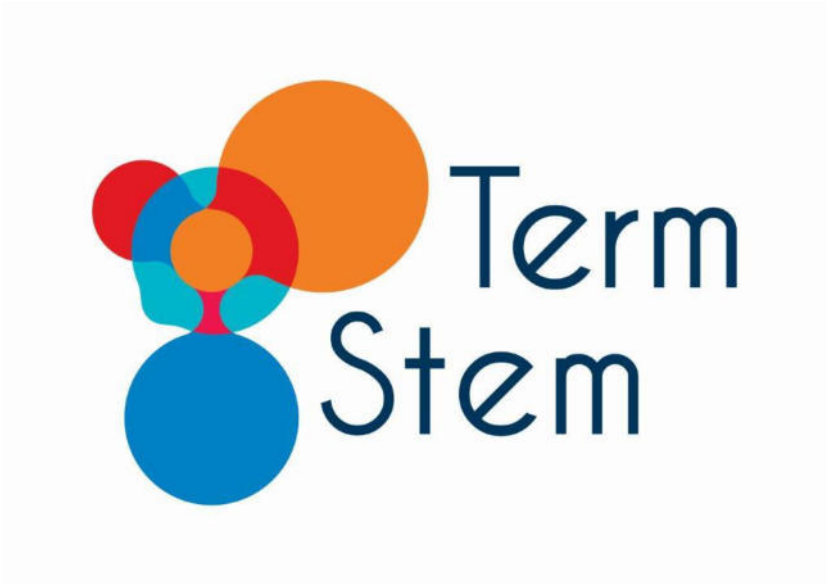
Hotel Vila Galé
Collection Braga

16-18 June 2021

Term Stem 2021

www.termstem.org



CONFERENCE HIGHLIGHTS

The TERM STEM 2021 will take place in the 16th and 18th of June, in the very hospitable city of Braga.

TERM STEM is a series of events organized by 3B's Research Group team that intends to make a stand in the worldwide range of conferences in the field. A range of world scientific leaders will be meeting and presenting their latest research, covering the most relevant topics related to Stem Cells and Nanotechnology and their uses in Tissue Engineering and Regenerative Medicine. In addition, besides a cutting edge scientific program in the field of Biomaterials and Stem Cells applied to Tissue Engineering and Regenerative Medicine, we have included a dynamic social program that will allow an informal interaction between participants and a delightful experience in this beautiful city of Braga.

Some of the objectives of this conference are to allow:

· The discussion of scientific and technological updates as well as new methodologies in this field;
· The development of cooperation platforms to enhance the research and share of knowledge;
· The anticipation of emergent technologies with scientific and technological impact;

All these aspects are essential to improve the level and quality of the research in the field of Tissue Engineering and Regenerative Medicine.

Scientific Topics:

TERM STEM 2021 Conference aims to promote a close interaction between highly skilled experts in the field, with students and young researchers interested in Tissue Engineering and Regenerative Medicine, with focus on some hot and emerging topics such as:

- **Personalized Tissue Engineering Strategies**
- **Innovative biopolymers in TERM**
- **3D Bioprinting and novel bioinks**

Looking forward to meeting you in Braga!

Rui L. Reis

SUPPORT

TERM STEM 2021 would like to sincerely thank the following support:

3B's

Universidade do Minho
Instituto de Investigação em Biomateriais,
Biodegradáveis e Biomiméticos

ICVS/3B's
Associate
Laboratory

GENERAL INFORMATION

All the information contained in this book is accurate at the time of its publication. The Conference Organizers reserve the right to make alterations to the programme and the associated events as circumstances dictate.

CONGRESS CHAIR

Prof. Rui L. Reis

LOCAL ORGANIZING COMMITTEE

Ana Guerra
Alexandra P. Marques
Iva Pashkuleva
Joaquim Miguel Oliveira
Luísa Rodrigues
Manuela Gomes
Natália Alves
Nuno Neves
Ricardo Pires
Rogério Pirraco
Subhas Kundu
Tiago H. Silva
Vitor Correlo

CONGRESS VENUE

The conference venue will be in the Hotel Vila Galé Collection, located very near to the heart of the city of Braga, being the ideal place also for those looking to experience the city's true essence. The beautiful city of Braga, considered one of the youngest European cities and distinguished the second Best European destination of 2019 by European Best Destinations. Founded by the Romans in the year 16 B.C and denominated "Bracara Augusta", Braga combines its bimillennial History with a youth and invigorating vitality. With more than 2000 years of History, Braga is the oldest Portuguese city and one of the oldest Christian cities in the world.

Overlooking the city of Braga, the Sanctuary of Bom Jesus do Monte is a UNESCO World Heritage Site. Centred on a Via Crucis that leads up the western slope of the mountain by a staircase, it includes a series of chapels that house sculptures evoking the Passion of Christ, as well as fountains, gardens and the oldest hydraulic funicular in Europe. The Via Crucis culminates at the church, which was built between 1784 and 1811.

In summary, a wonderful city providing a unique atmosphere and character together with an outstanding perspective of History, food and wine.

Hotel Vila Galé Collection
Largo Carlos Amarante,
4700-308 Braga
Portugal
D. Afonso Henriques room
Telephone (+351) 253 146 000
Fax (+351) 253 146 049

GETTING TO AND FROM THE VENUE

From the south: A1 motorway north, in the direction of Porto » A3 motorway from Oporto to Braga. Follow through the exit Braga Centro.

From the north: A3 motorway from Valença, in the direction of Braga. Follow through the exit Braga Centro.

Once in Braga: Follow through Dom Frei Caetano Brandão Street and Dom Afonso Henriques Street to Largo Carlos Amarante.

For those of you arriving in Braga by train, the Hotel Vila Galé Collection Braga is 1.2 kilometres from the train station, 15min walking.

GPS Coordinates: N 41° 32' 56.139'' - W 8° 25' 24.336''

REGISTRATION AND INFORMATION DESK

All attendees must be registered for the conference. Admission to the conference is permitted only to those wearing the official conference badge. If a name badge is misplaced, please contact the registration desk.

CERTIFICATE OF ATTENDANCE is available to all registered participants and will be sent by email after the event.

The information/registration desk will be located at the Foyer of D. Afonso Henriques room in the first day of the conference and will be open during the following days.

INTERNET

Wireless network at Hotel Vila Galé Collection will be available with free access.

LUNCH AND DIETARY REQUIREMENTS

Lunch planned for the conference is included in the registration fee and will be served in the Hotel Vila Galé Collection restaurants Fundação and Bracara Augusta. Please inform Organizing Secretariat at registration desk as soon as possible in case you have any dietary requirements.

SMOKING POLICY

From 1st January 2008 legislation was introduced in Portugal, which makes it forbidden to smoke in all public places. This includes cafes, bars and restaurants (excluding those with signalized smoking areas). Smoking is only allowed outside the conference building.

PHOTOGRAPHY POLICY

Recording and photographing Conference presentations will not be allowed.

ELECTRICITY SUPPLY

220V is the standard power supply throughout Portugal. If you need a plug or a power adapter, you may find in electronic specialty retailers or ask in the registration desk.

TRANSPORTATION

In Braga, there is a bus that lets you travel through the city centre but, as it is not a very big city centre, you probably will prefer to walk by foot and enjoy the harmony of this city.

Renting a car can be a very nice solution, because, in a small city, there is not many traffic jams, and if you want to stay in a place "far" from the centre, it can be a wonderful transport. It's not so expensive to rent a car but, if you want to feel the city, you can not make longer trips, because the city centre has a lot of streets, that you can only enjoy walking.

