



## Bone regeneration in 3D architected scaffolds

Doctoral school IMEP2 Starting Date : oct 2015

**Scientific context:** In the field of orthopedics, spine and dental surgery, traumatic situations or congenital diseases can lead to critical sized bone defects or to fractures, which cannot heal spontaneously. In about 5-10 % of cases, when consolidation is too weak, bone grafts need to be used. Implantable materials are currently being developed as an alternative to bone grafts. These metallic or polymeric implants can be degradable or non degradable. A great challenge is to boost bone regeneration in order to form a new functional bone.

### PhD project in engineered bioactive scaffolds biomaterials.

We aim to engineer 3D macroporous titanium scaffolds that possess a controlled macroporosity and a tunable surface bioactivity in order to study the respective influence of each parameter on the regeneration of bone tissue: 1) spatial architecture via the controlled macroporosity and 2) biochemistry via the presence of a protein able to induce locally bone regeneration. To this end, the scaffolds will be coated with a biopolymeric film recently developed in the group [1-2].

The new bone forming inside the macroporous scaffold as well as the interface between the scaffold and bone will be characterized at high resolution (about 500 nm). In vitro experiments will be done using bone progenitors and in vivo experiments will be done in a small animal model in collaboration with clinicians.

Techniques : additive manufacturing of architected scaffolds, mechanical characterization, scanning electron microscopy, histology, X-ray tomography, cell culture and biological assays.

### Location

The PhD candidate will be working at the Laboratoire des Matériaux et du Génie Physique (LMGP) in the « Interfaces between Materials and Biological Matter » (IMBM) group in collaboration with SIMAP and Univ of Illinois at Urbana-Champaign (Prof Wagoner Johnson). The lab is located on the MINATEC Campus in Grenoble on the scientific Polygone. The SIMAP laboratory is located on the university campus in St Martin d'Hères.

Grenoble offers a high quality of life and lots of opportunities for those who like outdoor activities and mountains.

Web Sites : <http://www.lmgp.grenoble-inp.fr/> and of the group : <http://erc-biomim.grenoble-inp.fr>

### Profile & requested skills

Engineer or Master Student in materials science/biomaterials/bioengineering who is open to multidisciplinary work. Team work and oral/written expression in english will be highly appreciated.

**Montly Allowance 1713 € brut/month.**

### Supervisors

-Catherine PICART, Grenoble Institute of Technology, 3 parvis Louis Néel - CS 50257, 38016 Grenoble

Email : [Catherine.Picart@grenoble-inp.fr](mailto:Catherine.Picart@grenoble-inp.fr)

-Remy DENDIEVEL, Grenoble Institute of Technology, SIMAP/GPM2, Domaine Universitaire, site Ampère BP46, 38402 Saint Martin d'Hères cedex

Email : [remy.dendievel@grenoble-inp.fr](mailto:remy.dendievel@grenoble-inp.fr)

### Application

Please send your CV (including 2 names of references) + a motivation letter + the record of your grades (M1 and M2) to [Catherine.Picart@grenoble-inp.fr](mailto:Catherine.Picart@grenoble-inp.fr)

**Before May 26<sup>th</sup> 2015**

### Bibliographic references

1. Guillot R., Gilde, F., Becquart, P., Sailhan, F., Lapeyrere, A., Logeart-Avramoglou, D., Picart, C. (2013) The stability of BMP loaded polyelectrolyte multilayer coatings on titanium. *Biomaterials*, 34 (23), 5737-5746.
2. Cruzier T., Sailhan, F., Becquart, P., Guillot, R., Logeart-Avramoglou, D., Picart, C. (2011) The performance of BMP-2 loaded TCP/HAP porous ceramics with a polyelectrolyte multilayer film coating. *Biomaterials*, 32 (30), 7543-7554.