

Title	New chemical processes directing the nucleation of bioactive nanoceramics, consolidated into 3D multifunctional scaffolds for regenerative medicine
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Project description:

The project will investigate chemical reactions yielding the nucleation and assembling of cell-instructing ceramic phases into 3-D porous bodies acting as scaffolds for regenerative medicine, particularly addressed to bone tissue. The new bioceramics will be obtained as micro-extrudable formulations with rheological properties thermally and chemically controlled to achieve consolidation into the final scaffolds at low temperature. This approach will uniquely permit to obtain 3D scaffolds capable of superior regenerative ability and mechanical performance. The Ph.D candidate will gain theoretical and practical skills in ceramic science and technology, particularly: - chemistry of calcium phosphates; -ceramic synthesis routes; -recrystallization phenomena; - powder processing; physicochemical, morphological mechanical and biological characterization methods. Non-conventional reactions in supercritical conditions and innovative heating technologies will be also investigated.

Publications:

- Tampieri A, Ruffini A, Ballardini A, Montesi M, Panseri S, Salamanna F, Fini M, **Sprio S** (2019). Heterogeneous chemistry in the 3-D state: an original approach to generate bioactive, mechanically-competent bone scaffold. *Biomater Sci.*, 2019, **7**, 307 – 321.
- Ballardini A, Montesi M, Panseri S, Vandini A, Balboni PG, Tampieri A, **Sprio S**. (2018) New hydroxyapatite nanophases with enhanced osteogenic and antibacterial ability *J Biomed Mater Res.* 106(2):521-530.
- Montesi M, Panseri S, Dapporto M, Tampieri A, **Sprio S**. (2017) Sr-substituted bone cements direct mesenchymal stem cells, osteoblasts and osteoclast fate, *Plos One*, 12(2): e0172100.
- Sprio S**, Dapporto M, Montesi M, Panseri S, Lattanzi W, Pola E, Logroscino G, Tampieri A. (2016) Novel osteointegrative Sr-substituted apatitic cements enriched with alginate. *Materials* 9: 763.

Collaborations/Network:

✦Prof. Maria-Pau Ginebra, Universitat Politècnica de Catalunya, Spain; ✦Prof. Christophe Drouet, Institut National Polytechnique de Toulouse, France; ✦Prof. Davide Bigoni, Università degli Studi di Trento, Italy; ✦Prof. Gianmario Martra, Università degli Studi di Torino, Italy.

Research funding:

- Progetto PG/2018/632022. Sviluppo e validazione di biomateriali medicati nanostrutturati per il trattamento e la rigenerazione del tessuto osseo metastatico – DINAMICA (2019-2022)
- Progetto PRIN 2017C8RYSS_002. Osteosarcoma and mesenchymal stem cells to assay innovative materials, bioactive injectable bone cements, with drug delivery ability (2019-2022)