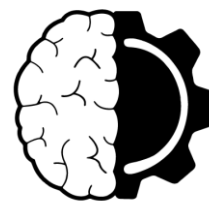




# XII Symposium on BIOENGINEERING

## PLAYLIST



**NEB-FEUP/ICBAS**  
núcleo de estudantes de bioengenharia

In this document, you can find all the sessions transmitted during the three days of the Symposium on Bioengineering with their descriptions and information. To access the sessions, you should click on the link hidden in the titles of each panel.  
Any session or panel not present is due to the disallowance of the speaker or speakers.

## WORKSHOPS

### Biological Engineering

#### *Molecular Gastronomy*

**Instructor:** Inês Gomes

Doctorate at Department of Chemical Engineering, Faculty of Engineering of University of Porto

Our kitchens are laboratories, and chemistry is the basis of successful dishes. Molecular gastronomy uses the knowledge of physics and chemistry to study the processes that occur while cooking. This knowledge allows us to create new and innovative recipes. During this workshop special attention was given to the jellification process, namely spherification and reverse spherification as well as agar jellification will be presented. These techniques allow you to prepare “fruit caviar”, “fruit egg yolk” and “mango spaghetti”. The role of some jellifying ingredients and their importance for the food industry was discussed, as well as the importance of knowing the ingredients, and possible limitations that they can represent in the final result. The resolution of specific challenges was asked and take-home experiences were proposed.

#### *Microalgae as a Nutraceutical in the Preparation of Yogurt*

**Instructor:** Narcisa Bandarra

Researcher and Head of Aquaculture and Upgrading Division at Portuguese Institute of Sea and Atmosphere (IPMA) and Team Leader at CIIMAR

Western diets are poor in healthy polyunsaturated fatty acids, such as docosahexaenoic acid. Since microalgae *Aurantiochytrium* sp. is rich in docosahexaenoic acid, a functional food based on lean yogurt and this microalgae was created. In this workshop, there will be an opportunity to learn about how the microalgae was obtained, the in vitro digestion model, and the determination and characterization of the lipids present in the yogurt.

## *Production of Biofuels from Microalgae*

**Instructor:** Luís Costa

Chief Operations Officer at A4F - Algae for Future

In this workshop, participants learned about microalgae, how they could be connected to biofuel production, and the various production pathways from microalgae to biofuels.

Case studies of R&D projects targeting the production of biofuels from algae were presented, some of them involving A4F - Algae for the future.

The status of the microalgae sector and the current trends in the algae to biofuels sector were discussed.

## **Biomedical Engineering**

### *Getting Started with BITalino*

**Instructor:** Hugo Silva

Researcher at IT – Instituto de Telecomunicações, Professor at EST/IPS – Escola Superior de Tecnologia do Instituto Politécnico de Setúbal and Chief Innovation Officer at PLUX

Low-cost computing platforms, such as the Arduino and Raspberry Pi had a transformational role in the way people learn, experiment, and create imaginative solutions to outstanding problems that can benefit from embedded systems. Within biomedical engineering, physiological sensing is increasingly capacitated with analogous albeit specialised resources, the added value of which is being recognised by policymakers and practitioners across different disciplines. As a result, low-cost and open source tools for physiological sensing are providing new opportunities for biomedical engineers at different states of their careers, ranging from their first years of study to research and/or professional practice.

During this workshop, participants learned how to benefit from low-cost hardware and open-source software to boost learning, research, and rapid prototyping in biomedical engineering. Particular emphasis was given to BITalino, which is the equivalent of the Arduino for biomedical sensing. We will review the basic concepts, show multiple projects and applications involving physiological sensing, explore modular wireless biosignal acquisition systems for real-time data acquisition, and become familiar with helpful software resources.

