

BIOENGINEERING FOR HEALTHY AGEING

ADDING LIFE TO YEARS

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BIOENGINEERING FOR HEALTHY AGEING

ADDING LIFE TO YEARS

November 8th and 9th, 2017

WELCOME

Dear Guests and Participants,

It is our pleasure to welcome you on the meeting “Bioengineering for Healthy Ageing. Adding Life to Years”, co-organized by B·DEBATE (an initiative of Biocat and “la Caixa” Foundation) and the Institute for Bioengineering of Catalonia (IBEC), with the support of EIT Health and the Ministerio de Economía, Industria y Competitividad.

Demographic change and well-being have been identified as major societal challenges. The rapid growth of the oldest age groups will have a major impact on health care costs. The reasons are: The incidence of diseases that affect the elderly will be soaring in the immediate future; and Diseases and events that would have often been fatal become survivable and chronic.

Engineering must play a substantial role managing the effects of this surge in demand for healthcare and providing care to be delivered in new ways. It can also be determinant to enable citizens to remain independent and able to live on their own as long as possible.

In this B-Debate we want to present the challenges an ageing population will have to face in terms of health and wellbeing and the possible solutions bioengineering can provide. The following hot technological topics that will revolutionize healthcare and assistance to aged people will be addressed: M-Health, Robotics for assisted living, Point of care diagnostics and Regenerative therapies.

Apart from the recent advances and envisaged opportunities, we would also like to discuss the barriers and hurdles, such as data protection, user and healthcare professionals’ acceptance, ethical issues, to overcome for these technological promises to become a reality.

Under this frame, this meeting is an opportunity to debate with experts and professionals of the field to review experiences and best practices and to identify and address barriers in the development and adoption of novel healthcare solutions.

We thank you in advance for your input and participation in the discussion. We hope to build a stimulating forum, where debate results in new perspectives and, if possible, a certain consensus on the road to follow.

Josep Samitier (IBEC) and B·DEBATE (Biocat and “la Caixa” Foundation)”

PROGRAM

Wednesday, November 8th, 2017

8:45 **Registration**

9:00 **Welcome**

Àngel Font, La Caixa Foundation

Marta Soler, Biocat

Josep Samitier, Institute for Bioengineering of Catalonia (IBEC)

9:30

SESSION 1: Challenges and opportunities of an ageing population

Chair: **Josep Maria Haro**, Sant Joan de Déu Sanitary Park (PSSJD), Barcelona, Spain

New perspectives on Healthy Ageing - the World Health Report on Ageing and Health

Somnath Chatterji, World Health Organization, Geneva, Switzerland

Population perspectives on Healthy Ageing

Carol Brayne, University of Cambridge, Cambridge, UK

11:00 **Coffee break**

11:30

SESSION 2: mHealth devices for connected care

Chair: **Raimón Jané**, Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain

A journey toward technology-supported services for high-definition medicine

Josep Roca, IDIBAPS & Hospital Clínic, Barcelona, Spain

The telehealth journey: from remote patient monitoring, via (e,p,m) health to population health management

Cristina Bescos, Philips Healthcare, Boeblingen, Germany

13:00 **Open debate**

13.30 **Networking lunch**

14:45

SESSION 3: Robotics for assisted living

Chair: **Paul Verschure**, Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain

The Potential for Robotics to Improve the Quality of Later Life

Tony Prescott, University of Sheffield, Sheffield, UK

Soft robotics: a new paradigm for human compatible assistive and service robots

Cecilia Laschi, Scuola Superiore Sant'Anna, Pisa, Italy

16:00 **Coffee break**

16:20

SESSION 4: Point of care diagnostics and prognostics

Chair: **Josep Samitier**, Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain

Point-of-care diagnostics 2.0

Emmanuel Delamarche, IBM Research, Zurich, Switzerland

Sensors and mobile diagnostics to support healthy ageing

Anthony Turner, University of Linköping, Linköping, Sweden

Near Patient Syndromic Testing

Jordi Carrera, STAT Diagnostica, Barcelona, Spain

17:50 **Open debate**

18:15 **Adjourn**

Thursday, November 9th, 2017

9:00 **SESSION 5: Regenerative therapies applied to ageing**
Chair: **Manuel Salmerón**, University of Glasgow, Glasgow, UK

Biomimetic Materials for Cartilage Regeneration
Marcy Zenobi-Wong, ETH Zurich, Zurich, Switzerland

Dreaming with organ regeneration: new hopes for regenerative medicine
Núria Montserrat, Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain

10:30 **Coffee break**

11:00 **SESSION 6: Making it happen**
Chair: **Marco Pugliese**, EIT Health, Barcelona, Spain

Ethical Issues
Ignasi López, “La Caixa” Foundation, Barcelona, Spain

Social barriers in the acceptance of advanced technologies for healthy aging
Tony Prescott, University of Sheffield, Sheffield, UK

Transformative governance of personal health ecosystems
Totti Könnölä, Insight Foresight Institute (IFI), Madrid, Spain

13:15 **Open debate**

13:45 **Concluding remarks**

Open round table for the general public (in Spanish):
Josep Maria Haro (PSSJD) - Challenges and opportunities of an ageing population
Raimon Jané (IBEC) - Opportunities and challenges of M-Health for an ageing population
Belén Rubio (IBEC) - Opportunities and challenges of Advanced Technologies for assisted living for an ageing population
15:00 Josep Samitier (IBEC) - Opportunities and challenges of point of care diagnostics and prognostics for an ageing population
Manuel Salmerón (University of Glasgow) - Opportunities and challenges of regenerative therapies for an ageing population
Marco Pugliese (EIT Health) - Challenges before these technologies become a reality

SCIENTIFIC COMMITTEE



Josep Samitier, President at **Catalan Association of Research Centres (ACER)** and Director at **Institute for Bioengineering of Catalonia (IBEC)**, Barcelona, Spain

Josep Samitier Martí, President of the Catalan Association of Research Centres (ACER) and Director of the Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain.

