

Internship and MSc Thesis: Computational Biology and Statistical Learning Approaches to Study B Cells in Allergy

Our Group at the Institute of Allergy Research (IAF)/Center of Allergy and Environment (ZAUM) at Helmholtz Munich investigates the molecular mechanisms that regulate B cell-mediated immune responses. Our research focuses on understanding how B lymphocytes differentiate into effector B cells, including antibody-secreting cells and memory B cells, during homeostasis and in diseases such as autoimmunity, cancer, and allergy.

Allergic diseases, including asthma and food allergies, affect more than one billion people worldwide and represent a major global health burden. A hallmark of allergic immune responses is the production of immunoglobulin E (IgE), a key driver of disease pathogenesis. However, the cellular and molecular mechanisms that sustain IgE responses remain poorly understood.

Recent studies have identified **type 2 memory B cells (MBC2s)** and **long-lived IgE-secreting plasma cells (IgE-PCs)** as key cellular reservoirs of IgE. Despite their importance, the molecular pathways governing their development, maintenance, and function remain largely unknown.

Project Description

We are seeking a highly motivated Master's student with a strong interest in **computational biology, statistical learning**, and **immunology** to join our team for an internship and subsequent Master's thesis project.

The goal of this project is to identify genes, molecular pathways, and regulatory networks that drive the differentiation and function of IgE-PCs and MBC2s. Candidate genes identified through bioinformatics analyses will subsequently be functionally validated in our laboratory using cutting-edge in vitro and in vivo CRISPR/Cas9 screening platforms in mouse and human B cells.

During the project, the student will:

- Analyze and integrate multi-omics datasets, including single-cell transcriptomic, epigenomic, and proteomic data derived from allergic patients and mouse models of allergic disease, using statistical learning algorithms.
- Identify candidate genes and pathways associated with the generation and maintenance of IgE-PCs and MBC2s.
- Contribute to the development of hypotheses for experimental validation using CRISPR-based functional genomics approaches.

The student will be jointly supervised by Dr. Zaikang Lin from the Fabian Theis laboratory and our research group, offering a unique opportunity to receive interdisciplinary training at the interface of computational biology, statistical learning, and immunology.

Candidate Profile

- Master's student in Bioinformatics, Mathematics, Statistics, Computer Science, Machine Learning, Biotechnology, Immunology, or a related field.
- Experience with programming and data analysis (preferably in Python).

- A high degree of scientific curiosity, creativity, flexibility, and enthusiasm for working in an interdisciplinary and international team.

If you are interested in applying computational approaches to answer fundamental questions in B cell immunology and allergy, we would be very happy to hear from you.

Feel free to contact **Dr. Lesly Calderon** (lesly.calderon@helmholtz-munich.de). **We look forward to receiving your application, including your letter of motivation, CV, the contact details of a referee, and BSc and MSc academic transcripts.**

For more information, check the **Molecular Immunology laboratory** website:

<https://www.helmholtz-munich.de/en/iaf/research-groups/rg-calderon>