Airport: www.ana.pt
Train: www.cp.pt
Bus: www.tub.pt

Taxis operate 24 hours and can be ordered from the Conference Venue or from your hotel. Taxis can be hailed in the streets if they have the green light on in the front which says "TAXI". Do not use unlicensed taxis, which are ordinary cars and drivers looking for business, offering taxis in the street.

WEATHER

Please visit the Portuguese Meteorology Institute website: www.ipma.pt. Or the worldwide known: www.weather.com

TOURISM AND LEISURE

The conference venue is located very near of the heart of the lively city of Braga. Just go out and enjoy! To know more about this roman origin city, please visit the following websites:
www.cm-braga.pt/pt
visitbraga.travel/
www.visitportugal.com/en/node/73738

CURRENCY

Portugal uses the Euro (€). Traveller's cheques can be exchanged for cash in banks and exchange bureaus.

EMERGENCIES

Police, ambulances, fire services: Dial 112.

LIABILITY

The Organising Committee of the conference accepts no liability for participant personal injuries or loss/damage to personal property either during or as a result of the Conference, or during the social events. They are entitled to make any changes, modifications or omissions with respect to the information published in this book.

INSURANCE

The Conference Organisers cannot accept any responsibility for personal accidents and damage to the private property of Conference and Exhibition Delegates.

SCIENTIFIC INFORMATION

ORAL PRESENTATIONS

The code attributed to your Oral Presentation in the program corresponds to the code given in this proceedings book in the abstract list.

KEYNOTE LECTURES FORMAT

45 minutes (presentation)
15 minutes (discussion)

SHORT ORAL PRESENTATIONS

15 minutes (presentation+discussion)

CONFERENCE PROGRAM

	Day 1 | Wednesday | June 16	Day 2 | Thursday | June 17	Day 3 | Friday | June 18
09.00 | 09.15	**Registration (Foyer)**	KL04	
09.15 | 09.30			
09.30 | 09.45			OP01
09.45 | 10.00			OP02
10.00 | 10.15		***Coffee-Break***	OP03
10.15 | 10.30			OP04
10.30 | 10.45		KL05	***Coffee-Break***
10.45 | 11.00			
11.00 | 11.15			KL10
11.15 | 11.30			
11.30 | 11.45		KL06	
11.45 | 12.00			
12.00 | 12.15			Closing session
12.15 | 12.30			
12.30 | 12.45	***Lunch***	***Lunch***	
12.45 | 14.30			
14.30 | 14.45	Opening session	KOL7	
14.45 | 15.00	KOL1		
15.00 | 15.15			
15.15 | 15.30		KL08	
15.30 | 15.45			
15.45 | 16.00	KL02		
16.00 | 16.15			
16.15 | 16.30			
16.30 | 16.45		***Coffee-Break***	
16.45 | 17.00	***Coffee-Break***	KL09	
17.00| 17.15			
17.15 | 17.30	KL03		
17.30 | 17.45			
17.45 | 18.00			
18.00 | 18.15			

SCIENTIFIC PROGRAM

	Day 1 | Wednesday, June 16
09h00-12h30	**Registration (Foyer)**
14h30-14h45	**Welcome and Opening Ceremony** Rui L. Reis (3B´s Research Group, University of Minho, Portugal | TERM STEM 2021 Conference Chair)
	Session I Chair: Rui L. Reis
14h45-15h45	**KL01 - The human beings as textile reinforced composites – biohybrid implants for cardiovascular & respiratory applications** Stefan Jockenhövel *(RWTH Aachen University | Maastricht University, Germany)*
15h45-16h45	**KL02 – Surface Functionalised Biomaterials and Nanostructures for Advanced Therapies** Nuno M. Neves *(3B´s Research Group, University of Minho, Portugal)*
16h45-17h15	**Coffee Break**
17h15-18h15	**KL03 – Delivery of Proteins and RNA molecules using nanotechnology** Maria Jose Alonso (*Dept. of Pharmacy and Pharmaceutical Technology, CIMUS Research Institute, University of Santiago de Compostela, Spain*)

** All abstract's codes are in reference to the abstract list published in this book.*

	Day 2 | Thursday, June 17
	Session II Chair: Nuno M. Neves
09h00-10h00	**KL04 – Tropoelastin and enhanced wound repair** Anthony S. Weiss *(Charles Perkins Centre, School of Life and Environmental Sciences, Sydney Nano Institute, University of Sydney, Australia)*
10h00-10h30	**Coffee Break**
10h30-11h30	**KL05 - Biocompatibility Issues for the Tissue Engineered Products for Commercialization** Gilson Khang *(Jeonbuk National Univ, South Korea)*
11h30-12h30	**KL06 - ROS-responsive polymers for tissue repair and regeneration via modulating inflammation microenvironment** Changyou Gao *(Department of Polymer Science and Engineering, Zhejiang University, China)*
12h30-14h30	***Lunch (Bracara Augusta and Fundação restaurants)***
	Session IV Chair: Alexandra P. Marques
14h30-15h30	**KL07 - Advances in Shear-thinning Hydrogels for Biofabrication and Tissue Repair** Jason Burdick *(University of Pennsylvania, USA)*
15h30-16h30	**KL08 – Tethered and dynamic biomaterial/cell receptor interaction – control systems for tissue engineering and regenerative medicine** Alicia El Haj *(University of Birmingham, UK)*
16h30-17h00	**Coffee Break / Poster Session**
17h00-18h00	**KL09 - Can blue have a role in biomaterials for regenerative medicine?** Tiago Silva *(3B´s Research Group, University of Minho, Portugal)*

** All abstract's codes are in reference to the abstract list published in this book.*

	Day 3 | Friday, June 18
	Session VI Chair:Tiago H. Silva
09h30-09h45	**OP1 - Engineered spider silk fibers with antimicrobial peptides prevent surgical site infections** Albina C. Franco *(3B´s Research Group, University of Minho, Portugal)*
09h45-10h00	**OP2 - Activity of cork polyphenols against Methicillin-resistant bacteria** Ana Rita Araújo *(3B´s Research Group, University of Minho, Portugal)*
10h00-10h15	**OP3 - Bioengineered implant surfaces with cell-instructive and antibacterial properties** Manuel Florit *(3B´s Research Group, University of Minho, Portugal)*
10h15-10h30	**OP4 - Gellan Gum-based Inks: A step aside from the ordinary** Lucília Silva *(3B´s Research Group, University of Minho, Portugal)*
10h30-11h00	**Coffee Break**
11h00-12h00	**KL10 - Growth factor-free vascularization of tissue engineered constructs** Rogério Pirraco *(3B´s Research Group, University of Minho, Portugal)*
12h00-12h15	**Closing session**

** All abstract's codes are in reference to the abstract list published in this book.*

KEYNOTE LECTURES

KL01

THE HUMAN BEINGS AS TEXTILE REINFORCED COMPOSITES – BIOHYBRID IMPLANTS FOR CARDIOVASCULAR & RESPIRATORY APPLICATIONS

Stefan Jockenhoevel

RWTH Aachen University | Maastricht University, Germany

Regenerative Medicine has promised to overcome the limitations of conventional implants with the potential to remodel, to self-repair and specifically for the pediatric applications to grow with the child. In the past two decades, many successful pre-clinical trials have demonstrated the potential of tissue-engineered implants, but the number of translated products to the clinic are very limited. This is due to the high complexity of the production process and the need to control the complex adaptive behavior of the patient-individualized cell source in the process.
While the classical tissue-engineered implant has primarily focused on a complete autologous solution, the biohybrid approach is looking for a balance combination of technical and biological components with regard to (i) a high (re)producibility by the technical component and (ii) an optimal hemo/biocompatibility by the biological component.
Based on the fact that "human beings are textile-reinforced composites", textile engineering offers a multi-scale toolbox for mimicking and supporting tissue engineered constructs. We have demonstrated the use of textile fibres to create anisotropic tissue constructs in cardiovascular and respiratory tissue engineering.
The keynote lecture will give an insight in the "evolution" of cardiovascular and respiratory tissue-engineered implants from complete autologous towards biohybrid textile reinforced constructs as key technology for a (re)producible and herewith transferable implant into clinic.

