



Ph.D. offer to start in October 2023

Biodegradable Polymeric Nanomaterials for Oral Vaccine Development

Context of the Ph.D. program

Mucosal vaccination could be an efficient way to prevent and combat infectious diseases. Although the mucosal route is the most effective for inducing a local protective immune response, only a few vaccines currently approved for human use are administered mucosally, most of which are live attenuated. Knowing that most of the microorganisms infecting the mucosa are typically nonspherical, soft objects and contain on their surface ligands for the specific targeting of the immune system, the idea of the Ph.D. program is to design nonspherical and biodegradable nanomaterials (NM) that mimic the living microorganisms. NM will then be used for mucosal vaccination.

However, designing biodegradable NM with controlled shapes, softness, and mucosal-specific antigens remains a challenge. Understanding how the NM shape affects their interactions with the immune system in the intestine requires robust technological tools to produce NM with controlled properties. This includes handling not only NM morphology, but also 3D dimensions, softness, and surface properties. This strategy provides insight into the key parameters involved in oral vaccination and will enable the precise design of the next generation of oral vaccines.

Scientific objectives

The objectives of the Ph.D. program are:

- (i) To synthesize a library of biodegradable polymers with precise control over their molecular architecture. The polymers will be synthesized by polymerization catalysis.
- (ii) To selectively attach targeting ligands and fluorescent dyes to the polymers.
- (iii) To design NM with controlled morphology and dimensions in a microfluidic device.
- (iv) To investigate the behavior of the NM towards the mucosal barrier by studying their diffusivity in mucus and possible transepithelial transport.

The Ph.D. candidate will work with a second Ph.D. at the University of Toronto, where the immunological evaluations will be performed.

Candidate's profile

- Applicants should hold a master's degree (or equivalent) in Polymer Science with strong expertise in polymer synthesis and characterization techniques.
- Teamwork skills and fluency in English are required.
- Applicants should be motivated to build a wonderful project together.

Ph.D. location

Chemistry Research Institute of Paris (IRCP, UMR CNRS 8247)
Chimie ParisTech, 11 rue Pierre et Marie CURIE, 75231 PARIS, FRANCE

Starting and duration

The Ph.D. program starts in October 2023 for 36 months.

How to apply?

Applicants will send a motivation letter and a CV comprising the names of two references.

Contact

- Professor Kawthar BOUCHEMAL kawthar.bouchemal@chimieparistech.psl.eu
- Professor Christophe THOMAS christophe.thomas@chimieparistech.psl.eu

References

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Diaz-Salmeron R, Toussaint B, Cailleau C, Ponchel G, Bouchemal K. *Advanced NanoBiomed Research*, **2022**, 2100138.
Hadji H, Bouchemal K. *Journal of Controlled Release*, **2022**, 342, 93-110.