We are looking for candidates to apply for a **doctoral funding from the University of Strasbourg (auditions by the Doctoral School in June)** for a project on the **synthesis of short peptide nanotubes for biomedical applications**.

For more information: http://ed.chimie.unistra.fr/en/funding-thesis/doctoral-research-contract/

Contact: Cécilia Ménard-Moyon (c.menard@ibmc-cnrs.unistra.fr) before 21st April 2023.

# Synthesis of short peptide nanotubes for biomedical applications

## Project description

Organic nanotubes are promising nanomaterials displaying many potential applications in nanotechnology, in particular in nanomedicine. They are generally obtained by stacking of organic macrocycles ("disk-like") via non-covalent interactions, such as π–π interactions and/or hydrogen bonding. Peptide nanotubes are a class of organic nanotubes attracting immense interest due their wide range of bio- (and other) functionalities, which leads to many potential use in nanotechnology and biomedicine. The supramolecular stacking of cyclic peptides is a versatile approach for the formation of nanotubes. Cyclic peptides composed of an even number of alternating D- and L-amino acids adopt a rigid flat and disk-like conformation. This conformation allows the peptides to stack through β-sheet hydrogen bonding, resulting in the formation of tubular structures. Peptide nanotubes are generally very long (several micrometers) and their length is difficult to control, which can hamper their biomedical potential. Therefore, there is a strong need of synthesizing short nanotubes with a narrow length distribution.

One of the main drawbacks of cyclic peptide nanotubes is their poor solubility in solvents and their tendency to laterally aggregate into large bundles. The conjugation of polymers on the periphery of the cyclic peptide cores will not only provide a steric hindrance avoiding the lateral aggregation of the nanotubes, but also improve their solubility. The polymer-cyclic peptide conjugates will self-assemble into nanotubes with a core (peptide)-shell (polymer) structure, the polymer allowing the control of the nanotube size, increasing the solubility and acting as a biological shield to prolong their biological effect.

In this context, this PhD project is centered on the synthesis of length-controlled polymer-peptide hybrid nanotubes as carriers for the delivery of drugs. For this purpose, a series of cyclic peptides will be synthesized, followed by the conjugation of biocompatible polymers. The polymer-peptide conjugates will be characterized by different spectroscopic and microscopic techniques, and their self-assembly capacity will be assessed by physicochemical analytical methods. The nanotubes will

be exploited as drug carriers for the treatment of cancer and/or autoimmune diseases in collaboration with biologists.

**Wished skills:**

The candidate needs to have strong a background in chemistry and organic synthesis, as well as knowledge on supramolecular chemistry.

**Expertises which will be acquired during the training:**

Organic synthesis and characterization of organic molecules mainly by HPLC, NMR spectroscopy, mass spectrometry and FT-IR spectroscopy; characterization of organic nanotubes mainly by transmission electron microscopy, UV-Vis and FT-IR spectroscopy, and circular dichroism.