

# Internship & Master thesis opportunity in developing an organoid-based mini-lung exposure model

## Establishing an ex vivo environment exposure model in stem cell-derived airway organoids

The <u>Funk lab</u> in the Institute of Lung Health and Immunity <u>(LHI)</u> at <u>Helmholtz Munich</u> is looking for a motivated master's student for an internship (starting August/September 2025), with the option of a following Master's thesis.



#### Background:

Chronic inflammatory diseases account for many deaths and disabilities worldwide. The development and progression of these diseases accelerate with advancing age and exposure to environmental insults. Especially, with worsening pollution levels, and likelihood of airborne pathogens, our lungs have become increasingly susceptible to inflammatory diseases like Chronic Obstructive Pulmonary Disease (COPD), the third leading cause of deaths globally by 2019 (WHO), with cigarette smoke (CS) and air pollution being major risk factors for disease development. With an overall decline in lung function and reduced regeneration and repair capacity of the stem cells, aging individuals are more prone to developing COPD (Peters, Nawrot and Baccarelli, 2021; López-Otín *et al.*, 2023).

Our research focuses on bridging the gap between chronological aging and environmental factors to study their synergistic effect on the regeneration and stem-cell capacity of the lung. For this, we use organoids, which are 3-dimensional (3D) mini-organs derived from the basal stem cells of the lung, in our case murine airway epithelium (Fig. 1). Organoids facilitate the study of regenerative capacity as their growth depends on the stem cell proliferation, thereby making it a powerful tool to study this effect from aged and/or environmentally challenged samples (Vazquez-Armendariz and Tata, 2023).

#### **Project description:**

Our model system, airway epithelium-derived organoids, allows us to study the interaction of epithelium with environmental factors and among different epithelial cell types in a controlled setting. The project will focus on establishing an organoid exposure model for disease-relevant environmental stressors such as cigarette smoke extract (CSE) and fine particulate matter of 2.5µm size (PM2.5). Specifically, organoids will be microinjected using a setup similar to the one used to microinject Xenopus laevis oocytes (Aguero,



Figure: 2, Organoids microinjected with green dye

Newman and King, 2018) (Fig. 2), to study the impact of environmental insults on epithelial cells regeneration and homeostasis. Airway organoids derived from young and aged mice will be subjected to microinjection under varying treatment conditions, such as time and concentration of the stressors. This will help investigate changes in the transcriptional landscape and stem cell regenerative potential in response to CSE and PM2.5, revealing potential candidates involved in the age-dependent susceptibility and environmental damage of the airway epithelium.

#### What you will learn:

During the project, you would learn various lab techniques, including (but not limited to) the generation and maintenance of airway organoids, microinjection for the delivery of environmental particles, RNA and DNA isolation from organoid cultures, qPCR and immunostainings.



### **Requirements and contact information:**

The following skills & qualifications would be valuable:

- Fluency in English
- Responsible, team-oriented, and creative way of working
- Prior experience in cell culture
- Previous experience with organoid models or toxicology is beneficial, but not required
- The internship has to be in agreement with the study curriculum.

Interested master's students in cell and molecular biology, developmental biology, biotechnology, toxicology, or a similar subject area with an interest in organoid research who meet the qualifications are encouraged to submit an <u>application including their CV and a motivation letter</u> (max. 1 page) **to Dr. Maja Funk** (<u>maja.funk@helmholtz-munich.de</u>).

Contact for questions regarding the project: <u>sharduli@helmholtz-munich.de</u> For more information on the lab, please visit our website: <u>www.funk-lab.de</u>.

## Further reading:

Aguero, T., Newman, K. and King, M. Lou (2018) 'Microinjection of Xenopus Oocytes', *Cold Spring Harbor Protocols*, 2018(2), p. pdb.prot096974. Available at: https://doi.org/10.1101/PDB.PROT096974. López-Otín, C. *et al.* (2023) 'Hallmarks of aging: An expanding universe', *Cell*, 186(2), pp. 243–278. Available at: https://doi.org/10.1016/J.CELL.2022.11.001.

Peters, A., Nawrot, T.S. and Baccarelli, A.A. (2021) 'Hallmarks of environmental insults', *Cell*, 184(6), pp. 1455–1468. Available at: https://doi.org/10.1016/J.CELL.2021.01.043.

Vazquez-Armendariz, A.I. and Tata, P.R. (2023) 'Recent advances in lung organoid development and applications in disease modeling', *Journal of Clinical Investigation*, 133(22). Available at: https://doi.org/10.1172/JCI170500.