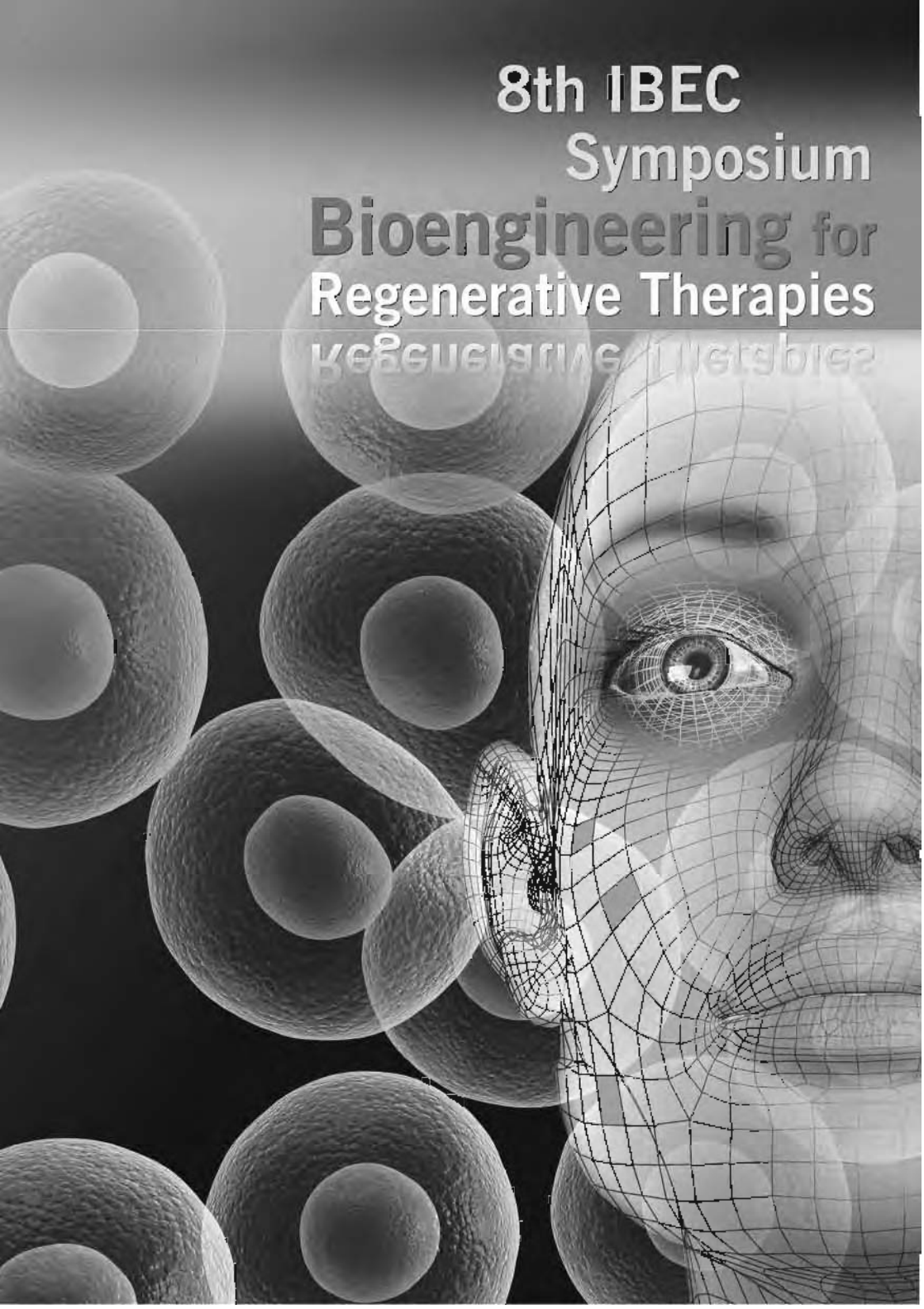


30th September 2015

Auditori AXA · Av. Diagonal, 547 · Barcelona

8th IBEC Symposium

Bioengineering for Regenerative Therapies



Designed and produced by the
Communications Office of the Institute for Bioengineering of Catalonia

Printed by GAM

www.ibecbarcelona.eu

8th IBEC Symposium
Bioengineering for Regenerative Therapies

Welcome to IBEC's eighth annual symposium

This year the theme will be one of IBEC's three areas of application, 'Bioengineering for Regenerative Therapies'. Combining new tailored nanobiomaterials with cell engineering drives advances in tissue engineering for the repair and replacement of human tissues damaged by injury, illness and ageing. By developing tailored biomaterials that provide the required microenvironmental influences to reprogramme cells or engineer their fate – such as enhancing differentiation and proliferation of cells – researchers can trigger the self-regeneration of damaged tissue.

The symposium is our yearly opportunity to publicly present our research and showcase some of the achievements of the international experts in our main fields of interest. In addition to the main talks, attendees can enjoy the flash presentations from our young researchers and PhD students, as well as the poster sessions.

