



Call for proposals: postdoctoral fellowship in the field of Biomaterials (18 months)

Project title: Antimicrobial Surfaces Development for Dental Biomaterials (SAMBA - *Élaboration de Surfaces Antimicrobiennes pour des Biomatériaux dentaires*)

Scientific project summary:

Currently, the severe rise in antibiotic resistance is one of the most serious threats to European and global health. A medical device with specific antibacterial properties would allow decreased antibiotic resistance and would therefore constitute a real public health issue. In this context, the aim of the SAMBA project is to develop new textured surfaces with antimicrobial properties. This effect can be obtained by optimizing these surfaces via the synergy of **(i)** chemical functionalization by an antimicrobial molecule (recent studies conducted by LMI have led to the development of an original group of antibacterial compounds based on copper, zinc and silver metal ions); **(ii)** optimised surface architecture, obtained at MATEIS by additive manufacturing. That would enhance the active molecules dispersion and the material surface topography, in order to inhibit initial biofilm formation on one hand, and then control the active antimicrobial agent release kinetics on the other hand.

In the SAMBA project framework, two complementary approaches would permit the release kinetics control at several stages: the first approach is that the antibacterial complexes could be directly incorporated inside the biomaterial, another approach is to encapsulate these complexes inside mesoporous silica particles (developed at LMI), These functionalized particles would be themselves introduced into the material before printing.

Mesoporous silica particles will then act as a vector for the active molecules, enhancing their efficiency and their release kinetics and in the same time preserve them from degradation. Ultimately, the aim will be to assess the biological reaction of the functionalised biomaterial and evaluate the release of active molecules incorporated effect. This project involves thus the complementary expertise of LMI (new bioactive materials development & biological assessment) and MATEIS (biomaterials processing and characterization).

Keywords:

Biomaterials, Bioactivity, Dental cement, Metal complexes, Antimicrobial surfaces, Mesoporous silica, Additive manufacturing (robocasting).

Desired skills: Materials chemistry (including synthesis skills), biomaterials, chemistry/biology interface

Degree: PhD

Candidate profile:

The motivated candidate should have a good knowledge in **chemistry** for the **new antibacterial complexes elaboration** and **their integration in the phosphocalcic cement**. Also, he/she should be familiar with **cell biology techniques (chemistry-biology interface)** for the biological behaviour assessment of the new functionalized biomaterial. Even basic knowledge of 3D printing will be appreciated. Moreover, this project being multidisciplinary, an interest in biomaterials for health and



their processing would be an advantage. This project, at the interface between different fields of chemistry, physical chemistry and cell biology applied to biomaterials, requires an open-minded candidate who can easily adapt to the proposed approaches. Due to the close collaboration with researchers from two research teams from LMI and MATEIS, the candidate relational and organizational aspects will also be required. The candidate will share his/her time between the two laboratories in Lyon (La Doua and Laennec campus) and will have to ensure the link between the 4 research teams involved in the research project.

Contact details: for LMI : Nina ATTIK (nina.attik@univ-lyon1.fr) & for MATEIS: Solène Tadier (solene.tadier@insa-lyon.fr)

Selection of publications from research teams related to the proposed topic:

1. Boughougal A, Cherchali FZ, Messai A, Attik N, Decoret D, Hologne M, et al. New model of metalloantibiotic: synthesis, structure and biological activity of a zinc (II) mononuclear complex carrying two enrofloxacin and sulfadiazine antibiotics. *New J Chem* 2018;42:15346–52. <https://doi.org/10.1039/C8NJ01774C>.
2. Ramirez Caballero SS, Saiz E, Montembault A, Tadier S, Maire E, David L, et al. 3-D printing of chitosan-calcium phosphate inks: rheology, interactions and characterization. *J Mater Sci: Mater Med* 2019; 30:6. <https://doi.org/10.1007/s10856-018-6201-y>.
3. Mocquot C, Colon P, Fernando D, Jackson P, Pradelle-Plasse N, Grosgeat B, et al. The influence of experimental bioactive glasses on pulp cells behavior in vitro. *Dental Materials* 2020;36:1322–31. <https://doi.org/10.1016/j.dental.2020.07.006>.

Host institutions:

Laboratoire des Multimatériaux et Interfaces (LMI) & Laboratoire Matériaux Ingénierie et Science (MATEIS)

Project estimated start date: November 2022.

Salary: Salary: between 3K and 3.5K€ gross/month according to profile.