Master thesis proposal at NIMBE/LIONS – IGPS

Design of functionalized lipid-polymer nanoparticles prepared by a microfluidic method for chemo/photodynamic therapy of ocular cancers

Context

Retinoblastoma (Rb) is a cancer of the retina that affects 1 in 15 to 20000 births each year. Conventional treatments include enucleation and chemotherapy. For small solid tumors like Rb, photodynamic therapy (PDT) may be of benefit because it is non-mutilating and generates few side effects.1 Phototoxicity results from the combination of effects of a photosensitizer (PS), light and oxygen. In such a context, the design of a functionalized colloidal nanocarrier which could solubilize, protect and lead porphyrin (PS) derivatives towards their target cells, facilitate their penetration and release in cell cytoplasm before illumination, would optimize the therapeutic effect. The final aim of the project LPHN-OnAChip is to form and functionalize in a single microfluidic chip hybrid nanoparticles (lipid-polymer nanoparticles referred as LPHN) co-encapsulating an anti-cancer drug and a photosensitizer associated to ligands. The project is based on complimentary expertises of two laboratories in innovative drug delivery systems, physico-chemical and biological evaluation of targeting of porphyrins for PDT (IGPS) and in the self-assembling systems, in situ characterization and microfluidics (LIONS).

Mission

The first part of the project and the aim of this internship is dedicated to the synthesis of non-functionalized LPHNs by microfluidics. The student will study the synthesis of poly(lactic acid) NPs containing anti-cancer agent by nano-precipitation in a single flow focusing device geometry. He/she will optimize conditions for size monodispersity and reproducibility by varying the flow rates, the ratio between the different components, the nature of the organic solvent used for nanoprecipitation.
Depending on the progress of the work, the candidate will investigate the formation of LPHNs by coating the previously obtained poly(lactic acid) NPs with liposomes carrying PS. In this case a two stages microfluidic device will be developed.
Several characterization technics will be used such as Dynamic Light Scattering (DLS), Atomic Force Microscopy (AFM), confocal microscopy, Cryo-Transmission Electron Microscopy (Cryo-TEM), and Small Angle X-ray Scattering (SAXS).

Profile

We are looking for applicants having a background such as Engineering/Biology/Chemistry, skills in microfluidics will be an asset but it is not mandatory. The applicant must be highly motivated by tackling challenges of working with multidisciplinary teams.
Applicants will have an experimentalist profile.
Applicants shall speak English or French, and have good communication skills.

Duration: 6 months
Starting date: To be filled first trimester 2021
Localization: LIONS at CEA/Saclay, Gif sur Yvette France
Contacts CV, motivation letter and recommendation letter should be sent to both contacts.
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