### *Computational Neuroscience: Simulating Neuronal Dynamics in a Computer*

**Instructor:** Paulo Aguiar

Principal Researcher at i3S (Neuroengineering and Computational Neuroscience Group) and Affiliate Professor in Biophysics at FMUP

Models play a fundamental role in science and this is particularly relevant in neuroscience. A powerful tool to understand the highly complex dynamics of neuronal activity is to carry out experiments *in silico*, using computational models. With these computational models, new ideas can be explored and hypotheses can be tested just as with *in vitro* or *in vivo* settings. This hands-on workshop gave the fundamental concepts on simulating biophysically realistic neurons in a computer and how to query and assess neuronal properties. It was used the NEURON simulation environment, a well-established tool freely available to the scientific community, to run detailed *in silico* experiments. Two models were created and explored: a single cell model to analyse action potential initiation and conduction and a small neuronal circuit model to analyse the communication between neurons.

## *Deep Learning from Biomedical Data*

**Instructor:** João Ribeiro Pinto

Research Assistant at INESC TEC and PhD Student in Electrical and Computers Engineering at FEUP

Deep learning techniques arose to take advantage of today's unprecedented amount of data collected from everything and everyone: sophisticated models are able to learn from raw data, identifying the most meaningful patterns and characteristics and using them for accurate and robust predictions. From character recognition to tumour diagnosis, deep learning has been pushing the boundaries of pattern recognition and helping companies and professionals in a wide array of fields. This workshop aims to prepare participants for advanced projects on the vibrant fields of pattern recognition and computer vision, delivering a solid foundation on deep learning through the introduction of essential theoretical concepts alongside a step-by-step practical tutorial on an example application to biomedical data.

## *Towards the Enhancement of Human Capabilities and Mental Well-being on athletes*

**Instructor:** Hugo Ferreira

Researcher at Institute of Biophysics and Biomedical Engineering (IBEB), Assistant Professor at FCUL and Co-Founder and CMO at Neroes

Find your mental powers with Neroes!

Data is power.

If you had the chance to collect and look at your own data, you could learn a thing or two about yourself and grow.

How much would you like to learn about your mental data?

If you replied "A lot!", then, in this workshop with Neroes, we will tell you how your mental abilities are.

Learn about how you process information, how good you are at planning, and whether you're more of the attentive or impulsive type, among other things.

Learn then how you can improve those mental skills and unleash your full potential!

Don't you worry, there are no good or bad results, just how much you can improve!

## **Molecular Biotechnology**

### *Alginate-based Biomaterials for Regenerative Medicine*

**Instructor:** Sílvia Bidarra

Junior Researcher at i3S | Bioengineered 3D Microenvironments and Invited Professor at ICBAS

As the field of tissue engineering progressed, improvements in the fabrication of more refined and tailored cell based therapies are emerging to replace, repair or enhance the function of damaged tissues or organs. The success of cell delivery systems is dependent on the use of a biomaterial vehicle/scaffold that should allow controlling three-dimensional shape, guide tissue development and cell delivery into the patient. Therefore, such biomaterials should allow adhesion, spatial distribution, protection and guidance of cells. For clinical applications, cell delivery through a minimally invasive approach may be a desired method, since these systems offer specific advantages over preformed scaffolds, such as ease of application, confined delivery and improved patient compliance and comfort. One example of an injectable biomaterial is alginate, a natural polymer typically extracted from brown seaweeds and have been extensively investigated and used for many biomedical applications. The most common method to achieve alginate gelation and crosslinking is through the exchange of sodium ions from guluronic acid units with divalent cations like calcium. The ionic crosslinking can be obtained through external gelation, by dripping an alginate solution into a solution containing calcium ions, such as calcium chloride, under mild conditions. Alginate microbeads, due to their extracellular matrix-like features, are an excellent choice to be used as cell carrier, and for that reason have an enormous potential in the context of tissue regeneration.

In this workshop, students will have the opportunity to get familiar with alginate as cell delivery system and to produce microbeads with different size and composition.

