What is the ExposUM Doctoral Nexus?

PhD funding opportunities in Montpellier, France : ExposUM Doctoral Nexus

A Doctoral Nexus, as proposed by the ExposUM Institute, brings together networks of three to four PhD students from diverse disciplinary backgrounds, affiliated with at least two distinct research units.

Unlike traditional PhD programmes, a Doctoral Nexus is designed to enhance collaborative skills and the ability to develop transdisciplinary projects, while allowing students to deepen their own field of expertise.

Nexus doctoral students will benefit from a dedicated training programme and will have the opportunity to organise seminars within their Nexus network.

The ExposUM Institute provides full funding for four years, covering both the PhD students' salaries and an environmental allowance.

The context of the thesis: The proposed PhD thesis is part of a doctoral Nexus network of 5 researchers and 3 PhD students, working on a common theme: "The microbial **EX**posome and drivers of **PER**sisten**T** infections in humans: an interdisciplinary approach to understand the interplay between bacterial pathogens of environmental and zoonotic origins and the host innate immune system." The microbial exposome includes a wide range of environmental and food-borne bacterial pathogens that continuously interact with the human host. Some of these bacteria can cause fatal infections, or persist within the host for prolonged periods after exposure, giving rise to chronic, often debilitating infections. These infections are particularly refractory to antibiotic treatments and prone to relapse, thus representing a major health issue that can result in medical complications, impaired life quality, and even death. The project studies the interaction of a panel of environmental-borne human opportunistic pathogens and a zoonotic pathogen, with macrophages *in vivo* using the zebrafish embryo model. The Nexus project integrates experimental approaches and uses mathematical modelling to deconvolute the heterogeneity of macrophage responses and to reveal the dynamics of processes that shape the post-exposure establishment of persistent human infections.

Macrophages are plastic cells that can adopt different polarization states, ranging from pro - (M1) to anti-inflammatory (M2) states, which are crucial in creating a survival niche for pathogens. The main goal of this PhD project is to investigate the contribution of macrophage polarization to bacterial persistence for 2 bacterial species associated with chronicity: *Salmonella enterica* serovar Typhimurium, *Pseudomonas aeruginosa*. We have recently developed a zebrafish model of persistent infection for these two pathogens. Thanks to their optical transparency and genetic tractability, zebrafish larvae represent a powerful model for studying host-pathogen interactions. In our laboratory, we have generated transgenic zebrafish lines with fluorescently labeled activated macrophages, allowing direct visualization and tracking of these immune cells in vivo. We have also fluorescent tools to differentiate growing bacteria from non-growing bacteria inside the host.

Planned start date: 01/10/2026

The title of the doctoral student's position: Persistent human infections caused by environmental and food-borne pathogens: are they driven by the macrophage niche ?

Main mission: The main objective is to investigate, in a whole vertebrate, the dynamic bacteria-macrophage interplay focusing on *S.* Typhimurium and *P. aeruginosa* and decipher the mechanisms driving long term survival in their host. The doctorant will : i) Compare macrophage polarization upon *ST* and *PA* infection and identify specific macrophages sub-populations hosting persistent bacteria; ii) Explore the replication state of bacteria at the single-cell level and localization of persistent bacteria inside macrophages; iii) Test *PA* strains from various environmental and clinical sources for persistence in zebrafish.

Activities:

- Macrophage transcriptome (RNASeq) and qRT-PCR analyses to study macrophage polarization states.
- Perform intravital imaging analysis using high spatio-temporal resolution microscopy (including bacterial localization at the subcellular level and growing state, interaction with specific host cells using transgenic zebrafish lines, macrophage polarization).
- Test *PA* strains from various sources for persistence in zebrafish.
- Poster and oral presentations at national and international meetings, networking, mandatory courses (doctoral school) etc., and organisation of a meeting in the third year together with the other PhD students of the network. The student will acquire skills needed to perform independent research and pursue a successful career in science. These include technical, (inter)personal, management, and time management skills. The Nexus network provides an opportunity to enhance collaborative skills and work in a transdisciplinary environment.
- Writing of a thesis manuscript, and a scientific publication following the rules of the doctoral school CBS2.

Expected skills and qualifications:

Essential:

- Strong background in bacteriology and immunology, and experience working under biological safety level 2 conditions
- Strong interest for host-pathogen interactions
- Experience in molecular biological techniques (DNA cloning, mutagenesis, RTqPCR etc).
- Good work ethics and organisation
- Teamwork
- Pro-active, initiative, curiosity and motivation
- Due to the international environment and publication in English, the student should be fluent in spoken and written English.

Desirable

- Experience in Bioinformatics analysis
- Experience with the zebrafish embryo model
- Experience in microscopical techniques (epi-fluorescence, confocal), image analysis, and interpretation of in vivo data.
- Strong scientific writing and communication skills.

Diploma/field required:

Applicants should hold a Master 2 degree in biology and health, microbiology, molecular biology, or biomedical sciences. Master students that do not have the diploma yet should provide the most recent transcripts from their Master 2 (semester 1 and/or semester 2) and Master 1.

Euraxess key words: Biological Sciences, Biology

Other Key words: *Salmonella* Typhimurium, *Pseudomonas aeruginosa,* zebrafish infection model, persistence, macrophages

CNU section to which the applicant belongs: 45, 47, 65

Application procedure

The application must include the following

- A CV
- A letter of motivation
- One or two letters of recommendation from Masters supervisors.
- A copy of the diploma required for enrolment or, if unavailable, the most recent transcripts from Master 2 (semester 1 and/or semester 2) and those of Master 1.

If you would like to apply for this position, please send an e-mail to the thesis director NGUYEN CHI, Mai (mai-eva.nguyen-chi@umontpellier.fr) and the co-director BLANC-POTARD, Anne (anne.blanc-potard@umontpellier.fr), with a CC to exposum-aap@umontpellier.fr to inform them of your interest. Sending your application via l'ADUM is not required and not requested.

Application deadline : Before 04 May 2026

The University of Montpellier

KEY FIGURES

RESEARCH CENTERS

From space exploration and robotics to ecological engineering and chronic diseases, UM researchers are inventing tomorrow's solutions for mankind and the environment. Dynamic research, conducted in close collaboration with research organizations and benefiting from high-level technological platforms to meet the needs of 21st century society.
The UM is committed to promoting its cutting-edge research by forging close links with local industry, particularly in the biomedical and new technologies sectors.
More Information: https://www.umontpellier.fr/en/recherche/unites-de-recherche

SCIENTIFIC APPEAL

Open to the world, the University of Montpellier contributes to the structuring of the European higher education area, and strengthens its international positioning and attractiveness, in close collaboration with its partners in the I-SITE Program of Excellence, through programs adapted to the major scientific challenges it faces.
More Information: https://www.umontpellier.fr/en/international/attractivite-scientifique