Along with the networking opportunities offered by the coffee and lunch breaks, the symposium promises an unrivaled opportunity to review the state-of-the-art in bioengineering and nanomedicine and promote multidisciplinary discussions.

Enjoy the symposium!

8th IBEC Symposium
Bioengineering for Regenerative Therapies

Information for participants

Information Desk

The conference registration and information desk will be located in the main reception hall of the AXA building Auditorium. It will be staffed from 08:30 to 17:30 on Wednesday 30th September.

Badges

Each registered participant will receive a name badge. For security reasons, the badge must be clearly exhibited in order to access the congress area during all scientific and social events. Replacements for lost badges will be available from the registration desk.

Speakers/Flash presentations

Speakers and those participants giving flash presentations should take their presentation(s) to the reception desk during the coffee or lunch break before their session. Those who are speaking in the first session in the morning should go to the desk at least 15 minutes before the start of the day's programme.

Poster sessions

Posters should be hung during registration between 08:30 and 09:00 on Wednesday 30th September. Please refer to the information board in the registration area or this book to check which board number has been allocated to you.

Posters can remain on display throughout the conference and should be removed between 18:35 and 19:00. Any posters remaining after the indicated time will be removed by the organizers, who accept no responsibility for loss or damage.

Poster sessions will take place during the coffee and lunch breaks.

Certificate of attendance

If you wish to have a Certificate of Attendance, you can request one from the Secretariat at symposium@ibecbarcelona.eu.

8th IBEC Symposium
Bioengineering for Regenerative Therapies

Programme

08:30 - 09:00	Registration
09:00 - 09:30	Opening ceremony
09:30 - 10:05	**Prof. Josep Samitier.** *Institute for Bioengineering of Catalonia (IBEC)* IBEC Evolution and Scientific highlights
10:05 - 10:40	**Dr. Nuria Montserrat.** *Institute for Bioengineering of Catalonia (IBEC)* Developing strategies for organ regeneration: how far are we from reality?
10:40 - 11:10	Coffee break & poster session
11:10 - 12:00	Flash poster presentations I. Cell Engineering Session
12:00 - 12:35	**Prof. Michael Schneider.** *Imperial College London* Cardiac stem cell differentiation: Forward programming, biomaterials and epigenetic remodeling
12:35 - 13:20	Flash poster presentations II. Nanomedicine and ICT for Health Session
13:20 - 14:30	Lunch & poster session
14:30 - 15:05	**Prof. Manuel Salmerón-Sánchez.** *University of Glasgow* Matrix engineering and synthetic biology to control stem cell fate
15:05 - 15:40	**Prof. Giorgio Scita.** *University of Milan* Endocytic Control Of Cellular Plasticity And Mechanics
15:40 - 15:55	Time for sponsors: IZASA Scientific
15:55 - 16:00	Time for PhD Committee
16:00 - 16:30	Coffee break & poster session
16:30 - 17:05	**Prof. Ronald McKay.** *Lieber Institute for Brain Development (LIBD)* Title to be confirmed
17:05 - 17:20	Awards and closing ceremony

Keynote Lectures

IBEC Evolution and Scientific highlights

Josep Samitier

Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain
University of Barcelona (UB), Spain

In the last year we have begun to implement our Strategic Plan 2014-2017, focusing on the three axes of Bioengineering for Future Medicine, Bioengineering for Regenerative Medicine and Bioengineering for Active Ageing. A sign of the consolidation of our short history as a research center is that in 2015 IBEC was awarded the Severo Ochoa Excellence Award. It's a satisfaction as well as an incentive to be added to the small group of 20 distinguished centers to be awarded in the first four years of the programme. IBEC is one of the youngest institutes to achieve the award, as well as one of those receiving the least economic support from the Catalan research system.

In 2014 we celebrated six Nature group papers, including a Nature Materials cover; 98 indexed journal papers in total, 77% of them in the first quartile; 2 new patents; 12 PhD theses; two more ERC grants in the consolidated and starting categories for junior group leaders Dr. Elena Martinez and Dr. Nuria Montserrat; and private funding successes from sources such as RecerCaixa and La Marató de TV3. Preliminary results in 2015 show a similar tendency of excellence, and moreover, IBEC has been awarded the 'Human Resources Excellence in Research' from the European Commission in recognition of its commitment to continuously improving its HR policies in line with The European Charter of Researchers and The Code of Conduct for the Recruitment of Researchers.

Even more excitingly, we learnt at the end of 2014 that our consortium of 144 European companies, research institutes and universities was chosen to be the Knowledge and Innovation Community (KIC) on healthy living and active ageing, EIT Health, of the European Institute of Innovation and Technology. The Spanish node will be based right here at IBEC's headquarters, the Barcelona Science Park.

