Master of Science Thesis Position in Mucosal Immunology and Host–Pathogen Interactions. Arnold lab – University of Zurich

We are offering a Master's thesis research project for a highly motivated student eager to explore how the innate immune system shapes responses to intestinal pathogens. Our work focuses on the roles of the mucosal immune system to control and respond to *Citrobacter rodentium* infection, a model organism for colitis.

Duration: 9-12 months (start: flexible, as soon as possible)
Laboratory of Prof. Dr. Isabelle Arnold, Institute of Experimental Immunology, University of Zurich.

Research topic:

Citrobacter rodentium is a Gram-negative, extracellular bacterium that infects the colonic epithelium of mice, enteropathogenic *Escherichia coli* (EPEC) and enterohaemorrhagic *E. coli* (EHEC). It uses a type III secretion system to inject effector proteins into host cells, disrupting barrier integrity and triggering inflammation. The immune response to *C. rodentium* infection involves a coordinated activation of innate and adaptive pathways, prominently featuring type 1 and type 17 immunity (1). Notably, eosinophils are recruited to infection sites where they directly interact with *C. rodentium*. They exert bactericidal effects via degranulation and extracellular traps, and modulate Th1 responses through IFN-γ–dependent PD-L1 expression. Thus, eosinophils are crucial in the immune response and pathogen control (2,3).

The project:

This intradisciplinary project uses a **transposon insertion mutant library (TnSeq) of *C. rodentium***, which allows us to pinpoint bacterial genes crucial for colonization and immune evasion. Building on this, you will help generate and study **single bacterial knockout *C. rodentium* strains** using microbiological and molecular biology methods. Additionally, we use **high-dimensional flow cytometry** and **immunofluorescence imaging** to investigate how eosinophils and immune cells respond in the gut, giving us a detailed view of eosinophil biology and mucosal immune dynamics.

Aims:

- Design, establish and perform *in vitro* and *in vivo* experiments using the TnSeq *C. rodentium* library.
- Deciphering *C. rodentium* genes and pathways involved in host colonization, immune evasion and systemic infection by bioinformatically analyzing TnSeq-*C. rodentium* experiments.
- Generating single bacterial knockout strains and investigating their elicited immune response.

The environment:

You will join a dynamic, creative team that values curiosity and team spirit. We offer dedicated supervision, training in cutting-edge techniques and strong support for your personal scientific development. The project offers the opportunity to work closely with international collaborators in a stimulating research setting.
You should have enthusiasm for immunology, microbiology, or molecular biology, and a drive to tackle complex biological questions. Prior lab experience and bioinformatic knowledge are an advantage but not a requirement.

Please apply by sending your **CV and a motivation letter** to crepaz@immunology.uzh.ch

References:

1. Jordan S, Frankel G, Mishra V. Citrobacter rodentium. Trends Microbiol. 2025 Mar;S0966842X25000757.
2. Arnold IC, Artola-Borán M, Tallón de Lara P, Kyburz A, Taube C, Ottemann K, et al. Eosinophils suppress Th1 responses and restrict bacterially induced gastrointestinal inflammation. J Exp Med. 2018 Aug 6;215(8):2055–72.
3. Gurtner A, Borrelli C, Gonzalez-Perez I, Bach K, Acar IE, Núñez NG, et al. Active eosinophils regulate host defence and immune responses in colitis. Nature. 2023 Mar;615(7950):151–7.