The platform of materials and functionalization routes for the biofabrication of GIOTTO devices

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Abstract

The incidence of osteoporotic fractures is expected to double rapidly due to progressive population ageing. In this context, the GIOTTO project aims to develop three different devices to treat specific osteoporosis fractures through the synergistic combination of smart nanomaterials and 3D fabrication technologies. The three devices will share the use of novel bioactive inorganic phases, nano-hydroxyapatites and mesoporous bioactive glasses, substituted with biologically active ions able to stimulate bone production (e.g. Sr^{2+}). The developed inorganic phases will be dispersed in a resorbable matrix to produce composites with the desired resorption kinetics and matching the fracture specificities at different body sites. In particular, the bioactive materials will be combined with the following different matrices:

- an optimised blend of biodegradable polyesters (e.g. PLLA, PCL) to fabricate 3D scaffolds by extrusion-based printing
- collagen matrix to produce a flexible, fibrous injectable scaffold through electrospinning
- calcium sulphate hemihydrate to produce an injectable resorbable radiopaque cement

GIOTTO materials will be also *ad-hoc* functionalised through different strategies, with the dual aim to impart specific properties (e.g. mechanical resistance, degradation kinetics) to the final devices and to couple them with a novel recombinant biomolecule able to inactivate the osteoclast activity (ICOS-Fc).

Biography

Sonia Lucia Fiorilli graduated in Industrial Chemistry and took her PhD in Materials Science and Technology at Politecnico di Torino in 2005. Currently she is Associate Professor at Politecnico di Torino, where she is lecturer of "Chemistry", co-lecture of "Physical chemistry of materials for nanotechnologies". Her research activity mainly focuses on the synthesis, characterization and functionalization of bioceramics, as coatings and 3D scaffolds, for bone and soft tissue regeneration. More recently, her research interests also include the design of 3D printed biomimetic scaffolds based on the combination of collagen and inorganic bioactive phases, properly optimised through different cross-linking methods.

Prof. Fiorilli is involved in several funded projects as principal investigator or WP/task leader, including EU-H2020 projects (e.g. EU-H2020- NMBP-22-2018- GIOTTO, EU-H2020-NMP6-2015 MOZART, MSCA-ITN Action POLYSTORAGE) and national projects (e.g. PI of ZODIAC "Zwitterionic mesOstructureD glAsses: powerful deviCes for bone regeneration").

She is currently involved in the supervision/co-supervision of 6 PhD students.