Attraction and retention of international talent is a crucial part of IBEC's success. Since the last symposium, we have incorporated three new research lines: Smart nano-bio-devices (Samuel Sánchez, ICREA Research Professor, ERC grantee); Pluripotent stem cells and activation of endogenous tissue programs for organ regeneration (Núria Montserrat, ERC grantee); and Nanoscopy for nanomedicine (Lorenzo Albertazzi, Fundacio AXA Grantee).

As far as our visibility and international status is concerned, there are several reasons to celebrate. We've seen our media appearances in the general press make a fourfold leap. Finally, I'd like to remark on some individual achievements: Xavier Trepat winning the Banc Sabadell Award for Biomedical research, Samuel Sanchez receiving the Fundacion Princesa de Girona de Investigacion Cientifica award, and Gabriel Gomila the ICREA Academia award.

Prof. Josep Samitier

Professor Josep Samitier *is Director of the Institute for Bioengineering of Catalonia (IBEC), group leader of the Nanobioengineering Group at IBEC and Full Professor of Electronics and Biomedical Engineering in the Physics Faculty (Electronic Department) University of Barcelona.*

Prof. Samitier is President of the Catalan Association of Research Centres (Associació Catalana d'Entitats de Recerca - ACER) and EIT Health Supervisory Board member.

He is founder and coordinator of the Spanish Platform on Nanomedicine, member of the international committee of the Int. Society for BioMEMS and Nanotechnology on the editorial board of the Journal of Nanoscience and Nanotechnology, and member of the international scientific committee of ITAV (Toulouse) and Canceropole CLARA (Lyon). Hes also been scientific advisor for a programme of the government of Argentina to foster nanotechnologies among SMEs and promoted and coordinated the Catalan Nanobiomedicine Alliance, involving 20 institutions in the Barcelona region.

Since 2013 he serves as Spanish Delegate of the working group on Biotechnology and Nanotechnology of the Organization for Economic Cooperation and Development. He has recently been designed member of the Science to Business Committee for ESOF 2016.

From March 2001 to June 2005 Prof. Samitier was Deputy Head of the Barcelona Science Park (PCB). from 2009 to 2013 he was one of the 20 Spanish researchers in biomedicine and biotechnology supported by the TechTransfer Programme of the Botin Foundation. He received the Barcelona City Prize of Technology in 2003.

He has more than 200 ISI publications, with over 2400 citations and an H-index of 26. Inventor of 4 licensed patents.

His research focuses on the design and development of miniaturized devices containing micro- and nanoscale features for biomedical applications. His group develops microfluidics and lab-on-a-chip devices with integrated multiplexed electrochemical biosensors.

Developing strategies for organ regeneration: how far are we from reality?

Nuria Montserrat

Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain

Probably, the gain in organ complexity and cell function has led to a decrease in healing capacities in the adult mammalian organs. In an effort to generate new venues for the generation of functional cells with an impact in Regenerative Medicine we have explored the possibility to manipulate cell fate and plasticity making use of different technologies.

First by the combination of gene-editing based methodologies together with the development of novel protocols for pluripotent stem cells differentiation into relevant tissues/organs, we are trying to develop experimental scenarios for modelling disease progression. In this regard we are particularly interested not only in the generation of transgene-free and disease free patient derived hiPSCs for disease modelling and drug discovery, but in the genome editing of pluripotent stem cells for the study of tissues development. In this regard we belive that the co-culture of differentiated patient pluripotent stem cells together with decellularized tissues (i.e: heart) offers a suitable condition when assessing functional parameters ex vivo.

Second making use of organisms that possess the ability to regenerate such as zebrafish or neonatal mice, we are trying to understand which molecular and cellular pathways would lead to organ regeneration. Taking advantage of preliminary observations made by us and other groups we are exploring the possibility to emulate regenerative responses making use of miRNAs in an effort to awake cellular responses that seem to be dormant in adult mammals. These approaches could ultimate lead to the regeneration of tissues compromised during disease progression and aging.

We believe that we are still far to produce complex tissues in the laboratory, however the possibility to interrogate cellular process during tissue development and regeneration would help us to define novel approaches for organ regeneration and disease modeling.

Dr. Nuria Montserrat

Dra. Nuria Montserrat *became interested in organ regeneration and stem cells during her master and PhD training that finished in 2006. The same year she got a Postdoctoral fellowship from the Fundaçao para a Ciência e Tecnología (Portugal). In 2007 she was hired as a post-doctoral researcher at the Hospital of Santa Creu i Sant Pau in Barcelona.*

In 2008 she moved to the Center of Regenerative Medicine of Barcelona (CMRB), as a research associate. There, Dra. Montserrat participated in developing strategies for the generation and banking of new induced pluripotent stem cells (iPSCs). In 2010 she first co-authored how to reprogram cord blood stem cells for the first time (Nature Protocols, 2010).Then she reasoned that iPSCs could be obtained by means of safe strategies with new factors. The work resulted in a high-impact publication in Cell Stem Cell (2013), in where she is the first co-author. She also collaborated in other projects aimed to characterize the genomic integrity of human iPSCs (Nature 2012) as well as in the differentiation of iPSCs towards different lineages (Stem Cells 2011; Nature 2012; Nature Methods 2012, Nature Cell Biology 2013, Nature Communications 2014). Dra. Montserrat has also participated in the generation of platforms for the study of disease progression by means of iPSCs (Nature 2012, Nature Communications 2014).

