INSTITUT NEEL Grenoble

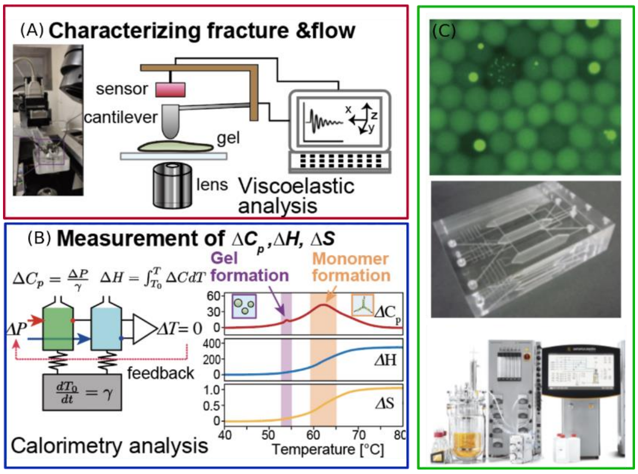
Proposition de stage Master 2 - Année universitaire 2020-2021

Rational design of functional DNA gels

Cadre général :

For soft matter engineering, DNA is the ideal polymer. In addition to being mechanically robust, chemically stable and enzymatically replicable, DNA is a sequence-defined polymer that can be designed to self-assemble into almost any shape, simply by tuning the arrangement of its monomers (the nucleotides). Given some DNA strands, a dynamic programming software can predict their thermodynamics from their sequences: the way they interact (binding energies) but also the structure they form at equilibrium (minimum free energy structure). Therefore, we see DNA as an ideal polymer to design, from the nanoscale, materials with unprecedented mechanical properties at the micro and macro scales.

Sujet exact, moyens disponibles :



To concretize this vision, we propose in this project to establish Multiscale MechanoProgrammable Gels (MMP gels). In these gels, DNA nanostructures orchestrate the development of function and mechanics at the macroscopic scale through a sequence of hierarchical chemical processes. As a result, we envisage applications where biocompatible and soft materials must change their mechanical properties based on physical and chemical stimuli (artificial skin, intelligent adhesive plasters, adaptable contact lenses, self-healing cartilage, smart stents...). We believe that this will lay the foundation for the rational engineering of soft materials.

In this project, the candidate will focus on measuring and engineering the thermodynamics aspect of MMP gels. Using calorimetry, the candidate will study how thermodynamics values (enthalpy, entropy) are related to mechanical properties at the microscale and macroscale. He will also leverage the vast repertoire of DNA nanotechnology to engineer gels with programmable mechanics and thermodynamics.

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Interactions et collaborations éventuelles :

This collaborative project involves 3 other partners, two of them are in Lyon one is in a CNRS unit in Japan

Ce stage pourra se poursuivre par une thèse : yes, for student with excellent academic background application to the lanef PhD call around april can be programmed.

Formation / Compétences :

Any student with a background in in physics, chemistry or biology is welcome to apply. We are seeking for motivated student willing to work at the interface between different disciplines.

Période envisagée pour le début du stage : Spring 2021

Contact : Guillou Hervé

Institut Néel - CNRS : tél 04 76 88 12 10 mel herve.guillou@neel.cnrs.fr

Plus d'informations sur : http://neel.cnrs.fr