Brief Biography

Stefan Jockenhoevel, Univ.-Prof. Dr. med. (*1967) is director of the Dept. for Biohybrid & Medical Textiles (BioTex) at RWTH Aachen University since 2011 and director of the Aachen-Maastricht-Institute for Biobased Materials (AMIBM) at Maastricht University since 2015. He studied medicine at the RWTH Aachen University and earned his MD in the Dept. of Physiology. Trained in the field of cardiovascular and thoracic surgery. He worked clinically at the University Hospitals Aachen, Zurich and the Heart Center Lahr and INCCI Luxembourg. His research focuses on the development of textile-reinforced biohybrid implants for cardiovascular and pulmonary applications.

Prof. Jockenhoevel is member of the National Academy of Science and Engineering, Germany.

KL02

SURFACE FUNCTIONALISED BIOMATERIALS AND NANOSTRUCTURES FOR ADVANCED THERAPIES

Nuno M. Neves

3B's Research Group, University of Minho, Portugal

Many biomaterials have been proposed to produce porous scaffolds, nanofibers and nanoparticles for different medical treatments and applications. Systems combining natural polymers and synthetic biodegradable polymers are particularly adequate for those demanding applications. Those biomaterial systems can be tailored with enhanced mechanical properties, processability, cell-friendly surfaces and tunable biodegradability. Our biomaterials may be processed by melting or solvent routes into devices with wide range of applications such as biodegradable scaffolds, films or particles and adaptable to many biomedical applications.
Non-woven meshes of polymeric ultrafine fibers with fiber diameters in the nanometer range can be produced by electrospinning. Those meshes are highly porous and have a high surface area-to-volume ratio and can mimic the structure of the extracellular matrix of human tissues and can be used as scaffolds for Tissue Engineering (TE). There is a great interest in developing also nanoparticles and hydrogels from those polymeric systems for injectable treatment modalities. All those structures can be used as substrates for specific surface functionalization having fine-tuned biological properties. This strategy enables developing highly controlled devices for exposure, capture and, if needed, inactivation of biological biomolecules relevant for novel treatment modalities in various disease conditions.

This talk will review our latest developments biomaterials, nanoparticles and nanofibre meshes in the context of novel therapeutic applications.

Brief Biography

Nuno M. Neves is an Associate Professor with Habilitation at the 3B's Research Group, Research Institute I3Bs, University of Minho in Portugal. This is a research unit of Excellence, directly funded by the Portuguese Foundation for Science and Technology (FCT). The Research Institute I3Bs also integrates the PT Associate Laboratory ICVS/3B's, as homologated by the Portuguese Ministry for Science and High Education, being Nuno M. Neves one of the members of the Board of Directors. His background education includes: (i) BSc in Polymer Engineering, Univ. Minho, (ii) a Master degree by research on Polymer Engineering and (iii) a PhD on Polymer Science and Engineering, Univ. Minho, Portugal, degree that was prepared in co-operation with the University of Twente, Netherlands. Nuno M. Neves has been involved in biomaterials research since 2002. He has worked several periods abroad at the University of Twente, in a sabbatical leave at the University of Tokyo, Japan (at Prof. Kazunori Kataoka's lab) and in a Visiting Professor position at the University of Trento in Italy. His main area of research is focused on tissue engineering and regenerative medicine strategies using stem cells and advanced drug delivery scaffolds and medical devices.
He is supervising or co-supervising the work of more than 20 post-graduation researchers (including Post-docs and PhD students). The researchers have a multidisciplinary background including, Mat. Sci. Eng., Polymer Eng., Chem. Eng., Chemistry, Biological Eng., Biochemistry, Pharmacy, Biology and Applied Biology.
As of June 2021, he is the author of 204 publications listed in the Web of Science (170+ peer reviewed international papers), with h-factor of 46 and a total number of citations of over 6500 (h:47;7100+ in Scopus). He was invited and currently serves as Academic Editor of PLoS ONE and the peer-reviewed Elsevier Journal on Regenerative Therapy. Nuno M. Neves acts as referee of more than 70 major scientific journals and major international scientific meetings. Furthermore, he is routinely invited to review grants and research proposals for the European Commission and for various funding agencies namely in

Portugal, Argentina, Austria, Czech, France, Georgia, Germany, Netherlands, New Zealand, Singapore, Slovakia, Slovenia, UK and USA and advisory panels of research labs in France and Croatia.

He is an elected member of the Board of Governors of the European Society for Artificial Organs and is currently the responsible for the Tissue Engineering Working Group of the ESAO. He was a member of the Council of the European Alliance for Medical and Biomedical Engineering and Sciences (EAMBES) in representation of the ESAO. He was previously a member of the Council of the European Chapter of the Tissue Engineering and Regenerative Medicine International Society, having served as member of the Nominating Committee of the European Chapter.

KL03

DELIVERY OF PROTEINS AND RNA MOLECULES USING NANOTECHNOLOGY

Maria José Alonso

Dept. of Pharmacy and Pharmaceutical Technology, CIMUS Research Institute, University of Santiago de Compostela, Spain

Biological drugs, including proteins and RNA-based polynucleotides, are taking an increasing space in the industry pipelines. Despite their potency, the difficulties of these macromolecules for overcoming biological barriers and reach the intracellular targets have limited their full exploitation.

Fortunately, the continuously improved understanding of the biological barriers and the molecular biology associated to pathological conditions is paving the way for a more comprehensive and rational design of protein formulations based on the use of nanotechnology. Our laboratory, with a long-track experience in the formulation of macromolecules using polymer nanoparticles, has significantly contributed to this field. As an example, in the 90's we were the first to report that nanoparticles made of either PLA-PEG or chitosan were efficient vehicles for the transmucosal delivery of proteins, antigens and polynucleotides. The result of our subsequent efforts is an array of nanotechnologies, which make use of polymers and lipids and can be used to deliver biologicals across mucosal surfaces, and to facilitate their intracellular delivery following parenteral administration.

In my presentation, I will focus on the design of carriers for proteins and RNA molecules that could be used in different therapeutic areas: (i) nanovaccines, taking HIV as an example, (iii) nose-to-brain delivery of RNA, (iv) delivery of mAb targeted to intracellular onco-proteins, as new oncological treatments.

Overall, our experience in this field has benefited from integrative approaches adopted by specifically designed consortia. Hopefully, the results of these cooperative efforts will help to accelerate the progress of a rational design of protein-based nanomedicines.

