Applications of Cyclodextrins to limit the Risk of Exposure to Organophosphorus pesticides and nerve agents

This PhD project will be carried out in collaboration between two research laboratories:

- *the partner 1 is UMR 6064 CNRS (CARMeN) based in Rouen (Normandy, France). The research developed within CARMeN (BioOrganic Chemistry group) is oriented towards organic chemistry and analysis. In terms of excellence in scientific research and training, the UMR 6064 COBRA is a member of the National Laboratory of Excellence in Organic Chemistry (Labex SynOrg), the Carnot I2C, and the University Research School XL-CHEM selected as part of the EUR call for projects from PIA3. The group of prof. Estour is specialized in supramolecular chemistry as well as in the selective functionalization of cyclodextrin derivatives, and it has especially an established expertise in the nerve agents decontamination.*
- *The partner 2 is Organic Chemistry Laboratory based in Chieti (Gabriele d'Annunzio University of Chieti-Pescara, Italy). This team has an international expertise in various aspects of supramolecular chemistry. The group of prof. Fontana has recently gained a lot of expertise in the field of graphene and its derivatives for applications spanning from biomaterials intended for tissue engineering and antimicrobial properties to gas adsorption and catalysis in the presence of metals.*

As the French laboratory is in a zone with restricted access, the recruitment is conditional on the acceptance by the High Official for Security and Defence.

Context and Objectives: This joint PhD program between labs of French and Italian universities aims to develop original approaches to solve problems with toxic organophosphorus compound-based pesticides and chemical warfare agents. The proposal concerns the development of new decontamination materials based on graphene oxide - cyclodextrin composite developed as efficient scavengers to accelerate the hydrolysis of organophosphorus pesticides and nerve agents. The expected results could undoubtedly have a significant impact with preventive action to intoxications by organophosphorus compounds thanks to efficient decontamination tools and also at a socio-economic level by providing high-performance materials for the decontamination of aqueous media.
Key words: chemistry-biology interface, organic chemistry, supramolecular chemistry, cyclodextrins, graphene, nerve agents, decontamination.

Candidates profile:

The PhD student involved in this project will be formed in a wide range of activities connected with chemistry: organic synthesis, chemico-physical characterization, host-guest recognition, supramolecular chemistry, preparation of materials and biomaterials, environmental concerns and solutions against the effects of exposure to nerve agents and organophosphorus pesticides. He/she will be trained for using and become familiar with spectroscopic techniques such as ^{1}H, ^{13}C, ^{31}P NMR, Raman and FTIR, UV-visible spectrophotometry, thermal analysis (TGA and DSC), mass spectrometry and laser light scattering. Electron and atomic force microscopy will also be part of the training.

The successful candidate (PhD in organic chemistry) should have a strong background in synthetic organic chemistry and supramolecular chemistry, be creative and highly motivated to join a multidisciplinary research team. Chemist exhibiting a specific interest at the chemistry-biology

interface would be preferred. We are looking for a PhD having the ability to take initiative in research, contribute innovative ideas, and work independently. Excellent communication skills to present research findings clearly and effectively.

Position to be filled: 36 months from October-December 2025

Application Process

Interested candidates should send their application to Pr. François ESTOUR and Pr. Antonella FONTANA

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Applications should include the following documents:
- A detailed CV
- A cover letter
- Grades (M1 and M2)
- Two recommendation letters (or references for potential referees)