Recently, she has first co-authored how the reactivation of endogenous pathways can be artificially reactivated and promote heart regeneration in mammals (Cell Stem Cell, 2014). Her expertise in the fields of somatic reprogramming and organ regeneration helped her to develop a massive project has been selected for funding from the European Research Council (ERC) within the call of ERC Starting Grant from 2014. From January 2015 she is junior group leader at the Institute of Bioengineering of Catalonia (IBEC).

Cardiac stem cell differentiation: Forward programming, biomaterials, and epigenetic remodeling

Michael D. Schneider

British Heart Foundation Centre of Research Excellence, Imperial College London, UK

Cardiac progenitor/stem cells in adult hearts are a potential mode of self-repair, therapeutic product, and target for activation *in situ*, though (inter)-relationships among reported cells remain obscure. Using single-cell qRT-PCR and clonal analyses, we have shown that PDGFRα demarcates the clonogenic cardiogenic Sca1+ stem cell. Clonogenicity plus cardiogenic gene expression (Gata4/6, Hand2, Tbx5/20) segregate specifically to PDGFRα+ cells. PDGFRα– cells were characterized, instead, by Kdr/Flk1, Cdh5, CD31 and lack of clonal growth. Clonal progeny of single Sca1+ SP cells showed tri-lineage potential (cardiomyocyte, endothelial, smooth muscle) after cardiac grafting, augmenting cardiac function although durable engraftment was rare. Unlike its DNA-binding targets, myocardin—a co-activator for Gata4 and Tbx5—is not expressed in cardiac stem cells. We hypothesised that its absence was a limiting factor for reprogramming, and demonstrated the pivotal importance of myocardin in driving CSCs toward a cardiac muscle fate.

Although the feasibility of cell reprogramming has proven possible both *in vitro* and *in vivo*, the efficiency of the process remains extremely low. We have found that topographical cues (parallel microgrooves) enhance the differentiation of cardiac stem cells after lentivirus-mediated delivery of Myocardin, Tbx5, and Mef2c. The microgrooved substrate provoked an increase in both histone H3 acetylation, known to be a permissive environment for reprogramming by “stemness” factors, as well as myocardin sumoylation, a post-translational modification essential to the transcriptional function of this key co-activator.

These biochemical effects mimicked those of a pharmacological histone deacetylase inhibitor, valproic acid (VPA), and like VPA markedly augmented the expression of cardiomyocyte-specific proteins by the genetically engineered cells. No instructive effect was seen in cells unresponsive to VPA, and no additive effect of VPA was seen in the responsive cells. Thus, a material-based approach has been used to facilitate cell fate switching through biophysical regulation of cardiac stem cells’ epigenetic landscape. In addition, the anisotropy resulting from parallel microgrooves induced cellular alignment, mimicking the native ventricular myocardium and augmenting sarcomere organisation.

Prof. Michael Schneider

Professor Michael Schneider *was recruited from the United States in September 2007 as the incoming Head of Cardiovascular Science for the National Heart and Lung Institute, Imperial College London, and served as Head of NHLI from 1 January 2009 through 31 August 2011.*

He was educated at Harvard, the University of Pennsylvania, and Duke, followed by research training at the NIH under Nobel Laureate Marshall Nirenberg. In 1984, he was appointed to the nascent program in cardiac molecular biology at Baylor College of Medicine, ultimately becoming Professor of Medicine, Molecular & Cellular Biology, and Molecular Physiology & Biophysics, Director of the Center for Cardiovascular Development, and inaugural recipient of the M. D. Anderson Foundation Chair. His trainees number more than 70 and have been recognized by young investigator competitions and tenured professorships world-wide.

Professor Schneider is the British Heart Foundation Simon Marks Professor of Regenerative Cardiology and Director of Imperial's BHF Centre for Research Excellence (2008-2019) He is the recipient of a Royal Society Wolfson Research Merit Award, an Advanced Investigator Grant from the European Research Council, the 2007 Distinguished Achievement Award of the American Heart Association Council on Basic Cardiovascular Sciences, the 2008 Medical Futures Cardiovascular Innovation Award, the 2010 Duke Medical Alumni Award, the 2011 Mikamo Lectureship of the Japanese Circulation Society, the 2011 Annual Clinical School Lectureship at the University of Cambridge, and the 2012 Jeffrey Isner Memorial Lectureship from Tufts University. He serves on peer-review panels for the European Research Council, and is a member of the MRC Council.

Professor Schneider's research concerns the molecular and genetic determinants of cardiac muscle cell number, encompassing innovative studies of the cardiac cell cycle, adult cardiac stem cells, and genetic circuits for cardiac muscle cell death.

