

FINAL MASTER PROJECT PROPOSAL



Title

“Immobilization of MNPs on cell membranes via cadherins for magnetic hyperthermia studies”

Supervisor(s)

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Summary of the project

The current FMP project will be part of a European project aiming at developing a novel methodology for transfection triggered by magnetic hyperthermia (MH). Our innovative approach is to induce a controlled, localized heating of the cellular membrane (“hotspots”) using magnetic nanoparticles (MNPs) immobilized onto cell membranes. MNPs are known to generate heat when exposed to an alternating magnetic field (AMF); this heat could lead to reversible changes in the cell membrane permeability/fluidity, which can be used to promote the artificial delivery of nucleic acids into cells.

During this Final Master project, the student will work on the optimization of the binding of MNPs on the cell membrane by targeting a cell adhesion protein present on the cell surface (cadherin E, E-cad).

Specific tasks:

- 1) Oriented functionalization of MNPs with E-cad fragments: Iron oxide MNPs will be decorated with a His-tagged recombinant E-cad fragment. The functionalized MNPs will be then evaluated in terms of colloidal stability and cytotoxicity.
- 2) Cell membrane targeting: Different cell types with distinct cadherin E profile expressions will be incubated with the MNPs obtained in Task 1. Specifically, MCDK (E-cad positive) and Balb/c (E-cad negative) cell lines will be used. Confocal fluorescence microscopy and SEM/TEM will be used to assess the presence of MNPs onto cell membranes.
- 3) Cellular uptake studies: Time lapse microscopy studies will be carried out after MNPs immobilization to establish if the MNPs are eventually internalized. Fluorescent labelling of cellular structures will be performed to determine MNP localization within the cells, and MNP accumulation over time at different intracellular locations will be investigated by fluorescence microscopy and TEM.
- 4) Hyperthermia studies: Cells with MNPs immobilized on their membrane will be subjected to an AMF for different periods of time. Subsequently, cell death mechanisms, as well as the formation of transitory pores on the cell membrane will be analysed.
- 5) Scientific literature analysis, preparation of reports and presentations of the research results.