

March 19, 2020

## 1) SUMMARY

Date: 19th – 20th March 2015

Location: Thermotechnisch Instituut, Arenberg Castle Park, KU Leuven.

Organizers: Prometheus-Division of Skeletal Tissue Engineering of KU Leuven

Co-organizers: Biomechanics Research Unit of Université de Liège, Universiteit Gent, & Universiteit Hasselt

Organizing committee: Prof. Frank P. Luyten, MD, PhD (Director, Prometheus, KU Leuven)  
Prof. Liesbet Geris, PhD (Scientific coordinator, Prometheus, KU Leuven)  
Dr. Wei Ji, DDS, PhD (Chairman of the organizing committee)  
Dr. Liliana Moreira Teixeira, PhD (Co-Chairman of the organizing committee)

The two-day (inter)national symposium on tissue engineering was successfully organised by “**Prometheus** - the Leuven Research & Development Division of Skeletal Tissue Engineering of the **KU Leuven** (<http://www.kuleuven.be/prometheus>)”. It represented an interuniversity initiative that was co-organised by tissue engineering oriented research groups from partner universities across Belgium.

This symposium attracted a significant number of young scientists nationwide (**75 peoples out of 100 in total**) as well as internationally (**25 peoples from Germany, United Kingdom, Turkey, The Netherlands, France, Poland, Switzerland and Singapore**). Together they contributed to 43 **accepted abstracts**. After stringent review by a scientific committee, **11 outstanding abstracts** were selected for oral presentation in three “young scientist forum (YSF)” sessions that were distributed over the two days. All other accepted abstracts were presented in the poster session. One best oral presentation and one best poster presentation were selected during the YSF and poster session based on the scoring from review committee.

In addition, the symposium was streamlined with 8 invited lectures by world renowned scientists on a series of scientific questions formulated based on a thorough study by Prometheus on the state-of-the-art of tissue engineering and its limitations, namely

- Mechanism of action underlying the stem cell-based strategy for tissue engineering
- Biomimetic microenvironment engineering
- Multi-scale modelling for scale up and clinical translation
- Quality controls for cell therapy applications
- Manufacturing challenges in tissue engineering and regenerative medicine

Furthermore, this symposium, collaborated with Regenerative Medicine Innovation Platform (RegMed) in Flemish Brabant (Belgium), organized a **workshop** focusing on the intellectual patent and regulation issue related with clinical translation of tissue engineering products.

### List of invited speakers

- Prof. Céline Colnot (INSERM – regenerative Medicine, FR)
- Prof. Fiona Watt (Centre for Stem Cells and Regenerative Medicine, King's College London, UK)
- Prof. Marcel Karperien (Department of Developmental BioEngineering, UTwente, NL)
- Prof. Dagmar Iber (ETH Zürich, Swiss Federal Institute of Technology, CH)
- Prof. Alan Ivković (Department of Orthopaedic Surgery, University of Zagreb, HR)
- Prof. Holger Gerhardt (London Research Institute, Cancer Research, UK)
- Prof. Pedro Granja (IBMC•INEB Associated Laboratory, UPorto, PT)
- Prof. Pamela Habibovic (MERLN Institute for Technology, UMaastrecht, NL)

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## 2) DESCRIPTION OF THE SCIENTIFIC CONTENT OF & DISCUSSION AT THE EVENT

This two-day symposium consisted of three sessions namely Biology, Technology and Biomaterials, which are the three major components in tissue engineering. Each session was primed with one or two invited lectures by international experts presenting the state-of-the art and their latest research technologies/findings, to initiate discussion on that specific topic. The sessions were then followed by a “young scientist forum (YSF)” where outstanding research findings relevant to the topic by young researchers were presented.

The first session emphasized the fundamental biological mechanism underlying stem cell based strategy for tissue regeneration. Prof Céline Colnot, from INSERM, *Imagine*-Institut of Genetic Diseases, Paris introduced the cellular and molecular bases of skeletal regeneration by using skeletal stem cells within periosteum. Their results illustrated that periosteum-derived stem cells exhibit increased regenerative capacities compared to bone marrow stromal cells. The periosteum also provides an ideal environment to support the efficient recruitment of skeletal stem cells to repair bone, through its cellular and molecular composition, mechanical properties and its interactions with surrounding muscle. Besides, muscle is also a key player in the process of skeletal regeneration via regulating inflammation, angiogenesis and producing growth factors to directly recruit cells to the fracture callus. On the other hand, Prof. Fiona Watt from King’s College London presents her fascinating data on epidermal stem cell niche. Her studies investigated the interplay between specific intrinsic and extrinsic signals in regulating stem cell fate, using a range of in vitro and in vivo approaches. Their studies have defined both soluble factors and extracellular matrix components in the niche. Taken together, these two key note speeches in the first session initiate the discussion regarding complex tissue interplays in the normal healing environment. The discussion was further expanded by four presentations in the YSF-Biology session, in which four PhD students from KU Leuven (BE), Radboud University Nijmegen (NL), UCLouvain (BE), presented their findings on fate of different sources of stem-cell, regulatory role of macrophages and hypoxia-induced signalling for bone regeneration.