Matrix engineering and synthetic biology to control stem cell fate

Manuel Salmerón-Sánchez

School of Engineering, University of Glasgow, Scotland, UK

Surfaces of synthetic biomaterials have been functionalized with a broad range of proteins, fragments, peptides and growth factors seeking to mimic the extracellular matrix (ECM) as a way to control cell behaviour. We have shown that we can use selected material surfaces to trigger the organization of ECM proteins in a biomimetic way, and that this constitutes a robust way to engineer microenvironments that present growth factors in a very efficient way. This system promotes integrin/growth factor receptor synergistic signaling and it allows low doses of growth factors to control stem cell behaviour, vascularisation and tissue healing. However, a limitation of these strategie is that they are static by nature and cannot provide the dynamic stimuli which are ideally required to orchestrate cell responses at the material interface. Significant efforts have focused on engineering materials that recapitulate characteristics of the ECM, such as the presentation of cell adhesive motifs or protease degradable cross-links, in order to direct cellular responses. However, the development of a cell/material interface able to provide biological stimuli upon demand, a functional dynamic interface between stem cells and synthetic materials, has not been established yet.

Non-pathogenic bacteria can colonise the surface of a broad range of synthetic materials and we hypothesise that can be genetically modified to express and secrete adhesive proteins, factors and biochemical cues to a living cell population upon external demand – in a truly dynamic way. As a proof of concept, genetically modified non-pathogenic bacteria expressing the FNIII7-10 fibronectin fragment as a protein membrane have been used to create a living biointerface between synthetic materials and mammalian cells. This fragment comprises the RGD and PHSRN sequences of fibronectin to bind integrins and triggers signalling for cell adhesion, spreading and differentiation. Mesenchymal stem cells were stable on this living interface during one month and underwent osteogenic differentiation with expression of osteogenic markers and mineralization of the matrix. Moreover, this biointerface based on living bacteria can be further modified to express any desired biochemical signal upon external demand, establishing a new paradigm in biomaterials engineering for biomedical applications

Prof. Manuel Salmerón-Sánchez

Professor Manuel Salmerón-Sánchez *is Head of Biomedical Engineering Research Division in the School of Engineering at the University of Glasgow. He is the holder of an ERC Consolidator grant (2013-2018) and leads a multidisciplinary group working at the cell/material interface (Microenvironments for Medicine – Mime www.mimeresearch.com). He received his PhD from the Technical University of Valencia (2002) and has held postdoctoral positions at Charles University in Prague (2003) and the Katholieke Universiteit in Leuven (2004, 2006). He was Associate Professor (2008) and then Professor (2010) at the Technical University of Valencia and Visiting Professor at the Georgia Institute of Technology (2010). In 2012 he was appointed to set-up the materials research division in Abengoa (international company with 20000+ employees).*

His group has played a pioneering role in the development of material surfaces to trigger the self-assembly of proteins. This work has spans fundamental mechanisms at the cell/material interface as well as translational research that has led to an ERC Proof of Concept Award (2015). He authored 100+ articles in major international journals and sits in the editorial board of Scientific Reports (Nature group). He is an active reviewer for a high number of journals and has acted as an expert for research agencies in different countries.

Endocytic Control Of Cellular Plasticity And Mechanics

Chiara Malinverno, Salvatore Corallino, Martin Berger, Fabio Giavazzi, Qingsen Li, Roberto Cerbino, Aldo Ferrari, **Giorgio Scita**

IFOM Fondazione Istituto FIRC di Oncologia Molecolare and University of Milan, School of Medicine, Dpt. of Health Sciences, Milan, Italy

The ability of multicellular tissue to alter their phenotypic and morphological characteristics, known as cellular plasticity, is critical in development, but also frequently exploited in adult life, such as during wound repair or de novo tissue vascularization, or in pathological situations, first and foremost during tumor dissemination. Individual cellular biochemical wiring and processes as well as cell and supra-cellular physical forces are key determinants of the response of collective entities to various stimuli.

However, how the formers impacts on the latters remains largely unexplored. We found that perturbation of endocytic/exocytic cycle (EEC) impacts on different morphogenetic, locomotory and mechanical properties of collective mammary epithelial cell assemblies, and on the chemotactic behaviors of malignant lymphocytes. Thus, EEC is critical in controlling diverse morphogenetic programs of collective cell assemblies, ultimately influencing multicellular plasticity and mechanics.

The molecular mechanisms, cellular and supra-cellular processes and physical properties through which EEC exerts these functions are, however, ill defined. Here, we will provide evidence that support the hypothesis that endocytic circuitries by regulating membrane homeostasis and trafficking orchestrate cell-cell communication and the mechanical response of epithelial sheets during collective locomotion in normal and tumorigenic setting.