More information about these projects can be found at:
http://www.usc.es/grupos/mjalonsolab/

Acknowledgements:

The following researchers have contributed to different projects:
Anticancer drug delivery: Ana Cadete, Ana Olivera and Dolores Torres from the USC, Spain and Gema Moreno and Angela Molina from the "Universidad Autónoma de Madrid", Spain.
Vaccine delivery: Jose Crecente, Tamara Gómez from the USC and Ma Luo and Francis Plummer from University of Manitoba, Canada.
Nose-to-Brain delivery: Eleni Samaridou from USC and Hannah Walgrave and Evgenia Salta from VIB, Belgium.
The research activity has been founded by the Horizon 2020 Program the European Comision (grant agreement # 646142 – NANOPILOT and grant agreement No. 721058- B-SMART), by MINECO- PCIN-2017-129/ AEI, under the frame of EuroNanoMed III, and by The National Institutes of Health (NIH) (Grant Number: R01AI111805).

Brief Biography

María José Alonso's lab has pioneered numerous discoveries in the field of Pharmaceutical Nanotechnology and nanomedicine. She has coordinated several research consortia financed by the WHO, the Gates Foundation and the European Commission. She is the author of 295 scientific contributions with more than 31,000 cites (H factor 75/93). Because of the quality of her scientific articles she has been among the TOP TEN in Pharmacology (Times Higher Education international ranking, 2010). Recently, she become part of the "Power List" of the most influential researchers in the field of Biopharmaceuticals (The Medicine Maker, 2020, 2021).

She has also been very active transferring her knowledge and discoveries to industry. She is the inventor of 22 patent families, most of them licensed to industry and she has been part of 3 start-up ventures.

She has served to the Release Society (CRS) for 15 years and she has been President of the CRS (2017-19). She is also Editor-in-Chief of the Drug Delivery and Translational Research, an official journal of the CRS, and she is part of the editorial board of 12 journals.

She has received 35 awards, among them the "Research and Education Excellence Medal" granted by the Spanish Government, the "Jaime I Award", the General Council of Pharmacy Medal, and other awards granted by scientific organizations, such as the "Marie Junot Award" of the APGI, the "Founders Award", the "Outstanding Service Award" and the "Women in Sciences Award" of the CRS. She was also recently awarded by the AIM-HI Women's Venture Competition program of the National Foundation for Cancer Research (NFCR) and the AstraZeneka Award for Excellence in Sciences.

She is a fellow of the American Institute for Medical and Biological Engineering (AIMBE) and a Fellow of the Controlled Release Society, a member of the Royal Academy of Pharmacy of Spain (RANF), the Royal Academy of Sciences of Galicia, the Royal Academy of Pharmacy in Galicia and a member of the Royal Academy of Medicine of Belgium and also a member of the US National Academy of Medicine (NAM).

She was the Vice-rector of Research and Innovation of the USC (2006-10).

KL04

TROPOELASTIN AND ENHANCED WOUND REPAIR

Anthony S. Weiss[1,2,3]

McCaughey Chair in Biochemistry, NHMRC Leadership Fellow,
Professor of Biochemistry & Molecular Biotechnology
[1]*Charles Perkins Centre*
[2]*School of Life and Environmental Sciences*
[3]*Sydney Nano Institute*
University of Sydney, Australia

Elastic tissue does not typically regenerate in adults, so there is demand for ways to restore these tissues following damage. This relies on the exogenous supply of elastin's primary building block, tropoelastin. We have developed ways to use tropoelastin to 3D print and build a range of elastic repair materials. To our surprise, tropoelastin also promotes broader tissue repair. Powerfully, the use of tropoelastin promotes healing following surgery, including the recovery of full thickness wounds.
An emerging model for tropoelastin is that it delivers this potency by emulating extracellular matrix interactions including those through development and repair. This paradigm for enhanced tissue repair encompasses a novel, pure, synthetic material that promotes the repair and fixation of soft tissues. Tropoelastin-based materials leverage the ability to promote new blood vessel formation and cell recruiting properties to accelerate healing on applied tissues. Understanding these mechanisms has led to the realization of a diverse range of promising biomaterials with tunable mechanical and self-assembly properties.

Brief Biography

Professor Weiss is the McCaughey Chair in Biochemistry, NHMRC Leadership Fellow, and Professor of Biochemistry & Molecular Biotechnology. He leads Tissue Engineering & Regenerative Medicine in the Charles Perkins Centre at the University of Sydney.
Awards include Fulbright Scholar, NIH Fogarty International Fellow, NSW Premier's Prize for Science & Engineering Leadership in Innovation, Eureka Prize for Innovation in Medical Research, Australian Academy of Technology & Engineering's Clunies Ross Award, Vice Chancellor's Award for Excellence, Australasian Society for Biomaterials & Tissue Engineering's Award for Research Excellence, Innovator of Influence Award, RACI's Applied Research Medal, and the Order of Australia.
He is on 13 Editorial Boards, authored >300 publications, and is inventor on 163 awarded international patents in 21 patent families covering human tropoelastin, which gives tissue its elasticity and enhances the repair of scars and wounds.
He is President-Elect of the Tissue Engineering and Regenerative Medicine International Society (TERMIS), was elected Chair of TERMIS Asia Pacific, and President of MBSANZ, and is Fellow of the Royal Society of Chemistry, Australian Academy of Technology and Engineering, Royal Australian Chemical Institute, Royal Society of NSW, American Institute for Medical and Biological Engineering, Australian Institute of Company Directors, Tissue Engineering and Regenerative Medicine, and Biomaterials Science and Engineering.
He founded the clinical stage company Elastagen Pty Ltd which was spun off from the University of Sydney to commercialize tropoelastin. Benefitting from a remarkable executive and board, Elastagen was acquired by Allergan plc, one of the world's 20 largest biopharmaceutical companies, in one of the largest transactions completed in the Australian life science sector.

KL05

BIOCOMPATIBILITY ISSUES FOR THE TISSUE ENGINEERED PRODUCTS FOR COMMERCIALIZATION

Gilson Khang

Dept PolymerNano Sci & Tech, Jeonbuk National Univ, South Korea

Around 1992 as 20 years ago, Advance Tissue Science Co (USA), now merged to Smith & Nephew Co., USA, had been submitted to approve to USA FDA for first cartilage TEMPs as autologous chondrocyte/polyglycolic acid (PGA) nonwoven scaffold. At that time, no one had doubted to approve cartilage TEMPs since PGA was already approved by FDA in human clinical trial and chondrocyte was used autologous primary cell. At last, this product has been still retard up to approve FDA. Main reason might be in terms of safety. Implanted TEMPs have been reported to induce sequential events of immunologic reactions in response to injury caused by implantation procedures and result in acute inflammation marked by a dense infiltration of inflammation-mediating cells at the materials-tissue interface. Prolonged irritations provoked by implanted biomaterials advance acute inflammation into chronic adverse tissue response characterized by the accumulation of dense fibrotic tissue encapsulating the implants.
In this lecture, we will discuss (1) recent advances for the commercialization trends for the tissue engineered products (TEMPS) including regenerative medicinal products, (2) scaffolds in terms of biocompatibility and safety issue, (3) smart scaffold for the application of clinical trial including improved biocompatibility and the reduction of host response, and (4) biocompatibility issue for the natural and synthetic polymers.

Brief Biography

Dr. Gilson Khang was born in 1960 in South Korea, where he obtained his degrees at the Inha Univ. He was studying for Ph.D. degree at the Department of Biomedical Engineering, The Univ of Iowa (Iowa City, IA, USA) from 1991~1995. His academic career started at the Department of PolymerNano Science and Technology at Chonbuk National University (CBNU). Dr. Khang was the one of Founder Members of TERMIS-AP Chapter. Prof. Khang was General Secretary and Treasurer for 2005~2009 of TERMIS-AP Chapter and served as a council member for TERMIS-AP. He was TERMIS-AP Past-President, & Founding Fellow TERMIS.

