

Characterization of Cell-Penetrating Peptides (CPPs) for the Delivery of Therapeutic Agents in Cardiomyocytes Models.

Level: Master's Year 1 (M1) – Biology, Biotechnology, Life Sciences

Duration: 2 months (between February and June 2026)

Location: L'Institut du Thorax, UMR1087, 8 quai Moncousu, 40007, Nantes

Supervision: Serena Hachem – PhD student / Team II – Michel De Waard, Flavien Charpentier

Internship Context:

Cell-Penetrating Peptides (CPPs), also known as Protein transduction Domains (PTD), are short peptide sequences (4-40 amino acids) capable of crossing cellular membranes through a variety of mechanisms. They facilitate the intracellular delivery of therapeutic molecules (Zorko & Langel, 2022).

As part of a project focused on modulating the cardiac sodium channel Na_v1.5, whose alterations are implicated in disorders such as the Brugada syndrome, CPPs offer a promising strategy for the targeted delivery of genetic molecules into cardiomyocytes. These cells, while physiologically relevant, are particularly difficult to transfect due to their low endocytic capacity and sensitivity to conventional transfection methods, making the identification of efficient entry vectors essential.

Objectives of the internship:

The main objective of this internship is to evaluate and compare the internalization efficiency of different CPPs in several human cell models, including cardiomyocytes derived from induced pluripotent stem cells (hiPSC-CM).

This work is part of a broader project aiming to improve intracellular delivery of antigene molecules targeting the gene encoding the cardiac sodium channel Na_v1.5, a key factor in Brugada syndrome. This internship will allow the student to:

- identify which CPPs show the highest uptake efficiency in hard-to-transfect cardiomyocytes,
- characterize the structural or physicochemical parameters influencing their internalization,
- contribute to the optimization of delivery strategies adapted to sensitive cardiac cells.

Mission / Student responsibilities:

- Maintenance and preparation of human cell cultures
- Incubation of cells with different fluorescent markers
- Image acquisition and analysis (fluorescence/confocal microscopy)
- Quantification of CPP internalization et comparison across cell types
- Participation in protocol optimization and presentation of results

As well as other project-related activities depending on progress.

Application / Contact:

Send a CV and a motivation letter to:

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Subject: *Application_M1_Internship_CPP*