Full Professor of Electronics and Biomedical Engineering. Electronics Department. Faculty of Physics. University of Barcelona (UB). Group leader of the Nanobioengineering Group at IBEC. EIT Health Supervisory Board member. Coordinator of the Spanish Nanomedicine Platform (NanomedSpain). President of the Catalan Association of Research Centres (Associació Catalana d'Entitats de Recerca - ACER). Spanish delegate in the Working Party on Biotechnology (OECD). Permanent member of Institut d'Estudis Catalans (IEC).

In 2003, he was awarded the City of Barcelona prize in the Technological Innovation category.



Josep Maria Haro, Research Director at **Sant Joan de Déu Sanitary Park**, Barcelona, Spain

Josep Maria Haro, psychiatrist and Ph.D. in Public Health, is the Research and Teaching Director of Saint John of God Health Park in Barcelona, Spain and associate professor of medicine at the University of Barcelona.

After his medical studies, he was trained in Epidemiology and Public Health at the Johns Hopkins School of Hygiene and Public Health (Baltimore, MD, USA). Later he got his specialization in psychiatry at the Clinic Hospital of Barcelona. During the past twenty-five years he has worked both in clinical medicine and in public health research and has published more than three hundred scientific papers.

His areas of investigation have been epidemiology of mental disorders and the analysis of treatment outcomes. As a researcher in epidemiology of mental disorders, he has conducted studies on the prevalence and impact of disorders in the general population and the treatment of mental disorders in primary care. His last studies focus on the determinants of healthy ageing, analyzing both the impact of physical and mental co-morbidity and the effect of societal and environmental aspects. In health outcomes, he has been interested in the consequences of mental disorders in patient functioning and quality of life, and the impact on society overall.

Dr. Haro is principal investigator of one of the groups of the CIBERSAM network. In 2011 he received the award of best researcher from the Spanish Society of Biological Psychiatry. He is currently the European coordinator of the EU funded project ATHLOS and was coordinator of the Roadmap for mental health and wellbeing research in Europe (ROAMER).



Raimón Jané, Research Director at **Universitat Politècnica de Catalunya** and Group Leader at **Institute for Bioengineering of Catalonia**, Barcelona, Spain

Raimon Jané is Group Leader of the Biomedical Signal Processing and Interpretation group at the Institute for Bioengineering of Catalonia (IBEC) and Research Director of the Automatic Control department at the Universitat Politècnica de Catalunya (UPC).

He is also Principal Investigator of the group Biomedical Signals and Systems of the CIBER Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN) of the Institute of Health Carlos III, where he is member of CIBER-BBN Steering Committee, as a Training Coordinator.

Prof. Jané is coordinator of the PhD Programme on Biomedical Engineering of the UPC and professor of advanced biomedical signal processing in the UPC-UB's Master in Biomedical Engineering.

He received the Barcelona City Award in Technology Research in 2005.

Since 2012, he is president of the Spanish Society of Biomedical Engineering (SEIB). Prof. Jané is Senior Member of Institute of Electrical and Electronics Engineers (IEEE) and member of Technical Committee on Cardiopulmonary Systems of the IEEE-Engineering in Medicine and Biology Society (EMBS).



Paul Verschure, Director of SPECS Research Group at **Institute for Bioengineering of Catalonia (IBEC)**, Barcelona, Spain

Paul Verschure is Catalan Institute of Advanced Studies (ICREA) Research Professor, and director of the neuro-engineering program at the Institute for Bioengineering of Catalunya where he runs the Synthetic Perceptive, Emotive and Cognitive Systems (SPECS) Laboratory (specs.upf.edu). He is founder/CEO of Eodyne Systems S.L. (Eodyne.com), which is commercializing a novel science grounded neurorehabilitation technology.

He received his MA and Ph.D. in Psychology, and Paul's scientific aim is to find a unified theory of mind and brain using synthetic methods and to apply it to the quality of life enhancing technologies. His theory of mind and brain, Distributed Adaptive Control, has been generalized to a range of brain structures and robotic systems and has laid the foundation for a novel neurorehabilitation approach called the Rehabilitation Gaming System (http://specs.upf.edu/research_in_neurorehabilitation). Paul explores new methods for the simulation, visualization, and exploration of complex data to support his DAC theory and advance clinical diagnostics and intervention in neuropathologies (brainx3.com). Complementary to his science, Paul has developed and deployed over 25 art installations (<http://specs.upf.edu/installations>). These include the biomimetic mixed reality space Ada experienced by over half a million visitors (2002) and more recently three virtual/augmented reality educational installations and applications for the Memorial Site Bergen-Belsen (2012 -) which is now generalized to other sites across Europe.

Paul manages a multidisciplinary team of 30 researchers (specs.upf.edu) with whom he has published over 300 articles in leading journals and conferences in a range of disciplines. Paul collaborates with a wide network of international researchers. He is chair of the annual Barcelona Cognition, Brain, and Technology summer school and co-chair of the annual Convergent Science Network's conference Living Machines.



Manuel Salmerón, Professor of Biomedical Engineering at **University of Glasgow**, Glasgow, UK

Prof Manuel Salmeron-Sanchez is Chair of Biomedical Engineering and Head of the Division of Biomedical Engineering in the School of Engineering at the University of Glasgow. He is the holder of an active ERC Consolidator grant and has established a multidisciplinary group working at the cell/material interface (Microenvironments for Medicine – MiMe, www.mimeresearch.com). He did a PhD in Valencia and then was a postdoctoral researcher at the Institute for Macromolecular Chemistry in Prague (2003) and the Katholieke Universiteit in Leuven (2004-2006). He was Associate Professor (2008) and then Full Professor (2010) at the Technical University of Valencia (Centre for Biomaterials) and Visiting Professor in Georgia Tech (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 polymers that trigger the self-assembly of proteins. This work spans fundamental mechanisms at the cell/material interface as well as translational research in regenerative medicine. He authored > 140 articles in major journals. He arrived in Glasgow in 2013 and since then has generated a grant portfolio from the UK (EPSRC, BBSRC, MRC, Cancer Research UK, FABW), international sources (FP7) and industry.

