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**Host laboratory:**

BioSanté, BRM team

<https://biosante-lab.fr/en>

**Title of the M2 research internship:**

Polymer brushes carrying BMPs to drive osteogenic differentiation (OsteoBrush)

**Project summary:**

This project named OsteoBrush aims to develop a novel biomimetic material to drive the osteogenic differentiation of stem cells for future regenerative medicine applications. This biomaterial is made of polymer brushes carrying bone morphogenetic proteins (BMPs). Bone morphogenetic protein 2 (BMP2) is a growth factor known for its osteogenic potential and for its clinical use for de novo bone formation. In vivo BMPs are presented to cells bound to the glycosaminoglycan heparan sulfate (HS). BRM team have shown that HS enhances BMP2-mediated osteogenic differentiation (Sefkow-Werner et al 2020, Migliorini et al 2017, Sales et al 2021). It is however complicated to present grafted HS on scaffolds for clinical applications due to its heterogeneity and its possible degradation. Polymer brushes presenting sulfonate groups may be a smart alternative to HS. In collaboration with the group of J. Gautrot at Mary Queen University of London we proved that these brushes bind to BMPs. The role of the candidate will be to test different brushes architectures, densities and thicknesses on BMPs binding and cellular response to identify the best conditions to obtain cell adhesion and differentiation. This project is part of a collaboration with J. Gautrot, therefore the student will spent part of his time in his laboratory in London to learn how to grow the polymer brushes and how to characterize them. At BRM team, the student will (i) study brushes interaction with BMPs and (ii) grow cells on top of these brushes to study their adhesion and osteogenic differentiation by immunofluorescence and/or qPCR.

We expect to recruit a highly motivated student with an interdisciplinary background on biology and/or biophysics and engineering. Good level of spoken and written English is important for the collaboration with the group in UK.

**Keywords:**

biomaterials, cell differentiation, bone morphogenetic proteins

**Relevant publications of the team:**

Migliorini, E., A. Guevara-Garcia, C. Albiges-Rizo and C. Picart (2020). "Learning from BMPs and their biophysical extracellular matrix microenvironment for biomaterial design." *Bone* 141: 115540.

Migliorini, E., P. Horn, T. Haraszti, S. Wegner, C. Hiepen, P. Knaus, P. Richter and E. Cavalcanti-Adam (2017). "Enhanced biological activity of BMP-2 bound to surface-grafted heparan sulfate." *Advanced Biosystems* 1(4): 1600041.

Sefkow-Werner, J., P. Machillot, A. Sales, E. Castro-Ramirez, M. Degardin, D. Boturny, E.-A. Cavalcanti-Adam, C. Albiges-Rizo, C. Picart and E. Migliorini (2020). "Heparan sulfate co-immobilized with cRGD ligands and BMP2 on biomimetic platforms promotes BMP2-mediated osteogenic differentiation." *Acta Biomaterialia*.

Sales, A., V. Khodr, P. Machillot, L. Chaar, L. Fourel, A. Guevara-Garcia, E. Migliorini, C. Albigès-Rizo and C. Picart (2022). "Differential bioactivity of four BMP-family members as function of biomaterial stiffness." *Biomaterials*: 121363.

Khodr, V., P. Machillot, E. Migliorini, J.-B. Reiser and C. Picart (2021). "High-throughput measurements of bone morphogenetic protein/bone morphogenetic protein receptor interactions using biolayer interferometry." *Biointerphases* 16(3): 031001.