Prof. Giorgio Scita

Professor Giorgio Scita *obtained his Ph.D. in Food Chemistry and Technology at the University of Parma, Italy, in the Department of Biochemistry. He received his first postdoctoral training at the University of California, Berkeley working on Vitamin A metabolism. Next, he moved to the National Cancer Institute (NCI) of the National Institutes of Health (NIH), where he worked on the integration between the retinoic acid receptor and Ras signaling pathways in Keratinocytes, under the leadership of Dr. Stuart Yuspa. In 1995, he returned to Italy, to the European Institute of Oncology (IEO), Milan where, under the supervision of Prof. Pier Paolo Di Fiore, he became interested in EGFR signaling. In 2001, he became Principal Investigator at the IEO, and in 2003 he moved to the IFOM Foundation, the FIRC Institute of Molecular Oncology, Milan, where he acquired tenured P.I status in 2008. In 2006, he was appointed associate professor of General Pathology at the School of Medicine of the University of Milan. His primary research interest has been on dissecting basic mechanisms of cell migration focussing on signaling leading to spatial and temporal regulation of actin dynamics: the powerhouse for cell motility. More recently, using breast cancer as a model system, he has been investigating the impact of membrane and actin dynamics interplay and its deregulation on tumor migration plasticity and dissemination.*

Scientific productivity: Scita has authored more than 90 publications, which include more than 80 original articles and 10 invited reviews in refereed journals. The average impact factor of these publications is slightly above 10. The average impact factor of the 44 publications of the last 10 years is above 12 and, of these, 20 publications (42%) have appeared in journals with an impact factor >10. He has also published 4 book chapters and 3 meeting proceedings.

He is ERC awardee (2011) and EMBO member since 2014

Wednesday, 30th September 16:30

Stem cell genetics at the Lieber Institute for Brain Development

Ronald McKay

Director of Basic Sciences, Lieber Institute for Brain Development

Dr. McKay's laboratory at the Lieber Institute studies pluripotent and somatic stem cells with a particular interest in the development of the nervous system. His research is focused on using the biology of stem cells to understand the genetic basis of human disease and to regenerate injured tissue. Current work is focused on using the power of stem cell technologies to probe the developmental origins of psychiatric illness.

Clinical studies show that molecular switches controlling fundamental features of development regulate the risk of psychiatric disorders. Genome-wide association studies have identified hundreds of genetic variations associated with disease risk. In most cases the influence of an individual genetic alteration on risk is small, but these studies suggest that specific signaling pathways influence disease through the interaction of multiple risk alleles and environmental signals. The efficient use of stem cells in clinical models suggests they can now be used to determine how an individual's genotype influences future brain function and health.

Our goal is to compare genetically distinct human pluripotent cells during self-renewal and the key transitions on the path that pluripotent cells traverse as they specialize to form neural circuits. To achieve this, we must start with precise control over the pluripotent cells and their genomes.

Dr. Ronald McKay

Before joining the Lieber Institute, ***Dr. Ronald McKay*** *was Chief of the Laboratory of Cellular Neurobiology of the National Institute of Neurological Disorders and Stroke (NINDS). Dr. McKay received a B.Sc. in 1971 and a Ph.D. in 1974 from the University of Edinburgh. His postdoctoral training was at the University of Oxford. In Edinburgh and Oxford, he contributed to the earliest work showing that the tools of molecular biology would make a major contribution to human genetics. In 1978, he moved to Cold Spring Harbor Laboratory. At Cold Spring Harbor, he was the first to show that specific DNA-protein complexes could be analyzed with antibodies, and pioneered the field of molecular neuroscience. Joining the MIT faculty in 1984, Dr. McKay identified neural stem cells as a tool to study brain development and function. In 1993, he joined the NIH as Chief of the Laboratory of Molecular Biology at NINDS. He is a founding board member of the International Society of Stem Cell Research. He has served on Scientific Advisory Boards of commercial and academic programs across the world. He is the recipient of the Ernst Schering Prize and the Robert Menzies, and Max Delbrück Medals.*

Recordings in a Dynamic Inspiratory Maneuver

[illegible]

INTRODUCTION

[illegible] signal of the diaphragm muscle (EMGdi) can be used to [illegible] during respiration.

[illegible] (ECG) signal introduces a distortion in both EMGdi time [illegible]

[illegible] usually recorded using surface Ag/AgCl disc electrodes in [illegible]

[illegible] disc electrodes have a poor spatial resolution, which is [illegible] effect caused by the tissue volume conduction.

- Laplacian of surface potential recordings increase the spatial resolution and attenuate deeper bioelectric interferences, such as the ECG.
- A direct and simple method to estimate Laplacian potential is using concentric ring electrodes (CRE) in which the differential voltage between an external ring and inner disc is recorded.
- The aim of this work is to compare and evaluate the performance of EMGdi signals, during a dynamic respiratory test with incremental inspiratory load, obtained with conventional bipolar recordings using disc electrodes with those obtained from bipolar Laplacian estimation with concentric rings of two different sizes.