He has co-authored or edited ≈30 books. He has published ≈700 original research papers, and ≈200 editorials, reviews or chapters in books. His papers were cited 16,520 times. (h-index >68) His major scientific contribution has been to appreciate and analyze the importance of natural/synthetic hybrid scaffold to reduce the host inflammation reaction as well as the commercialization for tissue engineered products as cartilage, bone, retinal pigment epithelium, cornea endothelium, etc. His international collaboration network is really worldwide and tight over 7 countries and 15 Universities. He is/was engaging the Visiting Professor of Tsinghua Univ, Peking Univ, Zhejiang Univ, China and Wake Forest Institute of Regenerative Medicine, USA.

KL06

ROS-RESPONSIVE POLYMERS FOR TISSUE REPAIR AND REGENERATION VIA MODULATING INFLAMMATION MICROENVIRONMENT

Changyou Gao

MOE Key Laboratory of Macromolecular Synthesis and Functionalization, Department of Polymer Science and Engineering, Zhejiang University, China

The degree of tissue injuries such as the level of scarring or organ dysfunction, and the immune response against them primarily determine the outcome and speed of healing process. In the tissue repair and regeneration processes, different types of biomaterials are implanted either alone or by combined with other bioactive factors, which will interact with the immune systems including immune cells, cytokines and chemokines etc. to achieve different results highly depending on this interplay. Several types of polymers including polyurethane elastomers and hydrogels responding to reactive oxygen species (ROS) have been synthesized and fully characterized in terms of ROS-responsiveness, mechanical properties, degradation and ROS elimination in our lab. By integrating with other functional molecules such as methylprednisolone (MP), dexamethasone, dimethyl itaconate (DMI), and catalase etc., therapeutic materials systems such as nanofibrous patches and injectable hydrogels and nanoparticles were designed and prepared for the treatment of myocardial infarction, osteoarthritis (OA) and lung inflammation etc. in vivo. These materials systems could effectively alleviate the inflammation microenvironment of tissues, and modulated the macrophages toward anti-inflammatory M2 polarization, and thereby could better restore the normal tissue microenvironment and achieve better tissue repair and regeneration outcome. For example, they effectively improved the reconstruction of cardiac functions including increased ejection fraction, decreased infarction size, and enhanced revascularization of the infarct myocardium, and significantly reduced the ROS level in articular cavity and alleviate destruction of oxidative stress and thus promoted significantly the therapeutic outcome of OA with a best score close to the normal cartilage.

Brief Biography

Changyou Gao graduated from Department of Chemistry, Jilin University to obtain his Ph.D of Polymer Chemistry and Physics (1996). From 1996 to 1998, he worked in Department of Polymer Science and Engineering of Zhejiang University as a postdoctor fellowship. He is a Cheung Kong Scholar of Ministry of Education of China, a winner for the National Science Fund for Distinguished Young Scholars of China, a fellow of the International Federation of Biomaterial Science and Engineering Societies, and a fellow of the American Institute of Medicinal and Biological Engineering. His research interests include regenerative biomaterials for cartilage, bone, nerve, and myocardium repair and regeneration, gradient materials to regulate cell adhesion and migration, immuno-modulation biomaterials, and colloids and nano-biomaterials and their biological effects. He is now serving as an associate president of Chinese Society of Biomaterials, and an associate editor of Journal of Tissue Engineering and Regenerative Medicine, and Materials Science & Engineering C. He has published more than 400 papers with a citation over 12,000 times by peers and an H-index of 70.

KL07

ADVANCES IN SHEAR-THINNING HYDROGELS FOR BIOFABRICATION AND TISSUE REPAIR

Jason Burdick

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Hydrogels represent a class of biomaterials that have great promise for biomedical applications, particularly due to our ability to engineer their biophysical and biochemical properties to meet design criteria for a specific application. A sub-set of hydrogels are those that are shear-thinning and self-healing, where they are assembled through dynamic and reversible interactions that allow disassembly with mechanical shear (e.g., during syringe extrusion) and then self-healing of the hydrogel when the mechanical force is removed. We have leveraged these properties to design hydrogels that can be directly injected into tissues for repair or for the processing of hydrogels into desired structures with biofabrication techniques. To accomplish this, we have focused on the molecule hyaluronic acid with chemical modifications that permit: (i) molecular assembly through reversible guest-host interactions (e.g., guest: adamantane, host: cyclodextrin) or (ii) covalent crosslinking into particles that can be jammed to form granular hydrogels. Both approaches are highly tunable with respect to hydrogel mechanics, degradation behavior, and the encapsulation and release of therapeutics. One area where we have applied these hydrogels is in the treatment of tissue after myocardial infarction (MI), with injection or catheter delivery of shear-thinning hydrogels to locally deliver therapeutics (e.g., miRNA to stimulate cardiomyocyte proliferation, homing factors to recruit cells for repair). Towards in vitro disease models of MI, we recently developed a new bioprinting approach to transfer cellular spheroids into self-healing support hydrogels at high resolution, enabling their patterning and fusion into high-cell density microtissues. Specifically, we bioprinted iPSC-derived cardiac microtissue models with spatially controlled cardiomyocyte and fibroblast cell ratios to replicate the structural and functional features of scarred cardiac tissue (e.g., reduced contractility, irregular electrical activity) and used them to screen microRNA therapeutics. As a last example, we have fabricated granular hydrogels from hydrogel fibers that assemble into structures that permit cell encapsulation and cell-mediated compaction, mimicking features of extracellular matrix.

Brief Biography

Jason A. Burdick, PhD is the Robert D. Bent Professor of Bioengineering at the University of Pennsylvania. Dr. Burdick's research involves the development of hydrogels through techniques such as photocrosslinking and self-assembly and their processing using approaches such as electrospinning and 3D printing. The applications of his research range from controlling stem cell differentiation through material cues to fabricating scaffolding for regenerative medicine and tissue repair. Jason currently has over 265 peer-reviewed publications, he is on the editorial boards of Journal of Biomedical Materials Research A, Biofabrication, Bioengineering, and Advanced Healthcare Materials, and he is an Associate Editor for ACS Biomaterials Science & Engineering. He has been recognized through numerous awards such as a Packard Fellowship in Science and Engineering, an American Heart Association Established Investigator Award, the Clemson Award for Basic Science through the Society for Biomaterials, and the Acta Biomaterialia Silver Medal Award. Jason has also been elected as a Fellow of the American Institute for Medical and Biological Engineering, to the International College of Fellows of Biomaterials Science and Engineering, and as a Fellow of the National Academy of Inventors. Lastly, he has founded several companies to translate technology developed in his laboratory towards clinical application.