DETAILED PROGRAM AND INVITED SPEAKERS

Wednesday, November 8th, 2017

Session 1: Challenges and opportunities of an ageing population



Josep Maria Haro, Research Director at **Sant Joan de Déu Sanitary Park**, Barcelona, Spain

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Chair of the **SESSION 1**



Somnath Chatterji, Coordinator, Surveys, Measurement and Analysis at Department of Information, Evidence and Research, **World Health Organization**, Geneva, Switzerland

Somnath Chatterji currently leads the Surveys, Measurement and Analysis programme in the Department of Information, Evidence and Research at the World Health Organization (WHO). He coordinates WHO's Study on Global Ageing and Adult Health (SAGE) supported by the National Institute on Aging (NIA), USA – a longitudinal study on ageing in six low and middle income countries. He has been a principal investigator in the Collaborative Research on Ageing in Europe (COURAGE) and is currently a lead investigator in the Ageing Trajectories of Health: Longitudinal Opportunities and Synergies (ATHLOS) and The Utility of omic-based biomarkers in characterizing older individuals at risk for frailty, its progression to disability and general consequences to health and well-being - The FRAILOMIC Initiative (FRAILOMIC), both funded by the European Commission. He has also been involved in the network on the Harmonization of Longitudinal Studies on Aging and the Biomarker Network supported by the NIA. The measurement of health, well-being and other health-related outcomes, their trends and determinants is the main focus of the international studies of the team. He also co-directs WHO's World Mental Health surveys on the epidemiology of mental disorders in 30 countries. He led the Lancet Series on Ageing published in 2014 and was one of the key persons responsible for WHO's World Report on Ageing and Health released in 2015.

New perspectives on Healthy Ageing – the World Health Report on Ageing and Health

The world is growing old – everywhere people are living longer, not just in the rich countries. The number of older adults will exceed 2 billion by 2050 with 4 out of 5 such persons living in low and middle income countries. The epidemiological and demographic transitions coupled with changes in dietary habits and urbanisation are likely to have a major implication for health systems worldwide. The real challenge for health systems everywhere is how to now increase the healthspan and not just the lifespan especially given complex multiple illnesses that this population has. Healthy Ageing is not just about keeping people working or employed for longer periods of time but keeping older adults functioning well for as long as possible to enable them to engage in things that matter to them and thereby improve their well-being. Healthy ageing is a function of both the health conditions that older people have as well as the environment they inhabit. This is especially important in light of global commitments to the Sustainable Development Goals and particularly to Universal Health Coverage. The World Health Organization's Global Strategy on Ageing and Health and its related priority actions is a response to this global public health challenge.



Carol Brayne, Director at **Cambridge Institute of Public Health**, Cambridge, UK

Carol Brayne CBE is a Professor of Public Health Medicine and Director of the Cambridge Institute of Public Health in the University of Cambridge. She is a medically qualified epidemiologist and public health academic. Her main research has been longitudinal studies of older people following changes over time with a public health perspective and a focus on the brain. She is lead principal investigator in the MRC CFA Studies and other population based studies and has played a lead role in teaching and training in epidemiology and public health at Cambridge University. She is a Fellow of the Academy of Medical Sciences, a NIHR Senior Investigator and was awarded a CBE in the Queen's Honours this summer.

Population perspectives on healthy ageing

This presentation will focus on lifecourse, profiles of ageing and their variation, persistent gaps in our knowledge and what we need to be addressing as societies. It will draw on existing cohort study data and broader conceptual work.

Session 2: mHealth devices for connected care



Raimón Jané, Research Director at **Universitat Politècnica de Catalunya** and Group Leader at **Institute for Bioengineering of Catalonia**, Barcelona, Spain

Read bio in page 6

Chair of the **SESSION 2**



Josep Roca, Professor at **University of Barcelona**, Senior Researcher at **IDIBAPS** and Senior Consultant at **Hospital Clinic**, Barcelona, Spain.

Josep Roca (Girona, 1952) is Professor of Medicine at the University of Barcelona, Senior Researcher at IDIBAPS, Senior Consultant at the Hospital Clinic (Barcelona) and Adjunct Professor in Innovative Medical Technology at the Faculty of Health Sciences, University of Southern Denmark. (2015-2020). Author of more than 250 original articles in peer-reviewed journals and several book chapters, review articles and books. His two main fields of interest are (I) Chronic patient management: convergence between integrated care and systems medicine with support of information and communication technologies (ICT); and, (II) Relationships between oxygen pathway and cell bioenergetics: biological mechanisms and impact at system level.

A journey toward technology-supported services for high-definition medicine

The high prevalence of chronic patients with one or more associated disorders, known as multi-morbidity, is the main source of dysfunctions and avoidable costs in conventional health systems worldwide. Health risk assessment and stratification are widely accepted tools facilitating large-scale adoption of integrated care of chronic patients while generating efficient healthcare and supporting the vision of high-definition medicine. However, only a small proportion of the huge potential of risk predictive modelling is being applied for health forecasting of patients due to the lack of in-place procedures for accessing and mining relevant health information.

Applying holistic strategies for subject-specific risk prediction and stratification, that consider multilevel covariates influencing patient health, would increase the predictive accuracy and facilitate clinical decision-making based on sound estimates of individual prognosis. Such strategies require dealing with highly complex data and creating new biomedical knowledge, which opens entirely new translational medicine scenarios and requires interplay between clinical practice and biomedical research. A core element for addressing current unmet needs in any given healthcare setting is the deployment of a Digital Health Framework (DHF) fostering communication among health data from various sources, namely: (i) healthcare; (ii) informal care, with special emphasis on environmental and self-management information potentially gathered via personal health folders; and (iii) biomedical research.

