

Master Thesis Topic

Shortened versions available for research internship (Fortgeschrittenen-/Vertiefungspraktikum)

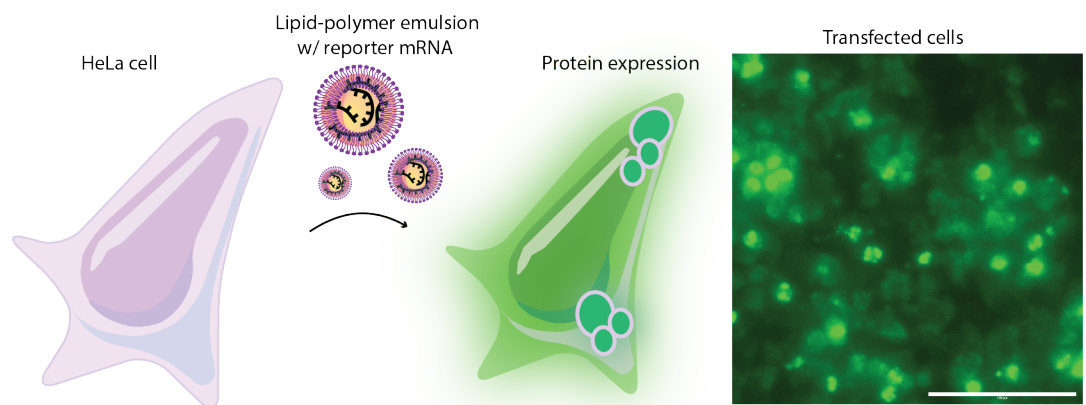
Walther Lab / Life-Like Materials and Systems

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Lipid-Polymer Nanoemulsions for Cell Transfection

Background: Transfection is the process by which proteins and nucleic acids are introduced into cells. Transfection formulations are key to the successful development of vaccines, protein replacement therapies and gene editing, which together represent some of the most successful approaches for infectious and genetic diseases. The transfection process must be compatible with the desired therapy, and new transfection methods that are safer and more efficient are constantly being sought. Our laboratory has developed a novel system for transfection based on lipid-polymer emulsions, which has proven to be very efficient in cell cultures. However, the transfection mechanism of this method still needs to be clarified for refinement and possible applications.

Scope: The aim of this project is to understand how lipid-polymer emulsions can transfect cells in culture. We will investigate variations of transfection formulations and their efficiency and toxicity to cells, while



trying to describe and understand the uptake mechanism of this novel formulation. The goal is to obtain a formulation that is compatible with both cells and the supramolecular structures being developed in our laboratory. The first milestone will be to optimize the composition of the formulation by tuning the lipid composition and polymer concentration. After that, we will understand the uptake pathway of this structure and compare it with other available transfection methods, as well as evaluate the potential applications.

What you will learn: Molecular biology (cell culture, protein expression, enzymatic assays), fabrication of self-assembled molecular aggregates (polymer emulsions, liposomes) and characterization techniques (microscopy, electrophoresis).

Join us if you are highly motivated, have a strong interest in polymer chemistry/molecular biology and show above average performance in your studies!

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