The second session was highlighted by four invited speakers’ talks with the topics of developmental engineering, modelling, imaging and clinical translation, respectively. These four topics are great asset for a successful development and application of an advanced therapeutic medicinal product (ATMP). Prof. Marcel Karperien from UTwente, the Netherlands, introduced their findings in the molecular pathways which differentiate the two types of hyaline cartilage, i.e. articulate cartilage versus growth plate cartilage. These findings, combined with the knowledge of developmental biology, will likely provide new cues that can help in resolving degenerative cartilage diseases in a process called developmental engineering. Prof. Dagmar Iber from ETH Zürich gave a wonderful talk on computational models of organogenesis. Her talk illustrated that by combining recent advancements in 3D imaging technologies, computer algorithms, and computer power, scientists can develop and analyze increasingly predictive models to address the mechanism of branching in lungs and kidneys, and bone development. Prof. Holger Gerhardt from London Research Institute also presented fascinating results by visualizing the guidance of tip cell fusion during vascular development. His work aims to translate the basic finding and tip cell biology concept into clinical relevant models of tumor angiogenesis and ischemic diseases. Last but not the least, Prof. Alan Ivković from University of Zagreb gave an overview, from a surgeon point of view, on current progress in the field of regenerative orthopaedics and tissue engineering, as well as current possibilities for clinical translation. The following YSF-Technology session focused on the recent advances in tissue engineering. Three PhD students from UTwente, University of Cambridge, and KU Leuven, present their work regarding high-

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throughput production of single cell microgels, a biomimetic 3D culture system and clinical-scale expansion of mesenchymal stem cells, respectively.

The third session of the symposium focused on the recent advances in biomaterial design for tissue engineering. Prof. Pedro Granja from UPorto, initiated the session by introducing his work in molecular design of biofunctional hydrogels as artificial 3D extracellular matrices for drug and cellular delivery. Prof. Pamela Habibovic from MERLN Institute for Technology, UMaastrecht presented her work in developing instructive synthetic ceramics for bone regeneration. After two invited lectures, four young scientists also presented their work in scaffold design for regeneration, such as peptide amphiphile based scaffold, hydrogel and demineralized cancellous bone.

Among the 11 oral presentations during YSF, the best oral presentation was awarded to Dr. C.Y.Tay, a postdoc from National University of Singapore, for his research work on “Delineating the role of cell shape contractile force signals of human mesenchymal stem cells during smooth muscle cell differentiation on micropatterned hydrogel”. The best poster presentation was awarded to Adrian Moya from Paris Diderot University for his research work on “Serum deprivation preconditioning enhances long term survival of hMSC under near anoxia and absence of glucose”. Toon Lambrechts and Guillaume Tournaire from KU Leuven were the runner-up for post award.

In addition to the scientific session, this symposium first every, in collaboration with RegMed, organized a workshop to focusing on the intellectual patent and regulation issue related with clinical translation of tissue engineering products. Dr Jan Schrooten, initiated the workshop by introducing the platform of RegMed. After that, Dr. Liesbet Paemen and Dr. Andrij Michalik from De Clercq & Partners gave an overview of the patent issues for translation basic sciences to market. Dr. Luca Faciola from Promethera used the example of Promethera Biosciences to illustrate the value of IP to defend position in rare diseases and cell therapies. In addition to the IP, Prof. Isabelle Huys chaired another session of workshop with the focus on regulatory challenges for clinical translation. In this session, Dr. Christiane Niederlander from MHRA gave an update on the recent regulatory framework of advanced therapy medicinal products (ATMPs). Dr. Gilbert Verbeken from Belgian Superior Health Council gave a detailed introduction on regulatory hurdles and ethical issues related to the ATMPs in the context of hospitals.

### **3) ASSESSMENT OF THE RESULTS AND IMPACT OF THE EVENT ON THE FUTURE DIRECTION OF THE FIELD**

This symposium has gathered the international experts and young researches to share and discuss the state-of-the art and latest findings on tissue engineering such an interdisciplinary topic in aspect of biology, technology and biomaterials. Specifically, this event has resulted in a positive impact on the following

- Encouraged young scientists participate in research publications and develop their transferable skills such as academic presentation.
- Promoted scientific communications and collaborations among groups (inter)national wide.
- Gained insights in the research field of tissue engineering from the keynote lectures.