The adoption of cost-effective technology-supported services capable of longitudinally measuring health parameters at high resolution, coupled with dynamic knowledge repositories and sophisticated analytics, will drive predictive, preventive and individualized health interventions. Bottle necks, facilitators and strategies for large scale implementation of high-definition medicine are analyzed.

- Torkamani A, KC Andersen, SR Steinhubl, EJ Topol. High-Definition Medicine. *Cell* 2017;170:828-843
 - Dueñas-Espín I, Vela E, Pauws S, et al. Proposals for enhanced health risk assessment and stratification in an integrated care scenario. *BMJ Open* 2016;6:e010301.
 - Coughlin SS. Toward a road map for global -omics: a primer on -omic technologies. *Am J Epidemiol* 2014;180:1188-95. doi:10.1093/aje/kwu262
 - Maddox TM, Albert NM, Borden WB, et al. The Learning Healthcare System and Cardiovascular Care: A Scientific Statement From the American Heart Association. *Circulation* 2017;135(14):e826-e857.
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Cristina Bescos, European Program Manager at **Philips Healthcare**, Boeblingen, Germany

Since 2013, European Program Manager for Philips Hospital to Home -Telehealth business in Boeblingen, Germany. She leads the ACT@Scale (Advancing Care Coordination and Telehealth Deployment at Scale) Programme, an EC co-funded project to facilitate the necessary organizational transformation towards scaling telehealth and integrated care. Dr. C. Bescos is coordinating the Action Area 2 on Change Management for the European Innovation Partnership on Active and Healthy Ageing B3 group - Integrated Care.

With over 15 years of experience both in research and in management of large international innovation projects in the area of eHealth and healthcare transformation. PhD in Biomedical Engineering and a Master in Telecommunication Engineer from the Polytechnic University of Madrid. Professional experience in Switzerland, The Netherlands, Germany, and Spain.

The telehealth journey: from remote patient monitoring, via (e,p,m) health to population health management

Healthcare organizations are undergoing a transformation in the way they think about, manage and deliver care. This transformation is a journey to continuous health for the entire population. Some started from pilots with remote monitoring technologies looking for improved clinical outcomes and cost-efficiency gains, others from the redesign of processes aiming at care-coordination and integrated care. At the pinnacle of maturity on that journey, health and care organizations have moved beyond episodic care delivery to a continuum health delivery that starts and ends in the home. It is not about one disruptive technology. In the end it is an ecosystem of integrated solutions that include analytics, care management services, telehealth programs, home monitoring systems, and connected devices to help organizations provide ongoing, cost-effective interventions to individual patients and groups as they move through different settings and levels of risk.

It is a new paradigm of seamless care—when, where and how people (persons, patients and consumers) want and need it. Population Health Management approaches provide an unprecedented ability to manage, promote and support improved health, while driving a healthy bottom line.

Session 3: Robotics for assisted living



Paul Verschure, Director of SPECS Research Group at **Institute for Bioengineering of Catalonia (IBEC)**, Barcelona, Spain

Read bio in page 7

Chair of the SESSION 3



Tony Prescott, Professor of Cognitive Robotics at **University of Sheffield and Sheffield Robotics**, Sheffield, UK

Tony Prescott is a Professor of Cognitive Robotics at the University of Sheffield where he directs Sheffield Robotics, a cross-disciplinary research institute with over one hundred researchers. He is also a director of Consequential Robotics, a UK start-up developing assistive and companion robots to enhance the quality of later life. Prof Prescott's background mixes psychology and brain theory with robotics and AI, and his research aims at answering fundamental questions about human cognition at the same time as developing useful robotic systems. Prof Prescott is the co-creator of the animal-like robots Scratchbot, Shrewbot, of the animal-like companion robot MiRo, and of an assistive robotic over-bed table called IntelliTable. He co-founded the International Living Machines conference series, and is currently editing Living Machines: A Handbook of Research in Biomimetic and Biohybrid Systems for Oxford University Press. He recently co-authored a White Paper on the use of robotics in social care for the UK EPSRC RAS Network. His research has been featured by Science Magazine, New Scientist, BBC TV and Radio, CNN, and Discovery Channel.

The Potential for Robotics to Improve the Quality of Later Life

A priority issue for the Europe is care for older people and those living with long-term conditions. The development of advanced assistive robots could be part of a broader strategy to meet our future needs for health and social care. Assistive

and companion robots have the potential to help us with our environments, with physical care, and with our social needs. These different challenges will require technological advances in the areas of dexterous manipulation, robot-human physical interaction, and robot social cognition. A key consideration is that assistive robots should be developed to boost personal independence, whilst taking care to ensure that human-human relationships are not compromised. An integrated ecosystem approach is needed with appropriate forms of help provided at home, in residential care settings, and in hospitals. This talk will review some of the opportunities and challenges in developing robotics system to assist in care, illustrating them with examples from current research in assistive and companion robotics.



Cecilia Laschi, Professor at **Scuola Superiore Sant'Anna**, Pisa, Italy

Cecilia Laschi is Full Professor of Biorobotics at the BioRobotics Institute of the Scuola Superiore Sant'Anna in Pisa, Italy, where she serves as Rector's delegate to Research. She graduated in Computer Science at the University of Pisa in 1993 and received the Ph.D. in Robotics from the University of Genoa in 1998. In 2001-2002 she was JSPS visiting researcher at Waseda University in Tokyo. Her research interests are in the field of soft robotics, a young research area that she pioneered and contributed to develop at international level, including its applications in marine robotics. She has been working in humanoid robotics she is now in the NeuroRobotic Platform of the Human Brain Project FET-Flagship.

She is in the Editorial Boards of several international journals. She serves as reviewer for many journals, including Nature, for the European Commission, including the ERC programme, and for many national research agencies.

