



Qu'est-ce que le dispositif ExposUM Doctoral Nexus ?

Les Doctoral Nexus proposés par [l'Institut ExposUM](#) sont des réseaux de 3 à 4 doctorantes et doctorants, issus de disciplines différentes et affiliés à au minimum deux unités de recherche différentes.

Par rapport à une thèse classique, participer à un Doctoral Nexus favorisera la capacité à travailler en équipe et à concevoir des projets de manière transdisciplinaire tout en approfondissant son propre champ d'expertise.

Un programme pédagogique spécifique sera proposé et les doctorant(e)s concerné(e)s auront également l'opportunité d'organiser un séminaire au sein du réseau Nexus.

Les thèses sont financées d'emblée pour 4 années, comprenant le salaire du doctorant ou de la doctorante ainsi qu'une enveloppe d'environnement.



Sujet de thèse

Intitulé du sujet de thèse : **Using an advanced 'airway on a chip' model for studying the effects of exposome on lung tissue/Part of the COCKTAIL Nexus project**

Date envisagée de démarrage de la thèse : 10/2024

Directeur de thèse : DE VOS John, HDR, UMR 1183/IRMB, CBS2, 50%

Co-directeur/encadrant de thèse : ASSOULINE Saïd, HDR, 1183/IRMB, CBS2, 50%

Sujet de thèse :

The project is part of a Nexus project implying 3 partners and 3 PhD students. Partner D1 (John De Vos' Lab) is expert in iPS cells and their differentiation into bronchial epithelium, Partner D2 (Gladys Massiera) is biophysicists experts in mucus rheology, cilia beating and microfluidics, and Partner D3 (Delphine Muriaux) is virologist expert in human viruses. The PhD students will work jointly to combine expertise and promote transdisciplinarity.

Context : The lungs, a vital organ, are constantly exposed to a multitude of environmental factors, collectively referred to as the exposome. It is not surprising that respiratory diseases such as COVID-19, chronic obstructive pulmonary disease (COPD), and asthma, are major public health concerns. However, the interactions between these exposures are complex and not yet fully understood due to the lack of a realistic in vitro model that mimics the complex structure of the airways. Organoids, which recapitulate normal tissues, offer a promising platform for studying the





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effects of the exposome on lung tissue. Our team has already developed a robust human induced pluripotent stem cells (iPSC)-derived bronchial epithelium at air/liquid interface model called iALI.

Proposed objectives and methods : The PhD student will develop, in close collaboration with biophysicists experts in microfluidics, an advanced "airway on a chip" model (iOC) which will allow for the precise and quantitative application of various pollutants, either alone or in combination with viral infections. The impact of the exposome on bronchial epithelium will be evaluated using a statistical design of experiments (DOE) approach, along with an array of high-precision tools such as proteomics, single-cell and spatial transcriptomics. The synergistic effects of pollutants and viral infections will be assessed, and the functional basis of the harm caused by the exposome will be investigated by knocking out candidate genes in iPSC lines used in the iOC, including those involved in cilia movement and mucus secretion.

Expected results : The synergistic effects of pollutants and viral infections will be uncovered, and the molecular contribution of key genes of the harm caused by the exposome exposed. The project will enhance our understanding of the lung exposome, but also facilitate development of personalized medicine, and enable us to respond quickly to emerging airborne infectious agents, which are essential for protecting public health.

Feasibility : Excellent feasibility as the team has the expertise in iPSC culture, differentiation, CRISPR/Cas9-based knock-outs, as well as advances tool skills such as single cell transcriptomics. In addition, this work is made possible by the ideal complementarity of the three partners that team up to bring their respective expertise in iPSC culture, microfluidics and virology. The project is part of a Nexus project implying 2 other PhD students whose expertise will be in virology and in biophysics and with who the recruited biologist candidate will closely interact.

Modalités de candidature

La candidature doit être composée des éléments suivants :

- Un CV
 - Une lettre de motivation
 - De la copie du diplôme permettant l'inscription
- Des éléments spécifiques demandés par l'école doctorale Chimie Biologie Santé CBS2 n°168 (<https://edcbs2.umontpellier.fr>)

Si vous souhaitez postuler sur ce sujet, adressez au plus vite un mail à John De Vos (john.devos@umontpellier.fr), en mettant en copie exposum-aap@umontpellier.fr afin de les informer de votre intérêt.

Avant le dimanche 21 avril, 20h CET



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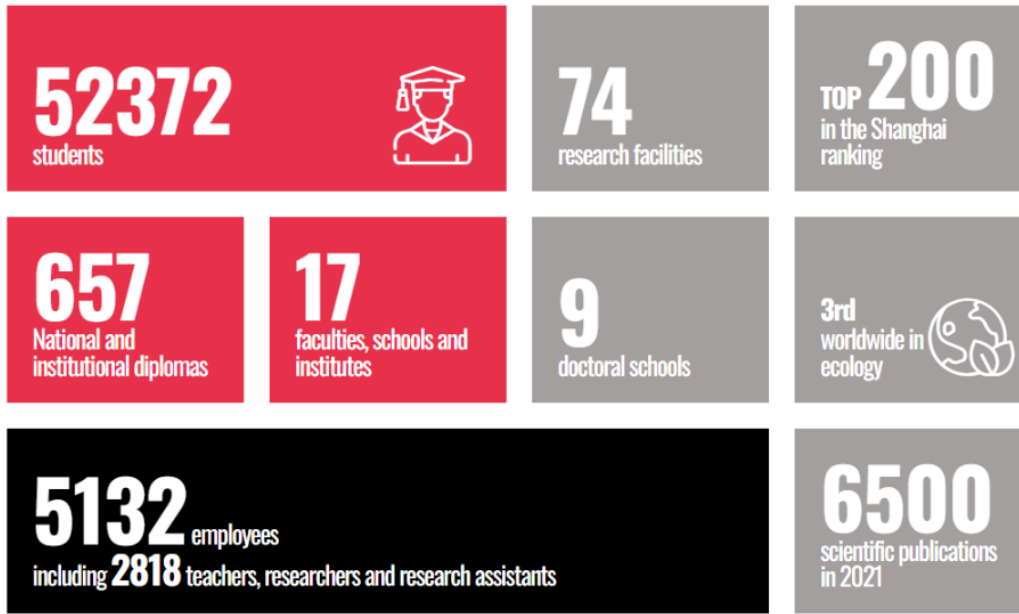


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KEY FIGURES



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>



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