

# Production of monodisperse nanometric coacervates and their use as mRNA non-viral vectors for the treatment of vascular complications

at the Institut Charles Sadron in Strasbourg (France)

## Description

mRNA-based therapeutics have emerged as an effective approach to treat diseases with known genetic targets like cancers, immune and infectious diseases, and neurological disorders.<sup>1</sup> The success of mRNA therapy relies on the development of safe and effective delivery systems. One possible strategy is to use a polycation as a vector by complexing it with the mRNA. A key challenge is identifying a polymer capable of sufficiently complexing mRNA to protect it from enzymatic degradation, yet not so tightly that it prevents the release of the mRNA once it reaches its target, thereby ensuring therapeutic action.

The project aims at using a comb-shaped polyarginine developed by our team (Fig. 1) that exhibits thermoresponsive behavior<sup>2</sup> to release the mRNA in a spatiotemporally controlled manner. The objective of the doctoral project will be to prepare monodisperse coacervates with a diameter of less than 200 nm. A study of the internal structure of these coacervates will be conducted to gain a better understanding of this system. As the project is a collaboration with Matthew Tirrell's group, the doctoral student will be required to conduct experiments at the University of Chicago (USA).

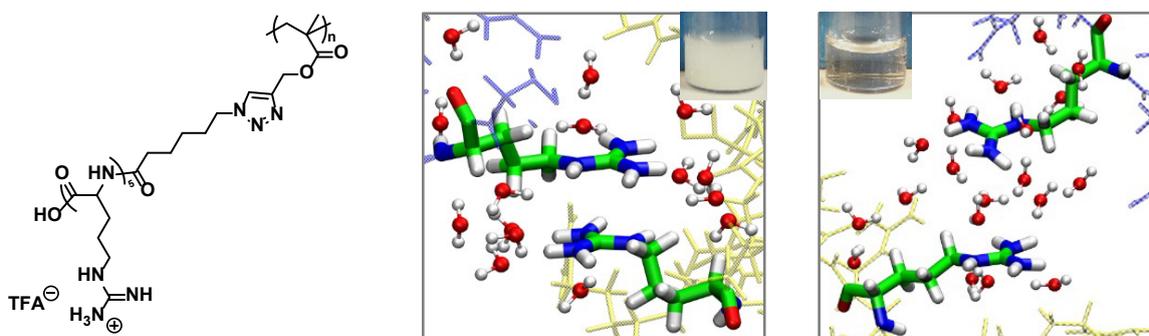


Fig. 1. Structure of the comb polymer with pentaarginine grafts and molecular dynamics highlighting the stacking of the guanidinium groups.

## References

1. a) Chaudhary et al., *Nat. Rev. Drug Discovery* **2021**, *20*, 817; b) Leong et al., *Viol. J.* **2025**, *22*, 71; c) Parhiz et al., *Lancet* **2024**, *403*, 1192
2. a) N. Zydziak, M. H. Iqbal, A. Chaumont, A. Combes, E. Wasielewski, M. Legros, L. Jierry, P. Lavalle, F. Boulmedais, D. Chan-Seng *Eur. Polym. J.*, **2020**, *125*, 109528; b) A. Augé, T. Dorosh, A. Rachdi, Q. Bievelot, A. Chaumont, F. Boulmedais, D. Chan-Seng *Eur. Polym. J.* **2025**, *238*, 114202

## Requirements & Application

We are looking for a motivated Master student with a strong background in physical chemistry interested in working on an interdisciplinary project at the interface of chemistry and biology. The application file should include a cover letter, a curriculum vitae, the transcripts of your Master degree, and the contact information of at least two persons that could be contacted as references. The cover letter should address your interest for this project and the skills you have already acquired that could be beneficial to this work. If you are interested, your candidature should be submitted on the website of CNRS employ (<https://emploi.cnrs.fr/>) to the offer referenced as UPR22-DELCHA-009 (applications received by other means will not be considered).