

EU GREEN - Research internship for students

SiFCIR laboratory USC INRAE 1330 - MiNT laboratory INSERM U1066 / CNRS 6021

Evaluation of an innovative strategy for pest's crop control: a smart nanohybrid system to obtain a controlled and sequenced release of an association between an insecticide and a synergistic agent

- **Link with the Sustainable Development Goal(s) and the global EU GREEN vision**

The world population has been growing exponentially since beginning of the 20th century, with 10 billion people expected in 2050. To feed the population, the crop yields have been increased and **uncontrolled use of pesticides has led to resistance to insecticides, loss of biodiversity and adverse effects for human and environment**. Thus, development of **innovative strategies should consider reduction of doses of treatment in pest management**, gestion of insecticide resistances and safe formulations. We have developed a **“nano-in-nano” approach**: a hybrid system based on **poly(lactic-co-glycolic acid (PLGA) nanoparticles (NP) loaded with poly(amidoamine) (PAMAM) dendrimer**, to encapsulate an **insecticide** (in the NP matrix) and a **synergistic agent** (complexed with PAMAM in the NP matrix). The aim is a controlled release of both compounds: **first release of the insecticide** which must be bioactivated and then **delayed release of the synergistic agent** to obtain a synergistic effect while reducing doses.

- **Missions of the students (with links to both research and training)**

The student will conduct *in vitro* and *in vivo* experiments with the hybrid nanoparticle formulation:

- Perform a **design of experiment to optimize the hybrid systems** thanks to their **characteristics** (size distribution, Zêta potential, encapsulation efficiency, sequenced release profiles);
- Study the **global stability of the hybrid systems** with various pH, temperature, lighting conditions, and set up an **optimized lyophilization protocol**; and

- Perform the **in vivo toxicological tests on the crop pest *Acyrtosiphon pisum* larvae** to determine the efficacy of the formulation.

- o **Conditions of the internship (location, potential compensation or advantages)**

A preference will be given to a **6-month internship** (between January and June) but we have some flexibility to accept internships lasting between 4 and 6 months. The internship would take place at the **SiFCIR laboratory (USC INRAE 1330 - <https://sifcir.angers-nantes.hub.inrae.fr>)** with some experiments at the **MiNT laboratory (INSERM U1066 / CNRS 6021 - <https://mint.univ-angers.fr/en/index.html>)**, at the university of Angers, France.

The student will be able to acquire several technical skills: **formulation, physicochemical characterization, toxicological test with larvae**, but also soft skills such as **project management, communication**, etc., in new strategies for controlling harmful insects in an environmentally friendly manner. Moreover, the student will have the opportunity to see how two laboratories operate and **to build a network in the fields of nanoencapsulation and new environmentally friendly insecticide strategies**.

We will pay close attention **to the student's integration** in both laboratories and into the city of Angers