

## Faculty of Science and Engineering

### Profile report:

EN: Pharmacology of host-pathogen interactions

NL: Farmacologie van gastheer-pathogeen interacties

Keywords: Immunopharmacology; host-pathogen interactions; disease modelling; antimicrobial resistance.

- Level: Tenure-track Assistant professor

- Fte: Full time (1.0)

### 1. Scientific discipline

Society is increasingly facing challenges associated with infectious diseases and antimicrobial resistance. These drive acute infections, exacerbate chronic diseases, and enhance susceptibility to develop such chronic diseases. Against the backdrop of the COVID19 pandemic on the one hand and the world-wide awareness of antimicrobial resistance on the other, one of the biggest scientific and societal challenges will be to identify new ways of therapeutically targeting host-pathogen interactions underlying infections and chronic diseases. This is particularly true for interactions with viruses, bacteria and fungi.

### 2. Vacancy

This position is opened by the Board of the Faculty (PT/gl/22/00243) and will be embedded in the Groningen Research Institute of Pharmacy, research group Molecular Pharmacology. The position falls within the framework of 'Career Paths in Science 4' ('Bèta's in Banen 4'). Please see link for [criteria and conditions](#).

### 3. Selection committee (BAC)

Prof. G.J. Poelarends, Scientific director of GRIP, chair

Prof. E. Hak, education director GRIP

Prof. M. Schmidt, chair Molecular Pharmacology group

Prof. A. Huckriede, professor of Vaccinology, UMCG

Prof. S. El-Aidy, professor of Host-Microbe Metabolic Interactions, GBB

Prof. P. Hiemstra, professor of Cell Biology and Immunology, LUMC (external member)

Student member: To be determined

Advisors: Prof. R. Gosens (chair of the board GRIP), Prof. P. Olinga (professor of Translational Biopharmacy), F. Salverda (HR), Dr. R. van Calck (scientific coordinator GRIP).

#### **4. Research area**

Society is increasingly facing challenges associated with infectious diseases and antimicrobial resistance. These drive acute infections, exacerbate chronic diseases, and enhance susceptibility to develop such chronic diseases. The COVID-19 pandemic is perhaps the most pressing example of how detailed knowledge on molecular mechanisms underlying host-pathogen interactions is needed for the development of novel vaccines and antiviral drugs. Likewise, the global development of antimicrobial resistance urgently requires novel antibiotics and antifungals. Also in the longer term, infections can trigger chronic diseases or exacerbate underlying diseases, as is already the case for example for Respiratory Syncytial Virus (RSV) bronchiolitis leading to enhanced asthma susceptibility and lung infections triggering exacerbations of COPD. In addition, several pathogens have been shown to reach the central nervous system, affect neuronal and microglial function and ultimately leading to neurodegeneration. Aged population and patients with neurodegenerative diseases are most vulnerable to COVID-19 infections and long COVID-19 has been shown to aggravate neurodegenerative conditions. However, it is not clear how COVID-19 infections and its long-term effects affect the pathology and the development of neurodegenerative diseases.

Understanding the molecular aspects of host-pathogen interactions will lead to a deeper understanding of underlying biological processes, pathogen invasion strategies, development of chronic disease, and insights into novel drug intervention strategies. Novel state-of-the-art screening platforms to study host-pathogen interactions will provide complementary information to what can be learned from genomics, transcriptomics, microbiomics and exposomics. Further development of *in vitro* and *in vivo* disease modelling technologies can help to unravel pathogen entry mechanisms and interactions with chronic disease.

Accordingly, this position aims to address molecular mechanisms underlying host-pathogen interactions and to identify novel druggable targets focusing on such interactions. This can include molecular immunopharmacology, the use of novel screening platforms for antimicrobial drugs, *in vitro* disease modelling technologies such as organoids and stem cells technologies, and *in vivo* modeling of host-pathogen interactions. This position aims to strengthen the already ongoing research initiatives focusing on respiratory and CNS pharmacology at the institute.

#### **5. Embedding: institute (and base unit)**

The Groningen Research Institute of Pharmacy is positioned within the Faculty of Science and Engineering (FSE) and physically located within the University Medical Centre Groningen (UMCG) of the Faculty of Medical Sciences (FMS) - hence, in an ideal position to benefit from collaborations between the two faculties. Together with Medical Sciences, GRIP participates in the joint UMCG-FSE Research Institute GUIDE (Groningen University Institute for Drug Exploration). Pharmaceutical research within GRIP is multidisciplinary and bridges the clinical and biomedical sciences on the one hand, and chemistry, mathematics (statistics) and physics on the other. The interaction between the

pharmaceutical sciences with these fundamental and clinical sciences offers excellent opportunities for cutting-edge research.