### *3D Bioprinting for Tissue Engineering and Regenerative Engineering*

**Instructor:** Rúben Pereira

Junior Researcher at i3s (Biofabrication) and Assistant Professor at ICBAS

This Workshop seeks to provide the fundamental concepts and cutting-edge advances on bioprinting strategies currently explored to create 3D constructs for tissue repair and in vitro tissue models for drug screening and personalized medicine. A special focus will be given on the different steps involved in the design of biofunctional bioinks capable of regulating the cell response within 3D microenvironments. Examples of bioconjugation reactions for biomaterial functionalization and crosslinking schemes for hydrogel crosslinking will be provided, along with the impact of microenvironmental cues on the biological function of bioprinted constructs. Finally, it will also provide insight in the translational challenges encountered in 3D bioprinting.

## **VIRTUAL VISIT**

### **Fraunhofer Portugal AICOS**

#### *The Research Center for Assistive Information and Communication Solutions*

Fraunhofer Portugal AICOS - was founded in 2009, following a partnership between the Fraunhofer Society (Fraunhofer-Gesellschaft), the Foundation for Science and Technology and the University of Porto (UP).

From its first industry research contract to its first product on the market, Fraunhofer Portugal AICOS has evolved significantly, raising notoriety, and growing its team in size as well as in diversity of competences. From its debut with 12 employees, AICOS now has two offices in Portugal (Porto and Lisbon) employing circa 100 people, of which 80 are highly qualified researchers. With a client portfolio from a broad range of areas, such as health, agriculture, retail or energy, Fraunhofer Portugal AICOS has consolidated competences in: Human-Centred Design; Intelligent Systems; and Connected Things.

## **PANELS**

### **Molecular Biotechnology**

#### *Switch On Regeneration*

Tissue regeneration is the process of renewing and growing tissue to repair or replace what was injured. It is achieved by enhancing the opportunity for one cell type to populate the damaged area all the while providing guidance to the developing cells.

Using the power of new and innovative biofabrication technologies, electrical stimulus, biomaterials, and stem cells to promote tissue regeneration in cases where normal growth is not viable or possible, bioengineering allows for improvement of function and the possibility of extending life using several regeneration techniques that can be applied to the most varied tissues, from cartilage to bone and nervous tissue and even the regeneration of complete organs.

In this panel, we will take a deeper look into the most recent discoveries in the world of tissue regeneration and understand the impact that this new biotechnological approach to tissue damage has on life.

Speaker	Talk
<b>Sarah Cartmell</b> Biomaterials Group - University of Manchester, United Kingdom	Electrical stimulating regimes to influence stem cell proliferation and differentiation for tissue engineering
<b>Lorenzo Moroni</b> Moroni Lab - University of Maastricht, The Netherlands	Biofabrication technologies to generate libraries of 3D scaffolds able to control cell fate
<b>May Griffith</b> Griffith Lab - University of Montreal, Canada	LiQD Cornea: Pro-regeneration collagen as a new treatment alternative to corneal transplantation

## Biomedical Engineering

*Technological Bonding, powered by  INESCTEC*

Emotion is fundamental to human experience, influencing cognition, perception, and everyday tasks such as learning, communication, and even rational decision-making.

Traditionally, emotions were linked to lifeless machines, and were normally studied by psychologists. However, recently, the emotional features are captured and processed by a computer, inside a multidisciplinary knowledge background involving psychology, cognitive, physiology and computer sciences. New ways to communicate, understand and respond to human behaviour are being developed, in order to advance wellbeing.

Along this panel, some challenges will be unriddled, namely: “How can sensing and affective strategies transform human and computer interaction?”, “How interactions between humans and technologies can be impacted by emotions?”, “How systems can be designed to utilize human emotions to enhance capabilities?”.