She is member of the IEEE, of the Engineering in Medicine and Biology Society, and of the Robotics & Automation Society, where she served as elected AdCom member and currently is Co-Chair of the TC on Soft Robotics.

She is founding member of RoboTech srl, spin-off company of the Scuola Superiore Sant'Anna, in the sector of edutainment robotics.

Soft robotics: a new paradigm for human compatible assistive and service robots

Soft robotics is an emergent paradigm in robotics, with high scientific impact and high potential for impact on applications and society. Soft robots have a high potential for application in daily life scenarios, in the support to citizens, and can greatly contribute to solutions for assistive living. Though a young discipline, some technological achievements are being applied already. A case is the soft assistive robot developed in the EU PHC project I-Support, intended to help elderly people in showering. The soft structure allows a safer and more effective interaction with the user and resulted acceptable and effective in user trials. Soft robotics is demonstrating to be the paradigm for service robots and ultimately for the wide scenario of robot companions.

Session 4: Point of care diagnostics and prognostics



Josep Samitier, President at **Catalan Association of Research Centres (ACER)** and Director at **Institute for Bioengineering of Catalonia (IBEC)**, Barcelona, Spain

Read bio in page 6

Chair of the SESSION 4



Emmanuel Delamarche, Manager Precision Diagnostics group at **IBM Research**, Zurich, Switzerland

Dr. Delamarche is currently leading activities on Precision Diagnostics at IBM Research - Zurich with the goal of using expertise in micro/nanotechnology, physics and biochemistry for solving important problems in biology and medicine. One of his main projects deals with the development of portable and precise diagnostic devices using microfluidic concepts and smartphones. In addition to his research, he is also a Lecturer at ETH Zurich and a contributor to scientific panels for grant agencies and governments. He published over 120 papers and is co-inventor on more than 70 patent families. He has received numerous awards from IBM, was named "Master Inventor" by IBM, and received the Werner prize of the Swiss Chemical Society in 2006.

Point-of-care diagnostics 2.0

Diagnostics are ubiquitous in healthcare because they support prevention, diagnosis and treatment of diseases. Specifically, point-of-care diagnostics are particularly attractive for identifying diseases near patients, quickly, and in many settings and scenarios. One of our contribution to the field of microfluidics is the development of capillary-driven microfluidic chips for highly miniaturized immunoassays. In this presentation, I will review how to program capillary flow and encode specific functions to form microfluidic elements that can easily be assembled into self-powered devices for immunoassays, reaching unprecedented levels of precision for manipulating samples and reagents. This technology can also be augmented using peripherals and smartphones for flow control and monitoring with sub-nanoliter precision. Is the next generation of point-of-care devices finally coming and how can we take advantage of such devices for supporting the elderly?



Anthony Turner, Full Professor & Head of Centre at **Linköping University**, Linköping, Sweden

Professor Anthony (Tony) Turner's name is synonymous with the field of Biosensors. He joined Linköping University in 2010, to create a new Centre for Biosensors and Bioelectronics, following a 35-year academic career in the UK culminating as Principal of Cranfield University at Silsoe. In 2016, he was awarded the Ukraine's highest academic honour, the Vernadsky Gold Medal and the Datta Medal by FEBS. He is a member of the Royal Swedish Academy of Engineering Sciences, a Fellow of the UK Royal Society of Chemistry and a Foreign Associate of the USA National Academy of Engineering. He has Higher Doctorates (DSc) from the University of Kent and the University of Bedfordshire, is a Visiting Professor in the UK, Italy, Korea, Japan and China, and has >750 publications and patents (>350 refereed journal papers and reviews) in the field of biosensors and biomimetic sensors with an h-index of 75. He is probably best known for his role in the development of commercial glucose sensors for home-use by people with diabetes, publishing the first textbook on Biosensors in 1987, as Editor-In-Chief of the principal journal in his field, *Biosensors & Bioelectronics* (Elsevier) and for chairing the World Congress on Biosensors, which he founded in 1990.

anthony.turner@liu.se | <https://liu.se/en/employee/anttu13> | [http://en.wikipedia.org/wiki/Tony_Turner_\(scientist\)](http://en.wikipedia.org/wiki/Tony_Turner_(scientist))
<http://scholar.google.co.uk/citations?user=SfilpLAAAAAJ&hl=en>

Sensors and mobile diagnostics to support healthy ageing

The top priorities to support an ageing population are effective ways to combat isolation and loneliness together with fall protection. After these two general targets, empowering users and their loved ones with the data and information they require to efficiently manage their health anywhere and anytime, while providing them with confidence in the integrity of data and the security of any automated actions are arguably the next most beneficial bioengineering targets. Implicit in this vision is the ability to supplement advanced information management with real-time measurements of both individuals and their immediate environment. The recent boom in wearable sensors may not have delivered the consumer revolution that investors had hoped for, but it has highlighted the potential of continuous measurement and the appetite amongst users for personalised information. Arguably, the major bottleneck at the current time is the availability of reliable sensors that directly measure key biochemical parameters. Most current devices have ingeniously exploited physical sensors that were readily available and used these to infer relevant secondary information. Chemical sensors and biosensors present greater challenges in sample acquisition, but the direct molecular information that they can deliver is essential to higher level algorithms for personalised management of health. Biosensors, as classically defined, incorporate biological or biologically derived sensing elements that harness the exquisite specificity and sensitivity of living systems in conjunction with electronic transducers and processors, to either provide data or to directly actuate an appropriate response. While glucose biosensors have been the highest profile success so far, they are far from the only example and biosensors have been widely commercialised for use in medicine, food safety and environmental monitoring. With the demand now so clearly in focus, the challenge is to harness the tens of thousands of research reports to hone products that can meet the urgent needs. On the one hand, we now have technology that can probe single biomolecules and begin to unravel the natural heterogeneities that may be the key to many important biological questions. Such new, inexpensive approaches will underpin new digital diagnostics, personalised medicine and fundamental biochemical research. Emerging advanced materials are providing tools to fabricate systems with improved performance, while areas such as printed electronics can show us the way to mass produce integrated systems at the right cost and with form factors that meet the rapidly evolving requirements for sensing interfaced with telecommunications. The future importance of biosensors in mobile health, point-of-care diagnostics and wearable sensing is clear and we need to bring engineers, clinicians and management together to implement effective ways forward to improve the prospects for an ageing demographic.



