Postdocotoral position

**Job title:** Development of cryogenic electron microscopy methods for the study of new tissue engineered biomaterials

**Workplace:** NANTES  
**Contract Period:** 12 months  
**Starting date:** 15 January 2021 at the latest  
**Proportion of work:** Full time  
**Salary:** around 2675 Euros gross monthly

**Short summary of job:**
This project aims at characterizing relevant structural, morphological and chemical factors at the origin of the interactions between innovative tissue engineered biomaterials with stem cells encapsulated inside the biomaterials’ structure. The recruited candidate will develop methods for cryogenic 3D FIB/SEM data acquisition and analysis and apply them to selected calcium phosphate cements (CPC)/polymer composite foams candidates with promising performance for bone repair applications.

**Full description of the project:**
Within a clinical context, a significant part of the population is affected by trauma, degenerative diseases and bone fractures, representing a major public health concern. Present trends in regenerative medicine aim at replacing damaged genuine tissue by tissue engineered structures. These are highly porous 3D structures capable of entrapping cells and growth factors to promote cell proliferation, viability and differentiation, as well as to act as templates guiding the growth of the new tissue. Generally, many of the materials tested to date as bone substitutes fail to integrate with the host tissue due to factors such as limited bone regeneration capacity, mechanical faults or infection. Understanding the materials-cells interactions at high spatial resolution could guide the optimization of novel formulations with enhanced biological performance.

The successful applicant will develop methods for cryogenic 3D FIB/SEM data acquisition and analysis and apply them to selected calcium phosphate cements (CPC)/polymer composite foams candidates with promising performance for bone repair applications. Tasks include trouble-shooting in cryo-FIB and cryo-FIB lift-out preparation of fresh frozen sections, development of novel acquisition schemes and workflows for the tomographic distribution of the different elements within the foam, the development of methods for ultra-low dose cryo-EDS acquisition and analysis to study chemical interdiffusion, identification of possible new products or chemical reactions.

The successful candidate will have access to unique imaging and analytical electron microscopy capabilities in the IMN. A newly acquired FIB (ZEISS Crossbeam 550L) with EDX and cryogenic capabilities will serve for 3D imaging and spectroscopy of the biomaterials. There is the possibility of preparation of a thin lamella to be further analysed in a scanning transmission electron microscope in cryogenic conditions. The Nant’Themis (STEM) (Thermo Fisher Scientific Themis Z G3) will be used and allows for the possibility of cooling (-196 °C), low dose mode and highly sensitive detectors (direct detection of electrons) coupled with an EEL spectrometer.

Promising new composite foams, with improved biocompatibility and biofunctionality have been developed within the framework of a long collaboration between RMeS and IMN. Fresh sections of these composite foams (cement + hydrogel), as well as bone sections containing the new composite foams with encapsulated human mesenchymal stem cells will be provided through close collaboration with Pr. Pierre Weiss (Team Leader of “Regenerative medicine of bone tissues”, INSERM U1229, Univ. of Nantes) and Pr. Jean Le Bideau (Head of group on confined liquids, IMN - PMN group).
Work Context / Scientific framework of the position:

This postdoc is funded as part of a Junior Talent project (e–BRIDGE), overseen by NExT and supported by the French ANR (ANR-16-IDEX-0007), the Pays de la Loire Region and Nantes Métropole.

The host laboratory is the Institute of Materials Jean Rouxel (IMN, UMR 6502). The IMN is a joined research centre between CNRS and the University of Nantes, composed by over 200 staff members including over 75 permanent staff members and around 80 PhD students and postdocs. The postdoctoral researcher will benefit from interaction with numerous colleagues working on a number of fields of material sciences through experiments using a myriad of advanced characterization techniques and through simulations. Through the e–BRIDGE project, the postdoc will be part of an advanced electron microscopy group, aimed at the elucidation of material structure and composition down to the atomic scale, using newly acquired cutting-edge electron microscopy capabilities in the Pays de la Loire. Within IMN, the postdoctoral researcher will join the PMN (Physics of materials and nanostructures) team, as part of a research axis aimed at the study of biomaterials and their interfaces at the nanometer scale.

The successful candidate will collaborate closely with the Regenerative Medicine and Skeleton (RMeS) laboratory, UMR Inserm U1229. The RMeS laboratory is a joint research unit (Inserm, University of Nantes, Oniris) and a center of excellence and national leader in skeletal ageing and regenerative medicine. Its themes range from the study of the mechanisms that govern the development, growth and aging of bone and joint cartilage to the development of innovative 4R (Replacement, Repair, Regeneration, Reprogramming) skeletal treatment strategies. The RMeS laboratory is organized in 2 independent research teams: STEP (28 people) and REGOS (29 people). Within each team, a strong link between fundamental research and clinical applications exists thanks to the presence of biologists, physico-chemists and clinicians. Work at RMeS will be undertaken within the REGOS (“Regenerative medicine of bone tissues”) team, focused on the molecular aspects of aging and bone pathophysiology and on the development of hybrid biomaterials for bone regenerative medicine.

Both laboratories are located in the Nantes area, with easy permutation (20 min, single tram line) using public transport.

Applicant’s profile and requirements:

You hold a PhD in the life sciences, physics, engineering or related disciplines.

You have several years of experience in focused ion beam and scanning electron microscopy (hardware and software), image processing and sample preparation.

You are enthusiastic and greatly interested on performing accurate experimental work using advanced equipment, experimental design as well as data processing methods.

You would like an interdisciplinary project with future clinical applications.

You are quality-oriented, conscientious, creative, and cooperative, with a taste for scientific rigor.

You are able to communicate to different audiences and have high level of English.

We are looking for a candidate with excellent experience in sample preparation and characterization by scanning electron microscopy and focused ion beam of electron beam sensitive materials as well as quantitative image analysis and used to interact with biologists. Experience in instrumentation optics, cryogenic methods, 3D FIB-SEM data reconstruction and knowledge of physico-chemical materials sciences would be a plus without it being mandatory.

Geographic location:
RMeS: map here; IMN: map here

Contact:
For any additional information on the project and/or recruitment process, please contact Dr. Patricia Abellan (patricia.abellan@univ-nantes.fr). All applications must be sent through the “portail emploi CNRS” and must include a CV and a cover letter outlining your motivation and 2 references.