SORS: "Systems Mechanobiology in Intervertebral Disc Degeneration and Osteoarthritis"

Abstract

While the burden of infectious diseases has decreased over the last decades globally, the one of Non-Communicable Disease and Disorders (NCD) continues increasing, in terms of premature loss of life quality and years of life. As such, NCD represent 70% of the top-10 disabling and life threatening diseases and disorders worldwide. Remarkably, more than half of these NCD affects mechanical load-bearing organs and tissues, and the identification of modifiable risk factors and of therapeutic targets is a major challenge. On the one hand, NCD can evolve subclinically over decades. On the other hand, the mechano-regulation of the cells that populate and regulate load-bearing tissues and organs makes pathophysiological processes be hugely multifactorial, driven by intricate physical, biophysical and biological phenomena. Computer models and simulations able to mechanistically represent key regulation phenomena over the scales are becoming increasingly valuable, to identify different pathophysiological mechanisms and stratify risk factors, for example in musculoskeletal joint degeneration. Yet, a large spectrum of the computer models and simulations must be employed, combining physics-based, biology-based, systems-based, and knowledge- and data-driven modelling. An overview of the development, analysis and achievements of such heterogeneous modelling approach, in rheumatology, will be given.

Short Bio

Jérôme Noailly holds a bachelor's degree in physical chemistry, an Engineer's and a master's degree in Material Science, and a master's degree in Acoustics. In 2002, he started a PhD on spine computational biomechanics at the Universitat Politècnica de Catalunya, Barcelona (UPC), Spain, focussing on theoretical approximations in finite element modelling. In 2006, he was awarded a Marie Sk?odowska-Curie fellowship (MECNOR-518768) and worked in computational mechanobiology for cartilage tissue engineering at the AO Foundation (Davos, Switzerland) and at the Eindhoven University of Technology (The Netherlands). In 2009, he obtained a Marie Sk?odowska-Curie reintegration grant (SEVBIOM-249210) and retook spine modelling activities at the Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain. In 2012, in his quality as PI and co-leader of the European research project My Spine (FP7-269909), he took the lead of the Biomechanics and Mechanobiology group at IBEC. He seized the opportunity to expand the research of the group to the field of computational systems biology, for the European project, The Grail (FP7-278557).

In 2015, Jérôme relocated at the Universitat Pompeu Fabra (UPF), in his quality as PI of the Multiscale and Computational Biomechanics and Mechanobiology (MBIOMM) group (2014-SGR-1616). As a member of the UPF Department of Engineering and of the SIMBIOSys group, he took the oportunity to include medical image analysis and machine learning components to his research. At the same time, he was consolidating the integration of computational systems biology approaches for multiscale explorations of tissues and organs. In 2016, he was awarded a Ramon y Cajal fellowship (RYC-2015-18888) from the Spanish government, in 2019, he became Tenure-Track Associate Professor at DTIC, and he was eventually promoted to **Full Professor**

, in 2023. He is currently co-director of the SIMBIOSys group and he is leading the Biomechanics and Mechanobiology Area of the Barcelona Centre for New Medical Technologies. He is the Coordinator of the European project Disc4All (H2020-IT-ETN-955735), and receipient of the European Research Council Consolidator Grant O-Health (ERC-CoG-101044828).

He has been supervising 15 PhD theses, and he has 150+ contributions to congresses, and 50+ articles in international journals. Internationally, he has served as a member Council of the European Society of Biomechanics (ESB), from 2016 to 2024, having been successively the **Treasurer, and the Vice-President of the ESB**, between 2020 and 2024. He is a past president of the National Spanish Chapter of the ESB, and Chair of the Student Committee of the Virtual Physiological Human Institute (VPHi).

Speakers

Speaker: Jérôme Noailly. Co-director of the SIMBIOSys group. Leader of the Biomechanics and Mechanobiology Area of the Barcelona Centre for New Medical Technologies. Coordinator of the European project Disc4All.
Host: Alfonso Valencia, Life Sciences Department Director, BSC.
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