Jordi Carrera, CEO at **STAT Diagnostica**, Barcelona, Spain

Jordi is co-founder and CEO of STAT-Dx, a company focused on the development of Near Patient Testing solutions. Trained as an aerospace engineer, he worked at the Glenn Research Centre (NASA) and later joined the Werfen Group leading medical device and IVD projects.

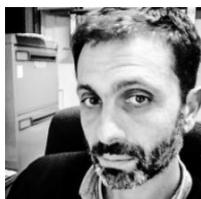
STAT-Dx founded in 2010 and based in Barcelona, develops Near Patient Testing systems that simplify and reduce time to results for the diagnosis of certain medical conditions. The company's novel in-vitro diagnostic system is a versatile, easy-to-use platform that focuses on syndromic testing.

Near Patient Syndromic Testing

Syndromic testing, the ability to test simultaneously for the presence or absence of multiple pathogens which may cause or are associated with clinical syndromes, is becoming increasingly important in laboratories and clinics, offering benefits in patient care, antimicrobial stewardship, infection control, epidemiology and surveillance. STAT-Dx believes that DiagCORE's syndromic testing capability, as well as its convenience and rapid performance, improves clinical decision making, delivers better patient management and generates significant cost savings to the healthcare system.

Thursday, November 9th, 2017

Session 5: Regenerative therapies applied to ageing



Manuel Salmerón, Professor of Biomedical Engineering at **University of Glasgow**, Glasgow, UK

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Chair of the SESSION 5



Marcy Zenobi-Wong, Professor at **ETH Zurich**, Zurich, Switzerland

Marcy Zenobi-Wong is a Professor in the Department of Health Sciences & Technology at ETH Zürich, Switzerland. She obtained her PhD from Stanford University where she studied how mechanical forces influence skeletal development. After a post-doctoral fellowship in the Orthopaedic Research Laboratories, University of Michigan, she moved to the M.E. Müller Institute for Biomechanics in Bern, Switzerland, where she became Group Leader of Cartilage Biomechanics and completed her Habilitation. In 2003, she joined the Institute for Biomedical Engineering at ETH Zürich, where she headed the tissue engineering activities. She was also instrumental in establishing the successful MSc Biomedical Engineering program at ETH Zürich and is the co-initiator of multiple graduate level courses in biomedical and tissue engineering. Her group's research is focused around the development of functional biomaterials for cartilage regeneration and biofabrication technologies including electrospinning, two-photopolymerization and bioprinting.

Biomimetic Materials for Cartilage Regeneration

Osteoarthritis (OA) represents one of the most frequent causes of disability in the aging population. OA afflicts articular cartilage, which is a tissue with a low capacity to regenerate. The consequence is that cartilage injuries often lead to progressive joint deterioration, a condition known as post-traumatic osteoarthritis. The Zenobi-Wong research group develops novel treatments for injured cartilage which try to overcome specific shortcomings of current therapies. The approaches are interdisciplinary and range from exploration of novel cell sources to development of new materials which are inspired by the design of native structure and composition of cartilage. These 'biomimetic' materials model the glycosaminoglycan-rich microenvironment and composite nature of cartilage. Finally in an integrative approach, we assemble these cell types and materials into higher ordered 3D structures using biofabrication techniques such as bioprinting and electrospinning.



Núria Montserrat, Group Leader at **Institute for Bioengineering of Catalonia (IBEC)**, Barcelona, Spain

Dr. Montserrat research is focused in understanding the molecular mechanisms leading to organ regeneration together with the development of basic knowledge in the field of pluripotent stem cells (PSCs) for human disease modeling. Her expertise in the fields of somatic reprogramming and organ regeneration helped her to develop a massive project selected for funding from the prestigious European Research Council (ERC) within the call of ERC Starting Grant from 2014. The possibility to combine emerging technologies from the field of pluripotent stem cells (i.e., organoids) together with innovative methodologies from the bioengineering field (i.e., 3D bioprinting, organ-on-chip, among others) is enabling Montserrat team to explore new scenarios of human disease modeling, with a special impact in kidney and heart related fields. First established as PI at the Center for Regenerative Medicine in Barcelona (CMRB) (2012-2014), from January 2015 she is Junior group leader at the Institute of Bioengineering of Catalonia (IBEC).

Dreaming with organ regeneration: new hopes for regenerative medicine

Regenerative Medicine aims to restore the loss of function in tissues and organs by the formation of new functional structures. For that purpose regenerative medicine makes use of different methodologies: stem cells, animal models, bioengineering related approaches, or gene therapy. Within the last decade seminal discoveries have paved the way towards the generation of potential cell sources amenable for cell replacement therapies as induced pluripotent stem cells (iPSCs). Similarly, advances in the bioengineering field are also opening the door towards the development of innovative strategies aiming to generate functional tissue grafts and models suitable for disease modeling and precise medicine. As such, the possibility to mimic complex tissue organization by means of 3D bioprinting, represents a new are of research with immediate applications in the field of Regenerative Medicine.