MATERIALS AND METHODS

[illegible] with no medical history of cardiorespiratory [illegible] had a protocol consisted of two parts.

[illegible] (BSM) - The subject was asked to interrupt his breath for a [illegible]

[illegible] maneuver (DIM) - The subject inhaled via a mouthpiece [illegible] muscle training (IMT) device (Threshold IMT, Philips [illegible] performed in four steps of 1 minute length: without the [illegible] and then using the IMT device with pressure resistance set [illegible]

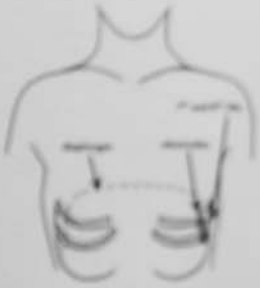
[illegible] Ag/AgCl electrodes in bipolar configuration was placed on the [illegible] 7th and 8th intercostal space at the midclavicular line. [illegible] were acquired using a CRE electrode carefully [illegible] differential signal between the external ring and the central [illegible] the external ring and the central disc were obtained. [illegible], the ECG signal was obtained from the standard lead I [illegible]

[illegible] using a pneumotachograph transducer.

[illegible] with a gain of 2000 and filtered between 1 and 500 Hz. [illegible] of 2000 and an analog high-pass filter with a cut-off [illegible] signals were digitized at 1000 Hz.

Data Analysis

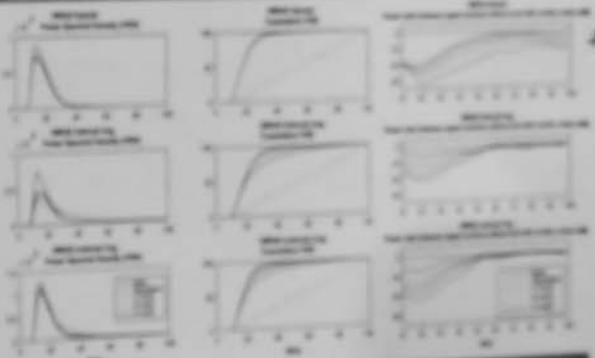
- Detection of the R peak of the QRS complexes was done on the ECG signal.
- Estimation of the power spectral density (PSD) of every signal was performed by applying the Welch modified periodogram method (Hamming window, 512 seconds length, 4096 points FFT, and 50 % overlap), analyzed between 0 – 10 Hz (1 – 128 Hz).
- To compare the spectral distribution of the EMGdi signals and estimate the signal bandwidth, the cumulative percentage of the power distribution (CumPD) were calculated.
- To evaluate the influence of the cardiac activity on the signals, the EMGdi was analyzed into two signal segments: with and without cardiac noise (WCN and NCN, respectively).



Concentric Ring Electrode

1. Central disc: 10 mm diameter
2. Internal ring: 15 mm diameter
3. External ring: 30 mm diameter

RESULTS



DISCUSSION AND CONCLUSIONS

[illegible] findings are severely interfered by cardiac activity, especially on the left side diaphragm.

[illegible] to enhance the spatial resolution, thus reducing the spatial filtering effect and enlarging the bandwidth of the signals recorded on the body surface.

[illegible] suggest that EMGdi acquired with CRE electrodes is less interfered by the ECG, and presents a wider signal bandwidth.

[illegible] interference is an important issue for the correct interpretation of EMGdi signals.

[illegible] of the inter electrode distance of the bipolar configuration and the study of different sizes of the Laplacian electrode in a future comprehensive validation confirm these results.

ACKNOWLEDGMENT

[illegible] by Instituto para la Competitividad e Aprovechamiento de Recursos Humanos and Secretaría Nacional de Ciencia, Tecnología e Innovación (IAAEU-2016-1) Government under grant 279.2012-273. This work was supported in part by Ministerio de Economía y Competitividad from the Spain Government under [illegible] and TEC2010-16945.

Posters and flash presentations

CELL ENGINEERING - Posters with flash presentation

Poster	Name	Title
1	Alberto Elosegui-Artola	Matrix mechanosensing and nuclear transduction by talin and integrin bond dynamics
2	Anna Labernadie	Physical forces driving fibroblast-led cancer cell migration
3	Joan Martí Muñoz	Calcium releasing glass coated PLA nanofibers: a new approach for bone regeneration
4	Claudia Navarro Requena	Angiogenic Stimulation by Calcium Phosphate Glass-Ceramic Particles in a Maleimide Cross-Linked PEG Hydrogel
5	Roger Oria Fernández	Interplay between integrin expression, clustering, and substrate rigidity in cell mechanical response
6	Aitor Sánchez Ferrero	Biomimetic hydrogels for *in situ* bone tissue engineering
7	Léo Valon	Quantitative subcellular control of Cdc42 and RhoA RhoGTPases activity to dissect cell polarization processes
8	Dobryna Zalvidea	Measuring traction forces during *in vivo* angiogenesis in the chicken embryo using a custom made multi-photon microscopy system