KL08

TETHERED AND DYNAMIC BIOMATERIAL/CELL RECEPTOR INTERACTION – CONTROL SYSTEMS FOR TISSUE ENGINEERING AND REGENERATIVE MEDICINE

Alicia El Haj

Interdisciplinary Chair in Cell Engineering,
Healthcare Technology Institute
University of Birmingham, UK

Regenerative medicine principles are based on the power of progenitor cells to regenerate and grow tissues in vitro and in vivo. Cell engineering provides the platforms and tools which enable the control and manufacture of cells used for clinical therapy and regenerative models. A combination of biological and physical factors play a key role in enabling the cell niche which supports the capability for rebuilding tissue complexity. Using our knowledge from processes for in vitro tissue growth, we can begin to design new ways to implement regenerative approaches in vivo for treating patients. One aspect of this is how to control cells, which can then be used routinely within a hospital environment. These control systems can use static tethered biomaterials as positional cues for defining tissue assembly and order. Another example is remote dynamic control systems which can control cell receptor activation and behaviour. In vitro 3D regenerative models allow us to study these new approaches. The long term challenge lies in engineering control solutions for stem cells which have clinical and pharmaceutical relevance. In this presentation, I will outline some of our recent approaches and define our route towards translating these approaches towards first in man.

Brief Biography

Professor Alicia El Haj, FREng, FRSB, FEAMBES, Interdisciplinary Professor of Cell Engineering, joined the Healthcare Technology Institute in the Institute of Translational Medicine at Birmingham University, UK in September 2018. Previously, she has been the founding Director of the Institute of Science & Technology in Medicine at Keele University Medical School. She is a leading figure in Bioengineering and Regenerative Medicine and has been involved in bringing together interdisciplinary groups within biomedicine, physical sciences and engineering interested in aspects of cell and tissue engineering and regenerative medicine to move innovative new cell based therapies to the clinic. She has published over a 200 publications in novel tissue engineering approaches such as biomechanics, bioreactors, and imaging systems for the delivery of cell therapies to the clinic with funding from EPSRC, MRC, BBSRC, AR UK and an ERC Advanced Award in 2018. She is also Director of a spin out company MICA Biosystems , Ltd involved in translating innovative in vitro pharma screening tools and stem cell control systems into clinical use.
She is Deputy Director of the MRC UKRMP Regen Med Hub and a partner in ARUK Centre in Tissue Engineering and Regenerative Medicine as well as multiple EU programmes. She has been a Research Director of an EPSRC Doctoral Training Centre in Regenerative Medicine, and a co-director of the EPSRC Centre for Innovative Manufacturing Centre in Regenerative Medicine. Prof. El Haj is ex-Chair of the European Council for the Tissue Engineering & Regenerative Medicine International Society (TERMIS).She was awarded with a Royal Society Merit Award in 2014 and is a Fellow of the Royal Academy of Engineering in the UK. In March 2015, she was awarded the MRC Suffrage Award for her role in leading women in STEM. Alicia actively engages in public events having presented 'Remote Control Healing' at the Café Scientifique in Royal Society London and at the 'Next Big Thing' at the Hay Festival 2017.

KL09

CAN BLUE HAVE A ROLE IN BIOMATERIALS FOR REGENERATIVE MEDICINE?

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One of the most promising approaches in the context of regenerative medicine is tissue engineering, which relies on the construction of extracellular matrix mimics to be used as temporary templates for cell culture towards the formation of new tissues. This strategy uses both synthetic and natural origin materials, with the perfect one being still to be discovered, particularly considering the need for tailoring in a patient-specific perspective. Marine biotechnology, known as blue biotechnology, has been proposing several compounds and materials isolated from different marine organisms to be applied in biomedicine, from bioactive natural products as drugs to biopolymers and ceramics as structural building blocks. With the raising awareness for the need of sustainable exploitation of natural resources and the increasing knowledge about the oceans, several groups around the world are devoting efforts to these field and a range of blue biomaterials are being disclosed. During this talk, the valorization of marine resources and by-products will be presented as the first step for advanced therapies, namely with the use of fish collagen and gelatin on the development of bioinks and hydrogels for the engineering of bone and cartilage tissues. Besides, biomedical applications of fucoidan from brown seaweeds will be also discussed, not only as potential antitumoral compound, but also as component of drug delivery systems and cell encapsulation devices, combining structural and bioactive functions. But marine environment has much more to offer besides raw materials. Likewise, overwhelming phenomena and structures are also a source of inspiration and particular examples will be explored, from dynamic collagenous tissues to hierarchical morphologies of marine sponges.

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Brief Biography

Tiago H. Silva is Principal Researcher (tenured) at 3B's Research Group, I3Bs – Research Institute on Biomaterials, Biodegradables and Biomimetics, from University of Minho (Portugal), member of ICVS/3B's Associated Laboratory, being coordinator of research on Marine Inspired Biomaterials. He is also member of the General Council of the University of Minho. He his graduated in Chemistry (2001) and PhD in Chemistry (2006), both by Faculty of Sciences – University of Porto (Portugal) working in surface modification by electrostatic layer-by-layer self-assembly of polyelectrolyte multilayers, with a visiting period at the Swiss Federal Institute of Technology in Lausanne (EPFL, Switzerland).

He has about 15 years of experience in valorization of marine resources and by-products and his research focus on the cross-talk between blue and red biotechnologies, by aiming the development of marine inspired biomaterials for regenerative medicine strategies, mainly focusing on bone, cartilage and cornea tissue engineering, as well as on diabetes and cancer advanced therapies. His team (currently 19 people) has established methodologies for the production of marine collagens, squid chitosan, fucoidans, calcium phosphates and biosilica from marine resources and derived by-products and their

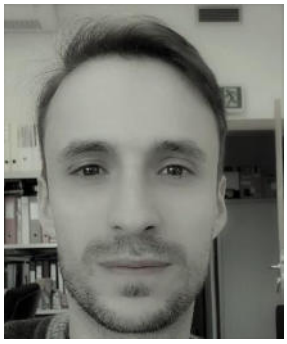
processing (freeze-drying, photocrosslinking and gelation, polymer complexation, 3D printing, among others) envisioning biomedical application. Marine biomimetics is also being explored, looking into particular features and phenomena of marine sponges and other marine invertebrates as inspiration for the design of innovative biomedical applications and smart materials. A focus is given to functional properties, enrolled in collagen aggregation and hierarchical morphologies.

These research activities have been developed through the coordination or participation on several collaborative projects (FP7/H2020, POCTEP, Atlantic Area, PT2020, NORTE2020, FCT), corresponding to the management of a total budget above 17 M€ (about 3.8 M€ of funding for UMinho).

As result of his research efforts, Tiago H. Silva is the author or co-author of 61 published or accepted scientific papers, 15 book chapters, 6 patent applications, with over 1300 citations and h-index 22 (WoS Clarivate Analytics), besides several (invited) oral and poster communications in international meetings.

He has been also active on the organization of symposia on natural origin materials and marine biomaterials within scientific conferences, being Board Member of the European Society for Marine Biotechnology and actively participating in several working groups and other forums on the topic.

Tiago H. Silva is married and a proud father of four.



KL10

GROWTH FACTOR-FREE VASCULARIZATION OF TISSUE ENGINEERED CONSTRUCTS

Rogério P. Pirraco

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ICVS/3B's – PT Government Associate Laboratory, Braga/Guimarães, Portugal

To engineer surrogates of vascularized tissues implies that a functional vascular network is created within those surrogates that will feed cells, assuring the survival and function of the tissue after transplantation to a living host. However, no completely successful strategy to achieve this objective has been developed. This vascularization problem is in fact considered the ultimate hurdle towards the widespread clinical application of Tissue Engineered constructs. The inability to successfully address this hurdle is due to many issues such as the use of poorly biocompatible scaffolds, the difficult sourcing of vascular cells, namely endothelial and ancillary cells, the need of using extrinsic angiogenic growth factors that carry a tumorigenic risk and the difficulty in providing network-maturing stimuli such as fluid flow. Thus, novel strategies to overcome these issues are needed. As potential solutions, we propose the use of scaffold-free strategies to obtain tissue engineered constructs and of the stromal vascular fraction of adipose tissue to improve the vascularization of said constructs.