Session 6: Making it happen



Marco Pugliese, Managing Director at **EIT Health Spain**, Barcelona, Spain

Born in Latina (Italy) in 1968. Bachelor in Veterinary in 1994 from the University of Perugia (Italy). PhD in Neuroscience from the University of Barcelona in 2005 with a research based on the characterization of cognitive dysfunction in companion dog and its usefulness as an alternative model of Alzheimer's disease. In 2005, he won a research prize of the Royal Spanish Academy of Veterinary Science with a study based on the selective neurodegeneration in dog's central nervous system (CNS). In 2006, he co-founded Neurotec Pharma with the aim to develop new treatments for CNS diseases mainly related with inflammation and neurodegeneration. From 2008 to 2014, he was CEO of the company. From July 2014 to September 2015 he has worked as Manager of Innovation and Technology Transfer at the Research Institute of Vall d'Hebron (VHIR). He is currently Director of the Spanish node of EIT Health. Dr Pugliese is co-inventor of 7 patents related to the development of treatment for CNS diseases and he is author of 24 international publications in the field of Neuroscience.

Chair of the SESSION 6



Ignasi López, Director Department of Science and Research at "**La Caixa**" Foundation, Barcelona, Spain

Working for "la Caixa" Banking Foundation in science related fields since 2000. Today contributing to coordinate its funding programmes of Research and Innovation, Fellowships and Science in Society - CosmoCaixa. He holds an extensive experience in Philanthropy of R&I, in Science and Innovation Policy and in Science in Society issues. He has been particularly active in the field of Responsible Research and Innovation as a leader of the EC funded project RRI Tools and as a participant and advisor in several H2020 projects. He is also Chairman of the ELSI Advisory Board of the EIT Health and a member of the Steering Committee of the Research Forum of the European Foundation Centre. He is a Physicist by the Universitat Autònoma de Barcelona and holds a postgraduate degree in Management by IESE-Universidad de Navarra.

Ethical Issues

Abstract not available.



Tony Prescott, Professor of Cognitive Robotics at **University of Sheffield** and **Sheffield Robotics**, Sheffield, UK

Read bio in page 10

Social barriers in the acceptance of advanced technologies for healthy aging

Abstract not available.



Totti Könnölä, CEO at **Insight Foresight Institute (IFI)**, Madrid, Spain

Dr. Totti Könnölä, Managing Director of Insight Foresight Institute, is experienced manager in the realm of innovation, entrepreneurship, sustainability and strategic transformative policy intelligence. He has designed and coordinated many strategic foresight, appraisal, evaluation and decision-making processes together with industry management, research directors, policy-makers and other stakeholders.

He has attained experience in Europe and the Americas in the areas of management, research and policy advice especially in: i) the JRC-IPTS of the European Commission and the European Institute of Innovation and Technology (EIT), ii) research and technology organisations and universities like IE Business School, VTT Technical Research Centre of Finland, Aalto University, Comillas Pontifical University (ICAI) and ESERP Business School and ii) venture caps, consultancies and industries like eGauss Business Holding I+T, Insight Foresight Institute, Impetu Solutions, Gaia Group and Stora Enso.

In particular, by founding and heading two innovation consultancies (previously Impetu Solutions and currently Insight Foresight Institute), Könnölä has become an active promoter of technological and societal transformations. He was also instrumental in the development of the European Institute of Innovation and Technology (EIT) and played active role in

the development of EU foresight capabilities and research and innovation policy benchmarking systems of JRC-IPTS. He is an international advisor experienced in foresight methodologies and digital platforms in numerous consulting assignments and working groups for private sector, governments, European Commission and international organisations. For instance, Könnölä is a nominated member of 'los 100 de Cotec', a group of experts for Cotec Foundation for Innovation and a Member of the Advisory Board of CARISMA Innovation for Climate Mitigation.

Transformative governance of personal health ecosystems

Future personal health ecosystems encompass various areas of application such as chronic disease management, life-style management, independent living and emergency services. Such future systems assist in the provision of continuous, quality controlled and personalised health services to empowered individuals regardless of location and provide a horizontal development area across variety of patients, clinical specialties, technology fields and health services. Hence, the development of such ecosystems requires transformative governance that enable coordination and federation of diverse stakeholders.

Open round table for the general public



Josep Maria Haro, Research Director at **Sant Joan de Déu Sanitary Park**, Barcelona, Spain

Read bio in page 6

Challenges and opportunities of an ageing population



Raimón Jané, Research Director at **Universitat Politècnica de Catalunya** and Group Leader at **Institute for Bioengineering of Catalonia**, Barcelona, Spain

Read bio in page 6

Opportunities and challenges of M-Health for an ageing population



Belén Rubio, Researcher at the SPECS lab of the **Institute for Bioengineering of Catalonia** (IBEC), Barcelona, Spain

Dr. Belén Rubio is a junior post-doctoral researcher at the SPECS lab of the Institute for Bioengineering of Catalonia (IBEC). Belen has a background in computational science, clinical validation and a track-record in neurorehabilitation. In 2010 she obtained a master degree in cognitive science and interactive media (CSIM) and in 2016 she graduated with honors (Cum Laude) obtaining a Ph.D. in Information and Communication Technologies for Neurorehabilitation at the Universitat Pompeu Fabra. Her PhD aimed at identifying the principles of motor relearning after stroke. She is the author of a number of recent publications proposing a novel motor rehabilitation approach based on sensorimotor manipulations and reinforcement. Specifically, her work reveals that the sensory augmentation of goal-oriented body movements immediately enhances performance and promotes the spontaneous use of the patient's affected arm. Her interests lie preliminarily in the development, deployment and validation of assistive devices for neurorehabilitation and motor learning.

Opportunities and challenges of Advanced Technologies for assisted living for an ageing population



Josep Samitier, President at **Catalan Association of Research Centres (ACER)** and Director at **Institute for Bioengineering of Catalonia** (IBEC), Barcelona, Spain

Read bio in page 6

Opportunities and challenges of point of care diagnostics and prognostics for an ageing population



Manuel Salmerón, Professor of Biomedical Engineering at **University of Glasgow**, Glasgow, UK

Read bio in page 7

Opportunities and challenges of regenerative therapies for an ageing population



Marco Pugliese, Managing Director at **EIT Health Spain**, Barcelona, Spain

Read bio in page 15

Challenges before these technologies become a reality

PRACTICAL INFORMATION

Venue: CosmoCaixa Barcelona



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Agora Room (-3 floor)

Free wifi

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Security issues:

The conference room will remain open. Please take care of your personal belongings, specially in the breaks. The Organizers won't be responsible of any loss or robbery occurred in the context of B-Debate.

