Laboratoire Colloïdes et Matériaux Divisés

Postdoc :
Cyste formation in hydrogel capsules

Possible artifactual behaviors of individual cells in 2D, as compared to 3D, stimulate the creation of 3D artificial environments that mimic the physiological environment experienced by cells in any multicellular organisms. LCMD has recently developed a novel protocol of liquid core capsule formation well suited for cell culture since the fabrication procedure involves a minimal number of steps and is only based on aqueous solutions and biocompatible compounds [1]. The basic principle is to gel a liquid core-shell structure template formed by a co-extrusion technique. Capsule creation is thus based on a two-step procedure: the formation of a compound drop in air followed by the gelling of the coating layer once the compound drop enters a gelling bath (Fig. 1). The so-formed capsules possess a thin hydrogel membrane made of alginate whose permeability and mechanical properties are known [2]. For example, capsules allowed to create multicellular spheroids for which the pressure exerted by cells during growth could be probed via the elastic deformation of the capsule [3]. Moreover, this encapsulation strategy allows a large production rate of such compartments that opens the way to screening applications of micro-tissues.

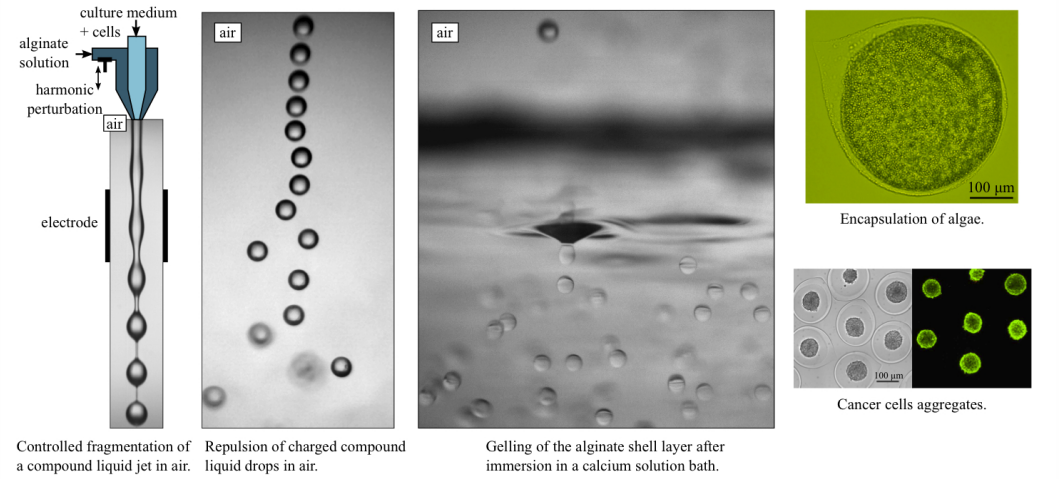

Figure 1: Principle of liquid core hydrogel capsule formation and examples of cell encapsulation.

For the present project, we wish to take advantage of this encapsulation process for implementing an extracellular matrix in the core that embeds cholangiocytes, the epithelial cells of the bile duct. One of the objectives is to decipher the role of a protein during the formation of cysts with a central lumen, and more generally its implication in epithelium features. Moreover, the role played by the mechanical features of the ECM on the tissue fate will be assessed. The postdoc will thus have the mission to create capsules having a gelled core with controlled properties and to monitor the development of tissue formation. The encapsulation approach will allow to parallelize tissue growth observation. This study will be undertaken in collaboration with Pascale Dupuis-Williams from the Inserm laboratory "Interactions Cellulaires et Physiopathologie Hépatique" at Orsay.

We look for a candidate having accomplished a PhD in cell biology, or in biophysics, who is motivated by such a multidisciplinary project. Strong skills in cell culture, live cell imaging, extra cellular matrix reconstruction are desired. Knowledges in histology, physico-chemistry of soft matter and micro-fabrication are welcomed.

Contact :
A motivation letter and a CV, including referent persons or letters of reference, should be sent to Nicolas Bremond (nicolas.bremond@espci.fr). For more information: 01 40 79 52 34.

References

[1] Bremond, N., Santanach-Carreras, E., Chu, L. Y., and Bibette, J. Formation of liquid-core capsules having a thin hydrogel membrane: liquid pearls. *Soft Matter* **6**(11), 2484–2488 (2010).

[2] Rolland, L., Santanach-Carreras, E., Delmas, T., Bibette, J., and Bremond, N. Physicochemical properties of aqueous core hydrogel capsules. *Soft Matter* **10**(48), 9668–9674 (2014).

[3] Alessandri, K., Sarangi, B. R., Gurchenkov, V. V., Sinha, B., Kiessling, T. R., Fetler, L., Rico, F., Scheuring, S., Lamaze, C., Simon, A., Geraldo, S., Vignjevic, D., Domejean, H., Rolland, L., Funfak, A., Bibette, J., Bremond, N., and Nassoy, P. Cellular capsules as a tool for multicellular spheroid production and for investigating the mechanics of tumor progression in vitro. *Proc. Natl. Acad. Sci. USA* **110**(37), 14843–14848, September (2013).