With this vacancy, GRIP's ambition is to strengthen its leading role in the area of infectious diseases and their relation with chronic disease. This position aligns well and strengthens the work on vaccine development in the research group Pharmaceutical Technology and Biopharmacy (Prof. Frijlink) and the work on antimicrobial resistance in the groups Chemical and Pharmaceutical Biology (Profs. Quax and Poelarends) and Drug Design (Profs. Dömling and Groves). Within the research group Molecular Pharmacology, the new position will strengthen ongoing research initiatives, focusing on Molecular Pharmacology (Prof. Schmidt), Translational Pharmacology (Prof. Gosens), Pharmaceutical Immunology (Prof. Melgert) and Regenerative Neuropharmacology (Prof. Dolga).

## **6. Local and (inter)national position**

The position is expected to strengthen the already established strategic local collaborations between GRIP and the Groningen Biomolecular Sciences and Biotechnology institute (GBB; e.g. Prof. Kuipers, Prof. El Aidy), the department of Genetics (e.g. Prof. Zhernakova; Prof. Withoff), the Microbes in Health and Disease programme of GUIDE (e.g. Dr. Akkerman, Prof. Huckriede, Prof. Van Dijk) and with the Groningen Research Institute for Asthma and COPD (GRIAC; e.g. Dr. Van den Berge, Prof. Nawijn).

At the national level, a bachelor and master programme in Pharmacy is offered by the Universities of Groningen, Leiden and Utrecht. The Utrecht Institute of Pharmaceutical Sciences (UIPS) has chairs in Experimental Pharmacology (Prof. Masereeuw), Interdisciplinary and Translational Pharmacology (Prof. Kraneveld), Immunopharmacology (Prof. Folkerts, Prof. Garssen), and Psychopharmacology (Prof. Olivier). The Leiden Academic Center for Drug Research has chairs in Predictive Pharmacology (Prof. De Lange), Quantitative Clinical Pharmacology (Prof. Knibbe), Quantitative Pharmacology (Dr. Van Hasselt), and Systems Pharmacology (Prof. Van der Graaf). The position of Pharmacology of host-pathogen interactions is unique in the Netherlands, bridging basic pharmacology and clinical medicine related to infectious diseases. This bridge is ideally supported by its strong anchoring in the research group Molecular Pharmacology within GRIP and its collaborations with the UMCG.

Internationally, collaborations in the area of host-pathogen interactions exist within the BREATH consortium of the Dutch Lung Foundation led by Prof. Clevers (Hubrecht Institute) and Prof. Kim (Harvard Stem Cell Institute); within the Inno4Vac consortium, a European public-private partnership to innovate vaccine development led by Dr. Depraetere of the European Vaccine Initiative; within the consortium funded by the Dutch Lung Foundation studying viral exacerbations of asthma and COPD led by Prof. Melgert; and with collaborating researchers from Philipps University of Marburg (Germany) on host-pathogen interactions in the brain.

## **7. Expected contributions to research**

The assistant professor is expected to develop an internationally leading, independent research line focusing on the pharmacology of host-pathogen interactions. With strong research lines embedded in the research group focusing on molecular pharmacology on the one hand, and *in vivo* pharmacology on the other, the position aims to bring these lines together and to develop new research to improve the pharmacological treatment of host-pathogen interactions and its relationship with chronic diseases. In particular, the position seeks to identify novel pharmacological targets at the cellular and molecular level, and to characterize and evaluate these targets in co-culture systems, organ culture systems, *in vivo* model systems and patients. The research group is well equipped to support this research line via its existing infrastructure and its embedding within GRIP and GUIDE.

Acquisition of substantial external funding is crucial for obtaining tenure. Demonstration of a strong ability to collaborate locally with relevant groups in the faculty of medical sciences and the FSE, and with colleagues on both a national and international level is also expected. An important aspect of the function will involve the supervision of PhD students.

## **8. Expected contributions to teaching**

The assistant professor will contribute to the Bachelor programs of Pharmacy, and Life Sciences and Technology, and the Master programs of Pharmacy, and Medical Pharmaceutical Sciences. In this framework the assistant professor will participate in the Receptor Pharmacology, Immunopharmacology, Physiology and Pharmacology, and Advanced Human Disease Modeling Technologies courses, as well as in master courses in Medical Pharmaceutical Sciences (Pharmaceutical Design and Engineering, Pharmacology of Chronic Diseases and Ageing). The assistant professor will be involved in the development of new courses (related to host-pathogen interactions) and/or in restructuring existing ones. For instance, with the aim to offer comprehensive education in vaccination and its associated technologies for future pharmacists, the candidate is expected to contribute to the development of a new course on this subject in conjunction with other staff members. In addition, the assistant professor is expected to supervise MSc and PhD students within the research group with research projects, essays and colloquia.

## **9. Expected contributions to the organization**

The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. At the level of the FSE, the candidate will contribute to the organization of the faculty, for example by participating in working groups and committees, in the fields of teaching, research and management. The candidate will participate in relevant national and international organizations.