Department of Biomedical Engineering
The Chinese University of Hong Kong

Bioactive materials interacting with cells and tissue through surfaces: The role of processes, linking arms and biomolecules

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Abstract

Over the last 50 years, biomaterials, prostheses and implants saved and prolonged the life of millions of humans around the globe. The main clinical complications for current biomaterials and artificial organs still reside in an interfacial mismatch between the synthetic surface and the natural living tissue surrounding it. This is particularly true on metallic biomaterials. In fact, despite several works addressed and advanced, the challenge that the interface represents, clinical complications are often observed. Today, additive manufacturing, nanotechnology, nanomaterials and surface modifications provide new insight to bring effective advances to the current problem of clinical complications and even allow us to envisage strategies for organ shortage. Advanced technologies from materials science, merged with new biological paths towards the development of functional solutions for clinical applications, open new doors for conferring properties to metallic biomaterials that a decade ago were unthinkable. In this talk, the potential of merging 1) novel processes from surface science allowing grafting of biologically active molecules, with 2) advanced processes for metals showing extreme properties and controlled composition to provide engineering solutions to clinical challenged will be depicted. Focus will be on how surface modifications might or might not fulfill the expectations for personalized medicine, on how nanostructures might or might not answer to the demand of metals-by-design implants, and how surface modifications might or might not confer what is required for the metal to interface and integrate the surrounding tissue and cells. The intrinsic goal of this talk is to present an extremely personal look at how the next generation of biodegradable and not-biodegradable metals can impact clinics and surgery, and how the resulting unique properties allowed biomedical functional applications to progress, from their introduction to the promising future that metals may or may not continue to hold for improving the quality of the life of millions worldwide.

Biography

Dr. Diego Mantovani is a Full Professor at Laval University's Department of Min-Met-Materials Engineering, Director of the Laboratory for Biomaterials and Bioengineering, and a senior scientist in regenerative medicine at the University Hospital Center of Quebec City, where he previously served as Adjunct Director of the Regenerative Medicine Division. A globally recognized specialist in biomaterials and bioengineering for organ and tissue repair, his research focuses on surface plasma modifications, polymer films, cell-materials interactions, degradable metals, and cardiovascular tissue regeneration. Since 2012, he has held the prestigious Canada Research Chair Tier 1 in Biomaterials and Bioengineering for Innovation in Surgery. He has authored over 500 articles, holds 5 patents, and has been cited more than 22,000 times. A Fellow of multiple major societies (including the World Biomaterials Science and Engineering Society, AIMBE, and Canadian Academy of Engineering), he served as President of the Canadian Society for Biomaterials and Executive Chair of the 10th World Biomaterials Congress. Regularly advising Health Canada, ASTM, and FDA on degradable metals, he has held invited professorships worldwide and, since 2020, has been ranked among the top 1% of most-cited scientists globally (Stanford ranking). In May 2024, he was elected to the FBSE Steering Committee, coordinating the International College of Biomaterials Science and Engineering.

***** ALL ARE WELCOME *****