Brief Biography

Rogério Pedro Lemos de Sousa Pirraco was born in 1982 in Porto, Portugal.
He concluded his PhD in 2011, at the 3B's Research Group of the University of Minho, in collaboration with Teruo Okano's group at the Tokyo's Women Medical University, Japan.
He presently serves as an Assistant Researcher at the 3B's Research Group, where he is supported by an FCT IF contract. He is the Manager of the Microscopy Facilities and Manager of the Animal Facilities of the same group.
Currently, his research is focused on the use of cell sheet engineering, stem cells and hypoxia for Tissue Engineering strategies, with a strong emphasis on vascularization. He has published more than 65 works in international refereed journals, books and conference proceedings.
Since 2019, he is the Principal Investigator of the project "CapBed - Engineered Capillary Beds for Successful Prevascularization of Tissue Engineering Constructs", supported by a 1.5 M€ Starting Grant of the European Research Council.

ORAL PRESENTATIONS ABSTRACTS

OP01

ENGINEERED SPIDER SILK FIBERS WITH ANTIMICROBIAL PEPTIDES PREVENT SURGICAL SITE INFECTIONS

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Surgical site infections (SSI) represent more than 19% of all hospital-acquired infections. Despite current scientific advances on SSI, the contamination of surgical materials and the increased rate of antibiotic-resistant microorganisms pose a serious healthcare problem[1]. In this sense, it is urgent to find new drug-free antimicrobial materials. Bioengineered spider silk proteins functionalized with antimicrobial peptides pose as an innovative drug-free biomaterial with antimicrobial properties able to inhibit early adhesion of pathogenic microbes[2,3].

Herein, we aim to explore the biological behavior and inflammatory potential of bioengineered silk-like fibers combining silk fibroin (SF) and spider silk proteins with antimicrobial peptides (6mer-HNP1) to prevent SSI by mimicking a bacterial infection in vivo. Silk fibers with 6mer-HNP1 or 6mer and commercial suture controls (Perma-Hand® silk Suture and VicrylPlus® Suture) were inoculated with Methicillin-resistant Staphylococcus aureus (MRSA) before implantation. The mechanical properties, antibacterial properties and cytotoxic behavior of the novel fibers were evaluated. The local inflammatory response of the silk fibers with 6mer-HNP1 was determined histologically and by the expression of infection-related mediators, and compared with empty defects.

The tensile strength of the silk fibers made of the bioengineered spider silk 6mer-HNP1 was significantly ($P<0.05$) higher when compared to fibers with 6mer or only SF. They showed a slow biodegradation profile. No cytotoxic effect against human fibroblast cells (MRC5 cells) was observed and no hemolysis was provoked. Moreover, the silk fibers with 6mer-HNP1 inhibited bacterial adherence in vitro by 5 log reduction on MRSA and by 6 log reduction on Escherichia coli (E. coli). The materials inoculated with MRSA in vivo generated transcript levels of inflammatory mediators upregulated after 1-day implantation, supported by histological analysis, suggesting a mild host response. After 7-days of implantation, the inflammatory mediators in the presence of silk fibers with 6mer-HNP1 and VicrylPlus® sutures were downregulated. Nevertheless, the formation of a fibrous capsule was observed in the inoculated Perma-Hand® sutures, suggesting an ongoing immunologic response.

The histological analyses of local inflammatory response indicated the presence of inflammatory infiltrates at the implant site after 1-day of implantation. Also, the transcript levels of inflammatory mediators were upregulated to the empty defects. No differences were observed between all the implanted materials after 7-days implantation, suggesting that silk fibers with 6mer-HNP1 did not elicit a long-term immunological reaction.

Results indicate that the presence of 6mer-HNP1 helped the host maintained a low but active response to bacterial infection, being able to impair the development of an acute infection. Our findings further support the potential of using bioengineered spider silk proteins to develop drug-free materials such as antimicrobial sutures capable to impair SSI.

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Brief Biography

Albina R. Franco is a Junior Researcher at the 3B's Research Group/I3Bs at the University of Minho. She received her BSc in Microbiology from the Portuguese Catholic University, Porto, Portugal, an MPhil in Plant and Soil Science from the University of Aberdeen, and her Ph.D. in Biotechnology from the Portuguese Catholic University. Her research interest focuses on unravelling the potential of polymers derived from natural sources as a new platform to develop innovative functional materials. Currently, she is exploring the application of bioengineered spider silk proteins functionalized with antimicrobial peptides as an innovative novel drug-free antimicrobial biomaterials aiming to impair materials-associated infections. She has published 31 full papers in refereed journals, with an h-index of 14, and over 660 citations and presented 62 communications, with a 3rd Best Poster Prize Award at ISBB 2012 Prague, CH.

OP02

ACTIVITY OF CORK POLYPHENOLS AGAINST METHICILLIN-RESISTANT BACTERIA

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Methicillin-resistant (MR) bacteria have emerged as a leading cause of post-operative biomaterial-related infections as they colonize and spread on their surface upon implantation. While spreading they create a physical and chemical barrier, i.e. biofilm, that protects them from most of the traditional therapeutic strategies.1 In fact, this growth of MR bacteria is not easily controlled using antibiotics, hampering patients' recovery and threatening their lives.

Natural polyphenols have been reported to present a variety of bioactivities that are relevant in the biomedical field, e.g., anti-oxidant, anti-amyloidogenic, anti-bacterial among others. Their activity is deeply linked to the number of galloyl units (Ga) in their chemical structure. In fact, previous studies from our group demonstrated that the cork-based vescalagin and castalagin (isomers presenting five Ga units per molecule) present anti-oxidant and anti-amyloidogenic activities.2,3 Moreover, epigallocatechin gallate has been reported to present enhanced anti-bacterial activity due to the presence of two Ga units per molecule.4 Based on this knowledge we extracted/isolated four cork-based extracts/compounds, i.e., cork water extract, cork water enriched extract, vescalagin and castalagin, and evaluated their anti-bacterial activity. For this assessment we selected four MR and non-MR bacterial strains that are responsible for a series of biomaterial-associated infections, namely: MR Staphylococcus epidermidis (MRSE); MR Staphylococcus aureus (MRSA); Staphylococcus aureus (SA) and Pseudomonas aeruginosa (PA). Our results show that both vescalagin and castalagin exhibit a strong bactericidal activity particularly towards the MR bacteria (i.e., MRSE and MRSA), inhibiting the formation of biofilms and disrupting the preformed ones. We show that they are able to modulate the normal assembly of the peptidoglycans present at the bacteria cell wall, leading to membrane disruption and bacterial cell death. Moreover, both compounds are non-toxic to eukaryotic cells and can be loaded into alginate hydrogels to generate anti-bacterial biomaterials.