Speaker	Talk
<b>Ana Tajadura-Jiménez</b> UC3M, Madrid   UCL, London	Magic Shoes: addressing the emotional and psychological barriers in physically inactive people
<b>João Silva Sequeira</b> IST, Lisboa, Portugal	Gasparzinho, the social robot and friendly fellow of young cancer patients
<b>Anne-Marie Brouwer</b> TNO, Netherlands	Synchrony in EEG, heart rate and electrodermal activity as a marker of selective attentional focus

## Transversal

### *Made in MIB/MEB*

Bioengineering professionals, using their broad background knowledge and expertise, are able to go far throughout their professional pathway, and MIB/MEB students are not an exception. Within this panel, MIB/MEB Alumni come back home to inspire the audience by presenting their journey through the Bioengineering world.

#### **Speakers:**

**Daniel Carvalho** - Molecular Biotechnology

**Pedro Sousa** - Biological Engineering

**Daniel Carvalho** - Biomedical Engineering (Integrated Master in Bioengineering)

**João Garcia** - Biomedical Engineering (Biomedical Engineering Master)

### *Bioengineering Evolving: Envision Pandemics*

Within the space of nearly a year, the new coronavirus SARS-CoV-2 has dominated the work of thousands of researchers in an unprecedented global effort. The COVID-19 outbreak has evoked a scare of epic proportions to the world, due to its potential to spread and infect humans worldwide.

Welcome aboard to a journey through the History of pandemics across the globe. Throughout this journey, we will visit the three Bioengineering branches, allocated into past, present and future, face to face in a mighty discussion. Bioengineers may have significant roles fighting pandemics, from critically analysing past pandemics, to applying artificial intelligence tools in diagnosis and prognosis of epidemics, passing through vaccine development and molecular studies.

#### **Past: Biological Engineering**

The study of our ancient biodiversity is essential to understand past pandemics, using computational biology methods.

**Speaker:** José Manuel Sobral

ICS, Lisboa

#### **Present: Molecular Biotechnology**

COVID-19 stopped our life routines too fast, so, as a quick response to the economic and public health crisis, it is essential to develop a vaccine as fast as science can.

**Speaker:** Miguel Prudêncio

iMM, Lisboa

#### **Future: Biomedical Engineering**

Robotics and artificial intelligence are slowly dominating our lives. Is this the path that future society should follow? Can computing be helpful to fight against future pandemics?

**Speaker:** Arlindo Oliveira

IST, Lisboa

### *Bioclairvoyance: Predicting Diseases*

It is well known that most of the diseases can be more effectively treated at an early stage. Being a relatively new subspecialty in healthcare, predictive medicine enables either prevention or early treatment of a given disease. The scientific challenges of understanding the pathogenesis of chronic diseases to the extent that we can effectively prevent, detect, diagnose and treat them are substantial. Nevertheless, there is an enormous amount of talent available to meet these challenges. Genomic biomarkers promise the risk of disease prediction, to enable early detection of disease, to improve treatment selection and to monitor the outcome of therapeutic interventions. Also, with big data, predictive medicine may soon be able to quantify individual risk for a variety of healthcare outcomes.

Throughout this panel, both biomarkers and big data will be addressed, showing how clairvoyance is performed in medicine.

<b>Speaker</b>	<b>Talk</b>
<b>Margarida Fardilha</b> Institute of Biomedicine, University of Aveiro, Portugal	Bioinformatic analysis to new urinary biomarkers for dysregulated proteins in prostate cancer patients
<b>David Grayden</b> Melbourne School of Engineering	Artificial intelligence technologies for a personalized epileptic seizure forecasting
<b>Sandra Anjo</b> Center for Neuroscience and Cell Biology, Coimbra, Portugal	Parkinson's disease potential biomarkers: a pilot study on circulatory mitochondrial proteins

### *Level Up Pharma*

With a growing population, we need to make sure that drug treatments are available for everyone and that they are as effective as possible. Pharmaceuticals are always evolving and there is a continuous need to optimise the production of recombinant protein medicines, the delivery of substances, and the speed of diagnosis, while making sure the environment, the economy, and humanity can keep up.

