

# ArCir – Dynamique project - BioCerMed

## Post-doc recruitment

A post-doctoral position is available (from October 2014, 18 month) at the Laboratory/Group of Research on Biomaterials (GRB, Inserm U1008, University Lille 2) located in Lille, France. This position is opened in the framework of the “Regional concerted initiative actions of research” of region Nord-Pas de Calais, France. The acronym of the project is BioCerMed: Anti-infection & Anti-cancer Functionalized Bioceramics Implants for Medical application.

### Scientific background of the project

Despite the progress in bone cancer surgery and chemotherapy, those methods compared with historical controls show only a modest improvement in overall survival due to failure of removing all residual cancer cells at surgical margin and the extreme side-effect from the adjuvant postoperative treatment. Calcium phosphate bioceramics could be ideally applied not only as a bone regeneration scaffold but also “carrying” the well-chosen anticancer weapons to eliminate residual cancer cells. The project proposes to associate degradable polymer drug carrier system with bioceramic bone substitute materials (calcium phosphate-polymer composite) to load anticancer drugs for supply extended drug release. The choice of appropriate drug delivery system can place drug at the right location, for the desired duration and at the efficient concentration.

Therefore, the main objective will be developing biodegradable hydrogel as drug carrier to retain anticancer molecule, and applied as bone regeneration materials in post-drug delivery phase. In addition, such carrier system could also be incorporated into the macroporous structure of bioceramic bone void filler to form a bioceramic composite. Therefore, it necessitate the evaluation of drug (anticancer & antibacterial agents) loading efficacy and delivery kinetics; and also concerns comprehensive biological evaluation (*in vitro*) on the cytocompatibility and tissue engineering scaffold potential of hydrogel material, the anticancer or antibacterial activity of delivered drug in *in vitro* model and *in vivo* animal implantation experiment, etc. No existing anticancer bone substitute biomaterials in the world market so far, if ever the final product has been proved efficacious, it can fill the gap of market besides that in cancer therapeutic field.

### Several international patents already protect the Project

Subsequently a Non-Disclosure Agreement will be signed.

## Summary of the task

Study of the release of active molecule: The kinetics of bioactive molecules release hydrogel-bioceramic composite will be evaluated in different environments (approximate *in vivo* conditions) and under different conditions (similar to that of the implantation site). These studies will determine, through mathematical modeling, the kinetics of release of the therapeutic molecule.

Biological evaluation: Once optimized the composite material (bioceramic and hydrogel), the biological evaluation will be conducted to investigate the cytocompatibility (proliferation, cell adhesion and vitality, mineralization, *etc*) of hydrogel material and bioceramic/hydrogel composite. Hydrogel/cell incorporation study should be conducted to assess the potential of this material as tissue engineering scaffold for bone regeneration or vascularization. Further study will then need to demonstrate the activity of the biomaterial on human bone tumor cells. It is also important to show that the presence of hydrogel system do not interfere with the proliferation of osteoblastic cells, endothelial cells after the release of the molecule (e.g. cisplatin, gentamicin).

Animal experimentation: Animal testing will be performed on a rat (or dog) model with the animal study infrastructure accesible by our lab. This study will prove the efficacy of this new product for extended drug delivery by pharmaceutical analysis; and its safety by investigation of histological section for inflammatory reaction, *etc*.

### Qualifications required

The recruit must meet following requirements:

- 1) Generally, the competence of **in vitro cell biological techniques** and the experience of **manipulation of hydrogel material for tissue engineering use**.
- 2) Good experiences in **experimental and surgical techniques in the rats or mice** for implantation of biomaterials and **post-sacrifice analytical techniques**.
- 3) A high **performance (oral and written) in English language** will be appreciated.

**Salary:** ~ 1800 € net/month for 18 months; from october 2014.

**To apply:** send an E-mail and a motivation letter with a CV mentioning some contacts, to Dr Nicolas BLANCHEMAIN.

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