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Brief Biography

Ana Rita Araújo was born in 1986 in Guimarães. Her academic journey started in 2006 at the Institute of Engineering of Porto (ISEP), with graduation and a Master degree course in Chemical Engineering, in 2011.During her masters, she finished her Master thesis at Kaho Sint-Lieven University, Gent (Erasmus Program). She arrived at the 3B's Research Group (3B's) in 2011, to work under the scope of different projects, namely, "WaterCork", "BioactiveCork", "LA ICVS/3Bs" and "Find & Bind" projects. In September 2014 she enrolled in her PhD at the 3B's from the University of Minho and in September 2016 she was awarded with a PhD scholarship in the Doctoral Programme in Advanced Therapies for Health (PATH) by the "Programa Norte 2020". She dedicated her PhD work to the development of natural-based compounds and the exploitation of their bioactivities as anti-bacterial, anti-UV agents, as well as in the field of Alzheimer's disease (AD). During this period she was awarded with a predoctoral grant from the IACOBUS Program, at the Center for Research in Biological Chemistry and Molecular Materials (CIQUS), University of Santiago de Compostela (Spain). As a result of her PhD research work, she was

awarded with the Young Biophysicist 2021 prize from the Portuguese Society of Biophysics (SPBf). From 2016 to 2018 she was a board member of the Portuguese Young Chemists group (GQJ) from the Portuguese Chemical Society (SPQ); Portuguese Delegate member in European Young Chemists Network (EYCN, EuChemS); and contributed to the organization of the 1st European Young Chemists Meeting (EYCheM), held together with the 5th Portuguese Young Chemists Meeting (2016). More recently, she was a founding member of the PhDynamics Group from 3B's (2018). She was also involved in the execution of the project "Chem2Nature" and "NORTHERN DISCOVERIES CTR" financed by the EC and Norte2020 regional programme, respectively. Finally, for several years that she is responsible for the Chemistry Laboratory at the 3B's, as well as for the maintenance and training actions of several types of equipment. At the moment, she is a Post-doc researcher at the 3B's.

OP03

BIOENGINEERED IMPLANT SURFACES WITH CELL-INSTRUCTIVE AND ANTIBACTERIAL PROPERTIES

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Metallic implants replace hard tissues in orthopedic and dental applications. Many are anchored in the bone and extend through soft tissues, either temporarily or permanently, to aid in recovery from lesion or to replace native tissues[1]. However, a main reason causing their failure is the lack of integration of metallic surfaces with soft tissues. This allows bacteria entering the implantation site, form a biofilm and trigger a complicated inflammatory response[2]. We hypothesized that multifunctional surfaces with cell-instructive and antimicrobial properties could improve soft tissue integration while decreasing bacterial colonization. We created anisotropic nanopatterns based on the controlled deposition of cellulose nanocrystals (CNC) on metallic surfaces. Furthermore, we used CNC surface chemistry to sequester and present bioactive molecules from platelet lysate (PL). The ability of these surfaces to guide cell growth was tested using human gingival fibroblasts. The bioactivity of the nanocoatings was tested using macrophage polarization assay and bacteria live/dead assay. We produced anisotropic nanopatterns on titanium surfaces by spin coating CNC at high speed. Furthermore, CNC-coated surfaces sequestered and formed a coating of PL-derived biomolecules, as confirmed by proteomic analysis. The anisotropic nanopatterns guided fibroblasts growth and alignment for 14 days of culture. Moreover, the PL-derived proteins polarized macrophages towards M2-like phenotype. As well, the PL-coated surfaces showed antibacterial activity against Staphylococcus aureus. These results suggest that the developed multifunctional surfaces could promote soft tissue integration to metallic implants and, at the same time, prevent bacterial invasion, tissue inflammation, and failure of biomedical metallic implants.

Acknowledgements: ITI Grant 1306_2018.

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Brief Biography

Manuel Gómez-Florit received his PhD degree in Cell Therapy and Tissue Engineering in 2015 from the University of Balearic Islands, Spain. After a post-doctoral position at the University of Oslo, in 2016, he was awarded with a Marie Curie Individual Fellowship at 3B's Research Group, University of Minho. In 2018, he was awarded with a Junior Researcher Fellowship from Portuguese Science Foundation (FCT). His research interests include the use of platelet-derived product to engineer bioactive biomaterials and to develop bioprinting strategies for tissue engineering and regenerative medicine.

OP04

GELLAN GUM-BASED INKS: A STEP ASIDE FROM THE ORDINARY

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3D bioprinting technology brought to the tissue engineering field the possibility of developing complex tissues with high reproducibility. Despite the acknowledged advantages of this technology, bioengineers are facing innumerous challenges on adapting the biomaterials previously optimized for tissue engineering, to inks for bioprinting. Up to now, collagen, fibrin or gelatin are the most used materials as inks for bioprinting owed to their rheological and biological cues. Nonetheless, issues of fast degradability are recurrently documented post-printing. Thus, herein we will introduce a new ink based on gellan gum (GG), its advantages and all the struggles overthrown throughout its adaptation for bioprinting. We aimed to develop a printable ink in which printed cells could adhere, proliferate and maturate to form a functional tissue surrogate. To attain this goal, we developed different ink formulations of GG combined with GG biofunctionalized with RGD1,2. The printability of the inks was optimized by triggering a sol-gel transition right after printing, by tailoring ink temperature pre-extrusion and prompting a fast crosslinking with an ionic crosslinker post-extrusion. The printing speed, needle diameter and layer height were also optimized for each ink. The adaptation of the ink to different cell types isolated from the human skin tissue was also performed. It is well known that cells respond differently to hydrogels of different mechanical properties and this was confirmed with our developed inks, as human dermal fibroblasts (HDFBs), human microvascular dermal endothelial cells (HMDECs) and human adipose-derived stem cells (HASCs) preferred stiffer inks since they behaved better and similarly to control conditions. We acknowledged that cell density was a key factor for the communication of the encapsulated cells and hence it was tailored for each cell type. Interestingly, cell behavior also differed among populations obtained from different donors which highlights the need of a broader study to present reliable and reproducible results. HDFBs and HDMECs viability was not affected by printing but HASCs viability decreased by 10%. Overall, cells were capable of colonizing the hydrogel one-week post-printing without affecting the mechanical structure of the hydrogel, evidencing GG-based inks as suitable and advantageous inks for the bioprinting of different skin cell types.

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Brief Biography

Lucília P. da Silva graduated in Biochemistry (BSc) in 2008 and concluded the master degree in Cellular and Molecular Biology (MSc) in 2010, both at the Faculty of Sciences and Technology of the University of Coimbra. In 2011, Lucília was awarded with a PhD grant from FCT and started the PhD program in Tissue Engineering, Regenerative Medicine and Stem Cells at the 3B's Research Group in the University of Minho. Lucília joined Healy's Lab at the University of California (Berkeley, CA, USA) as a visiting student in 2013. In 2016, she obtained her PhD degree with the highest mention of Very Good. Lucília continued at the 3B's research as post-doctoral researcher and was awarded with a junior investigator grant from FCT in the individual call to scientific employment stimulus in 2020.

Her main scientific interests are to better understand the diabetic wound pathophysiologies and to find an efficient therapy for these wounds. To achieve such goals, Lucília developed gellan gum-based spongy-like hydrogels and gellan gum-based inks that work as suitable substrates for the adhesion and proliferation of stem/primary cells. These biomaterials were published as two international patents, an important hallmark since it motivated the writing/execution of many national/international projects and boosted the interest of different biotechnology companies. Since their development, spongy-like hydrogels have been explored for different tissue engineering and regenerative medicine applications. In particular, the pre-culture of human adipose-derived stem cells in spongy-like hydrogels promoted an integrated healing of mice diabetic wounds, a work that was published in the prestigious JID journal and was recently proposed to advance for pre-clinical studies. Gellan gum-based inks are currently being explored to bioprint skin analogues in order to further develop diabetic wound models to study diabetic wound pathophysiologies.

Thank you for your participation!

Hope to see you next year in TERM STEM 2022!

Organization

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