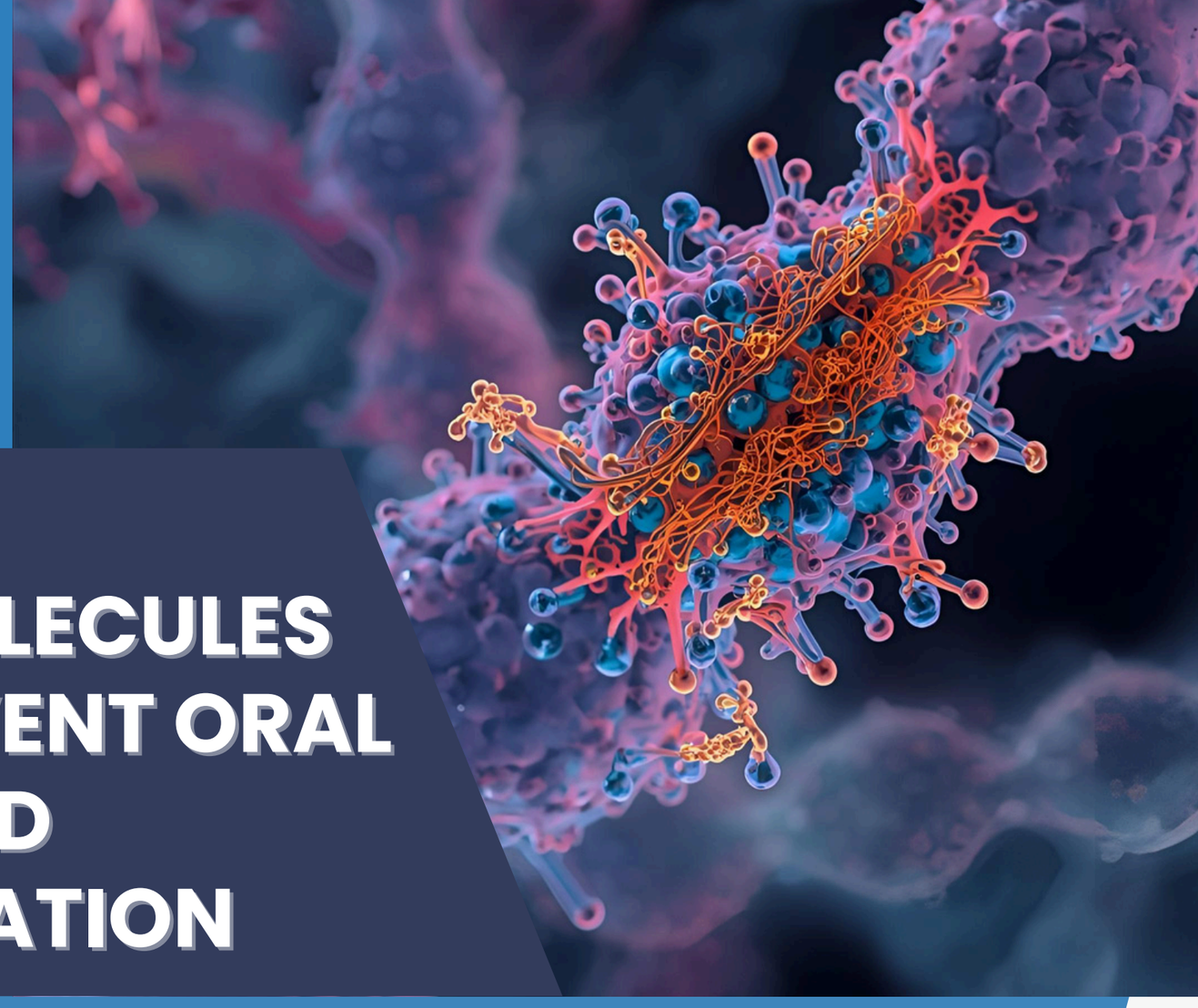
Politecnico di Torino



DIMEAS SEMINAR

SELF-ASSEMBLED BIOMOLECULES AND MATERIALS TO PREVENT ORAL IMPLANT INFECTIONS AND CONTROL BIOMINERALIZATION

SPEAKER

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Tuesday, October 14
9.30 am

Meeting room, III floor,
DIMEAS - Politecnico di Torino

Abstract

Infections of transepithelial implants, such as dental implants, catheters, or osseointegrated prostheses for amputees are the most prevalent cause of rampant failures for these devices. We have explored bioinspired modification of surfaces of restorative/regenerative materials and implants to address oral infections by harnessing the biomolecular toolbox --oligopeptides, proteins, recombinamers, … and thus, mitigating the worldwide threat of antimicrobial resistance.

One of our strategies aimed at exploiting secondary structure and self-assembly of anti- biofilm peptides and recombinamers to increase anti-biofilm potency vs relevant oral biofilms and to form highly hydrophobic interfaces to obtain dual-action surfaces to address infection in dental and other transepithelial peri-tisular and peri-implant sites. Alternatively, we have found inspiration in the natural junction at the tooth-oral mucosa interface. We have tapped basement membrane peptides known to engage specific integrins as well as synthesized new bioinstructive photocurable resins that stimulate formation of hemidesmosomes on synthetic and natural surfaces. We recently have also combined those strategies with immunomodulatory regulation to reduce inflammation triggered by pathogenic biofilms causing infection.

Surface modification of transepithelial implants with biomolecules represents a versatile, multifunctional, and effective approach to control bacterial colonization and thus, prevent infection.

If time allows, the seminar will also cover our work on building a variety of advanced biomaterials for hard tissue engineering using synthetic organic biomatrices as structural template for the bottom-up fabrication of organic-inorganic nanocomposites. By controlling mineral deposition in the organic matrices, predictable morphology of the mineralized nanocomposites can be obtained. We have designed and used elastin-like recombinamers (ELRs) and cellulose in different shapes, electrospun nanofibers, 3D hydrogels, and coatings to template mineralization ofhydroxyapatite nanocrystals using the biomimetic Polymer-Induced Liquid-Precursor (PILP) process or the enzyme-directed mineralization process. Different from conventional mineralization where minerals are nucleated and grown or deposited on the surface of organic matrices, the minerals are deposited within the framework of the insoluble biomolecular structures, attaining high mineral density, bioactive response, and mechanical properties similar to those of natural hard tissues

By designing and controlling the morphologies of biopolymers matrices at different dimensional levels, diverse hybrid nanocomposites with optimized mechanical and biological properties can be constructed, suited for the treatment of bone defects using regenerative medicine approaches.

BIO

Dr. Aparicio is Group Leader of the *Bioinspired Oral Biomaterials and Interfaces (BOBI) Lab*, ICREA Research Professor and Full professor at the Dpt. of Materials Science and Engineering of the *UPC-Technical University of Catalonia* since September 2024. Dr. Aparicio is materials engineer by training. He started his academic career at UPC, but moved to University of Minnesota (UMN) where he spent 12+ years in the Dpt. of Restorative Sciences and was Deputy Director of the Minnesota Dental Research Center for Biomaterials and Biomechanics. He returned to Barcelona as FBA fellow at UIC Barcelona–Universitat International de Catalunya, where he was Vice-rector for Research, Innovation and Knowledge Transfer and director of the Study and Control of Oral Infections Research Group. He is also associated researcher at IBEC-Institute for BioEngineering of Catalonia and elected fellow of AIMBE-American Institute for Medical and Biological Engineering.