Contact persons during the event



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SUGGESTED READING

- **A comparison of health expectancies over two decades in England: results of the Cognitive Function and Ageing Study I and II.**
Jagger C, Matthews FE, Wohland P, Fouweather T, Stephan BC, Robinson L, Arthur A, Brayne C; Medical Research Council Cognitive Function and Ageing Collaboration.
Lancet. 2016 Feb 20;387(10020):779-86. doi: 10.1016/S0140-6736(15)00947-2. Epub 2015 Dec 9.
- **The World report on ageing and health: a policy framework for healthy ageing.**
Beard JR, Officer A, de Carvalho IA, Sadana R, Pot AM, Michel JP, Lloyd-Sherlock P, Epping-Jordan JE, Peeters GM, Mahanani WR, Thiyagarajan JA, Chatterji S.
Lancet. 2016 May 21;387(10033):2145-54. doi: 10.1016/S0140-6736(15)00516-4. Epub 2015 Oct 29. PMID: 26520231
- **Robot companions for citizens.**
Dario, P., Verschure, P. F., Prescott, T., Cheng, G., Sandini, G., Cingolani, R., ... & Roelfsema, P. (2011).
Procedia Computer Science, 7, 47-51.
- **Soft Robotics: new perspectives for robot bodyware and control.**
Laschi C and Cianchetti M(2014) *Frontiers in bioengineering and biotechnology*, 2:3.
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- **Established users and the making of telecare work in long term condition management: implications for health policy.**
Rogers A, Kirk S, Gately C, May CR, Finch T., Soc Sci Med. 2011;72(7):1077–84. doi: 10.1016/j.socscimed.2011.01.031
- **Using preventive home monitoring to reduce hospital admission rates and reduce costs: a case study of telehealth among chronic obstructive pulmonary disease patients.**
Dinesen B, Haesum LK, Soerensen N, Nielsen C, Grann O, Hejlesen O, Toft E, Ehlers L. - J. Telemed. Telecare. 18, 221–225 (2012).
- **Multiplexed lateral flow biosensors: Technological advances for radically improving point-of-care diagnoses.**
Jia Lia, Joanne Macdonald - Biosensors and Bioelectronics83(2016)177–192
- **A 3D bioprinting system to produce human-scale tissue constructs with structural integrity.**
Kang HW, Lee SJ, Ko IK, Kengla C, Yoo JJ, Atala A. Nat Biotechnol. 2016;34(3):312-9
- **Nanostructured Pluronic hydrogels as bioinks for 3D bioprinting.**
Müller M, Becher J, Schnabelrauch M, Zenobi-Wong M. Biofabrication. 2015 Aug 11;7(3):035006

OUTCOMES

B·Debateca

On the website of B·Debate, you will find all the information related with the celebration of the meeting that includes reports, conclusions, scientific documents, interviews with the experts, speaker's CVs, videos, images, press documentation and other related materials. We invite you to visit the section B·Debateca on www.bdebate.org

Contents of the meeting: "Bioengineering for Healthy Ageing. Adding Life to Years"

B·DEBATE International Center for Scientific Debate BARCELONA

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DEBATECA

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- » Programa 2016/17
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- » Cicles de debats

20/04/2017 a 21/04/2017
The Genotype Tissue Expression (GTEx) Project Community Meeting. Enhancing the Usage of Human Genomics for the benefit of all
El projecte Genotype-Tissue Expression (GTEx) ha creat un mapa públic d'expressió i regulació gènica a través de múltiples teixits humans. Aquest recurs ja està proporcionant informació valuosa sobre els mecanismes específics de la regulació de gens en teixits, donant lloc a estudis sobre l'...

23/05/2017 a 24/05/2017
Zika virus and other mosquito-borne viruses. Science for preparedness and response in the Mediterranean region
L'epidèmia global de Zika ens recorda el risc real d'importar patògens exòtics a la regió

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B-Debate International Center for Scientific Debate Barcelona is a joint initiative of **Biocat** and “**la Caixa**” **Foundation**. It drives first-rate international scientific debates, to foster dialogue, collaboration and open exchange of knowledge with prestigious national and international experts, to approach complex challenges of high social interest in life sciences. B-Debate sees debate as a powerful, effective way to generate knowledge and strives to help position Barcelona as a benchmark in generating knowledge and Catalonia as a country of scientific excellence.

The debates are top-notch international scientific meetings featuring a selection of experts of renowned international prestige and scientists that work in Barcelona and Catalonia, moderated by scientific leaders. Since 2009 B-Debate has invited about 1750 recognized speakers and over 13.000 attendees. B-Debate seeks out answers to the challenges and needs of society in the field of life sciences, taking into account the complex, ever-changing conditions of this global world. The debates foster the integration of different disciplines of science and deal with such diverse topics as ageing, new therapeutic approaches to various diseases, innovative technology to improve knowledge of the human genome, food resources, new tools to integrate knowledge management, clinical genomics, neurosciences, climate change, and new energy sources, among others. The knowledge and results obtained through these events is spread throughout both the scientific community and general society through the various **B-Debate** channels and instruments.

More info: www.bdebate.org



The Institute for Bioengineering of Catalonia is a research centre whose purpose is to carry out interdisciplinary research at the highest international quality level which, by creating knowledge, helps to improve health and quality of life and generate wealth.

IBEC research is structured in four broad avenues of knowledge: nanomedicine, mechanobiology, cell engineering and ICT for health. These are placed at the service of science and society to progress in three major application areas, namely Future Medicine, Regenerative Therapies and Healthy Ageing.

More info: <http://ibecbarcelona.eu/>

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