CELL ENGINEERING - Posters

Poster	Name	Title
9	Noelia Campillo	Effects of Intermittent Hypoxia on Prostaglandin E2 Production by Macrophages in a Cell Culture Chip
10	Lorena de Oñate	Alpha myosin heavy chain (α-MHC) reporter cell lines generated by direct targeting human embryonic stem cells
11	José Antonio Del Río Fernández	A microfluidic device for controlled neuron axotomy for regenerative studies of lesioned spinal cord
12	Elena Garreta Bahima	Recellularization of acellular cardiac matrices with human embryonic stem cell-derived cardiomyocytes as a platform for cardiac tissue engineering
13	Arnau Hervera	Injury-induced inhibition of HDAC3 induce axonal regeneration after spinal cord injury
14	Verónica Hortigüela	Developing a platform for receptor clustering studies
15	Ignasi Jorba	A Poly(dimethylsiloxane) Chip to Study the Effect of Oxygen Tension on Cell Mechanics
16	Anita Joana Kosmalska	Physical principles of membrane remodelling during cell mechanoadaptation
17	Andreu Matamoros	A genetic modification of Olfactory Ensheating Cells to overcome axon inhibition afer spinal cord lesion
18	Andreu Matamoros	PLA nanofibers in Spinal Cord Injury treatment
19	Lourdes Recha Sancho	Human Chondrocytes seeded into Self-Assembling Scaffolds to assist Cartilage Regeneration
20	Pilar Rodríguez Franco	Forces driving epithelial boundary formation by Eph/Ephrin interactions
22	Marina Uroz	Forces driving cell migration in zebrafish epicardium

NANOMEDICINE - Posters with flash presentation

Poster	Name	Title
23	Gizem Altay	Microvillous soft hydrogel scaffolds for intestinal crypt cultures
24	Maria Chiara Biagi	Nanoscale Electric Permittivity of Single Bacterial Cells at GHz frequency by Scanning Microwave Microscopy
25	Berta Gumí Audenis	Simultaneous AFM, FS and X-Ray Reflectometry study of receptor-independent interactions of small-molecules with model lipid membranes
26	Marc Van Der Hofstadt Serrano	Quantitative lift mode electrostatic force microscopy applied to bacterial spores

NANOMEDICINE - Posters

Poster	Name	Title
27	Sonia Aznar Vicente	Crosstalk between antibiotic resistance plasmids and their hosts: The R27 paradigm
28	Sonia Aznar Vicente	The repC sequence is required for IncHI1 plasmid stability
29	Aida Baelo	Improving wound healing through infection treatment
30	Aida Baelo	Could ribonucleotide reductases-containing outer membrane vesicles protect from bacterial infections?
31	Anna Crespo	Ribonucleotide Reductase anaerobic enzymes are essential for mature biofilm formation.
32	René Fábregas	Three-dimensional modeling of electrical scanning probe microscopy problems
33	Mario Hüttener Queiroz	Virulence regulation by the nucleoid-associated protein YdgT in the enteroaggregative strain 042
34	Montse López	Electrochemical Force Microscopy on Azurin Protein
35	Lucas Pedraz López	A single transcription factor behind all bacterial dNTP synthesis revealed as a novel antimicrobial target
36	Alejandro Prieto Durán	Tracking bacterial virulence: global modulators as indicators
37	Eduard Torrents	Mycobacteria for non-muscle-invasive bladder cancer treatment

ICT FOR HEALTH - Posters with flash presentation

Poster	Name	Title
38	Raquel Rodríguez Pérez	Multivariate data analysis for biomarker discovery in genomics
39	Oiane Urra	The Effect of Visual Feedback on Muscle Synergies during the Execution of Stroke Rehabilitation Exercises

ICT FOR HEALTH - Posters

Poster	Name	Title
40	Luis Estrada	The use of fixed sample entropy as an analysis tool of diaphragm EMG signals during a respiratory protocol
41	Manel Lozano	Multichannel analysis of continuous adventitious sounds for the assessment of airway obstruction in patients with asthma
42	Sergio Oller Moreno	Package for data analysis of Multi-capillary column Ion Mobility Spectrometry
43	Leonardo Sarlabous	Noninvasive mechanical estimation of respiratory muscles activity from sample entropy of Mechanomygraphy in patients with COPD

IBEC
Institute for Bioengineering of Catalonia

Baldiri Reixac, 10-12
08028 Barcelona, Spain
Tel. +34 934 039 706

www.ibecbarcelona.eu

With the generous support of:

Izasa Scientific
A WerfenLife Company

Fisher Scientific
Part of Thermo Fisher Scientific

BioLab

www.ibecbarcelona.eu/events/Symposium2015

Generalitat de Catalunya
UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH
UNIVERSITAT DE BARCELONA
Unión Europea
Fondo Europeo de Desarrollo Regional "Una manera de hacer Europa"
Obra Social "la Caixa"