Innovative approaches like nanofluidics, molecular pharming, and drug encapsulation aim to take pharma to a whole new level and improve health all around the world.

<b>Speaker</b>	<b>Talk</b>
<b>Rita Mota</b> i3S, Porto	Cyanobacterial extracellular polymeric substance to encapsulate drugs
<b>Teófilo Vasconcelos</b> BIAL, Porto	Drug delivery in pharmaceutical technology
<b>Fredrik Westerlund</b> Chalmers University of Technology, Sweden	Nanofluidics for ultrafast diagnosis of bacterial infections

### *Towards Biosensitivity*

Biosensors are devices used to detect the presence or concentration of a biological analyte, such as a biomolecule, a biological structure or a microorganism. Research and development of biosensors is becoming an extensively studied discipline, strongly contributing to advances in many fields, namely in next-generation medicine and in industry, by detecting various chemical compounds.

This panel represents a multidisciplinary research in chemistry, biology and engineering, simultaneously preventing and monitoring various problems that a bioengineer can face.

<b>Speaker</b>	<b>Talk</b>
<b>Alessandro Tonacci</b> National Research Council of Italy, Rome, Italy	Electronic nose as a novel strategy to identify early signs of cancer
<b>Simone Morais</b> ISEP, Porto, Portugal	Electrochemical Biosensors: Design and Applications
<b>Mahmoud Tavakoli</b> FCTUC, Coimbra, Portugal	Dermotronics: Stretchable electronics stickers that adhere to the human skin and collect biopotentials for biomonitoring applications

## **PITCH CONTEST**

### *Science Under 5'*

Science Under 5' is the second edition of the scientific pitch competition organised within the Symposium on Bioengineering. Its goal is to provide an opportunity for participants to showcase their work to a broad audience, made up of both students and prominent figures in their field. Participants can undergo a true experience on Scientific Communication and Public Speaking, which contributes to their overall education.

Three elements were considered for evaluation: a brief abstract, the pitch itself (as the most relevant element), and the public's vote. Any work submitted must be an original production/research, and should pertain to the scientific area of Bioengineering, which includes Biomedical Engineering, Biomolecular Technology and Biological Engineering. Every work will be evaluated together, regardless of its scientific area.

#### **Participants:**

**Ana Sofia Pinho** - After the antibiotic era effect of Nanostructured Lipid Carriers against *Helicobacter pylori* biofilms

**António Ramôa** - AMP PLGA Nanoparticles to Fight Bacterial Wound Infections

**Inês Passos Fernandes** - Graphene oxide, heparin and decellularized arteries a promising recipe to change the paradigm in cardiovascular diseases?

**Maria Bravo** - The development of a multifunctional drug delivery system for efficient cancer cell targeting in 3 D cell models

**Mariana Coelho** - Reshaping in vitro Models of Breast Tissue Integration of Stromal and Parenchymal Compartments in 3D Printed Hydrogels

**Marta Lima** - Chitosan engineered surfaces to prevent implant associated infections



## Winners:

### 1st Place

**Maria Bravo** - The development of a multifunctional drug delivery system for efficient cancer cell targeting in 3 D cell models

### 2nd Place

**Mariana Coelho** - Reshaping in vitro Models of Breast Tissue Integration of Stromal and Parenchymal Compartments in 3D Printed Hydrogels

### 3rd Place

**Inês Passos Fernandes** - Graphene oxide, heparin and decellularized arteries a promising recipe to change the paradigm in cardiovascular diseases?

## SOCIAL EVENING

### Live Show - Diogo Leite

Symposium on Bioengineering is a progressive event not only focused in our evolving technological world, but also in broadening your horizons, boosting your inner talent! Art encourages us to explore ourselves and our inspirations, besides being a linking opportunity. For the first time, we want to provide you a memorable experience. Here you can watch the live show with Diogo Leite, one of the finalists in The Voice Portugal 2020.



Instituto dos Vinhos do Douro e do Porto, I. P.