4) FINAL PROGRAMME

Thursday, 19<sup>th</sup> March 2015

8:15 – 9:00	<b>Registration</b>
9:00 – 9:15	<b>Welcome</b> <b>Prof. Dr. Frank P. Luyten</b> (Chairman, Prometheus, KU Leuven, Belgium)
9:15 – 10:00 Chairman: <b>Prof. Dr. Frank P. Luyten</b>	<b>Invited Lecture 1 - Mechanisms of action:</b> <i>Cellular and molecular bases of skeletal regeneration - new therapeutic approaches to enhance bone regeneration</i> <b>Prof. Céline Colnot</b> (INSERM – regenerative Medicine, FR)
10:00 – 10:30	<b>Coffee Break</b>
10:30 – 11:15 Chairman: <b>Prof. Geert Carmeliet</b>	<b>Invited Lecture 2 - Cell manipulation and micro-environments:</b> <i>Intrinsic and extrinsic factors modulating stem cell niches</i> <b>Prof. Fiona Watt</b> (Centre for Stem Cells and Regenerative Medicine, King's College London, UK)
11:15 – 12:15 Chairman: <b>Dr. Nick van Gestel</b>	<b>Young Scientist Forum 1 - Biology</b>
12:15 – 13:30	<b>Lunch</b>
13:30 – 14:15 Chairman: <b>Dr. Annelies Bronckaers</b>	<b>Invited Lecture 3 - Developmental engineering:</b> <i>Translation of principles of developmental biology into technology based therapeutic strategies</i> <b>Prof. Marcel Karperien</b> (Department of Developmental BioEngineering, UTwente, NL)
14:15 – 15:00 Chairman: <b>Prof. Liesbet Geris</b>	<b>Invited Lecture 4 - Modeling:</b> <i>Understanding of the dynamics and evolution of signalling pathways that determine cell fate during development</i> <b>Prof. Dagmar Iber</b> (ETH Zürich, Swiss Federal Institute of Technology, CH)
15:00 – 15:30	<b>Coffee Break</b>
15:30 – 16:15 Chairman: <b>Prof. Katleen Vandamme</b>	<b>Invited Lecture 5 - Clinical translation:</b> <i>Regenerative orthopaedics and tissue engineering: current possibilities for clinical translation</i> <b>Prof. Alan Ivković</b> (Department of Orthopaedic Surgery, University of Zagreb, HR)
16:15 – 17:00 Chairman: <b>Dr. Greet Kerckhofs</b>	<b>Invited Lecture 6 - Imaging:</b> <i>Sequential timelapse imaging in combination with clinical imaging modalities</i> <b>Prof. Holger Gerhardt</b> (London Research Institute, Cancer Research, UK)
17:00 – 17:45 Chairman: <b>Dr. Ioannis Papantoniou</b>	<b>Young Scientist Forum 2 - Technology</b>
17:45 – 18:45	<b>Poster Presentation &amp; Networking (with reception)</b>
20:00	<b>Dinner at Faculty Club, Leuven</b>

## Scientific Report – 3rd Belgian Symposium on Tissue Engineering (BSTE) 2015

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Friday, 20th March 2015

8:30 – 9:00	<b>Registration</b>
9:00 – 9:45 Chairman: <b>Prof. Peter.Dubruel</b>	<b>Invited Lecture 7 - Biomaterials for Drug and Cell Delivery:</b> <i>Molecularly-designed, cell-instructive biomaterials as 3D artificial matrices for multistage drug and cell delivery</i> <b>Prof. Pedro Granja</b> (IBMC•INEB Associated Laboratory , UPorto, PT)
9:45 – 10:15	<b>Coffee Break</b>
10:15 – 11:00 Chairman: <b>Prof. Jennifer Patterson</b>	<b>Invited Lecture 8 - Calcium Phosphate-based Biomaterials:</b> <i>Understanding mechanisms behind osteoinduction by biomaterials</i> <b>Prof. Pamela Habibovic</b> (MERLN Institute for Technology, UMaastrecht, NL)
11:00 – 12:00 Chairman: <b>Dr. Yoke Chin Chai</b>	<b>Young Scientist Forum 3 - Biomaterials</b>
12:00 – 13:30	<b>Lunch</b>
13:30 –15:10 Chairman: <b>Dr. Liesbet Paermen</b>	<b>Regenerative medicine IP &amp; regulation Workshop</b> <b>Part I – Patenting strategies</b>
15:10 – 15:30	<b>Coffee Break</b>
15:30 – 17:15 <b>Dr. Isabelle Huys</b>	<b>Regenerative medicine IP &amp; regulation Workshop</b> <b>Part II – Regulatory challenges</b>
17:30 – 18:00 Chairman: <b>Dr. Wei Ji</b>	<b>Awards and Closing</b>

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### 5) List of participants

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