

## Faculty of Science and Engineering

**Profile report:** Genome Editing (Genoom Modulatie)

- Discipline: Genome Editing
- Level: Tenure-track Assistant professor
- Fte: Full time (1.0)

### 1. Scientific discipline

Central to the discipline Genome Editing is the development of efficient genetic-based strategies to engineer cells. Recent advances in gene editing based on CRISPR/Cas systems have triggered a revolution in gene targeting and genome editing research, with the potential to radically reshape the treatment of genetic diseases by replacing or deleting defective genes. Metagenome mining and protein engineering, in combination with smart screening strategies, have proven their value in creating Cas enzymes with improved and new functionalities. In terms of pharmaceutical research, the development of effective genetic-based strategies to better combat human diseases, and the development of CRISPR/Cas-based systems as advanced tools to detect the presence of viral pathogens or treat viral disease are of paramount importance. The development of procedures for efficient and safe delivery of CRISPR/Cas systems to target cells or tissues remains crucial for application in clinical gene therapy.

### 2. Vacancy

This position is opened by the Board of the Faculty of Science and Engineering (PT/gl/22/00243) and will be embedded in the Groningen Research Institute of Pharmacy (GRIP), research group Chemical and Pharmaceutical Biology (CPB). 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.dr. G.J. (Gerrit) Poelarends, Scientific director of GRIP, chair

Prof.dr. E. Hak, education director of GRIP

Prof.dr. R. Gosens, professor translational pharmacology, chair of GRIP board

Prof.dr. M. Schmidt, professor of molecular pharmacology

Prof.dr. M.G. Rots, professor of molecular epigenetics (UMCG)

Prof.dr. A.M. Aartsma-Rus, professor of translational genetics (LUMC)

Student member: To be determined

Advisors: Prof.dr. W.J. Quax (head research group Chemical and Pharmaceutical Biology), F. Salverda (HR), Dr. R. van Calck (scientific coordinator GRIP)

#### 4. Research area

Recent advances in gene editing based on CRISPR/Cas systems have triggered a revolution in gene targeting and genome editing research. Developments within this discipline are fast and include, but are not limited to, the discovery and design of novel CRISPR/Cas systems with new or improved functions, enabling diverse medical and biotechnological applications. CRISPR/Cas systems can be used as advanced gene modulating tools to replace, silence or activate genes, as well as alter the epigenetic code by modifying chromatin structure or DNA-methylation. Hence, the CRISPR/Cas associated technologies have shown immense promise for human gene and cell therapy, diagnosis, construction of animal- and cell-models for disease investigations, and many other applications including genome editing in plants and microbes. The tremendous potential of CRISPR/Cas editing technology to radically reform the research into, and treatment of, genetic diseases, has further fueled GRIP's ambition to expand and strengthen its research in this area.

The research group Chemical and Pharmaceutical Biology (CPB) has as its central aim the exploration of the living cell as a source of pharmaceutically relevant products. Next to phytochemical analysis, molecular-biological techniques are applied to gain insight into biosynthetic routes and to control the production of bioactive compounds via pathway engineering. The biosynthesis of complex natural products is a universal theme within CPB, and its associated bottlenecks can be addressed by developing cell factories. The efficacy of biopharmaceuticals is being improved by the application of new techniques of combinatorial biology, protein engineering and computational design. New biocatalysts for stereoselective bond-forming reactions are being engineered, enabling the greener and more step-economic synthesis of Active Pharmaceutical Ingredients. Gene therapy for in situ expression of therapeutics is being pursued using the adenovirus as a vector, with a focus on the targeted delivery and expression of the transgene product. Through modulation of the activity of certain intracellular as well as membrane proteins, such as histone modifying enzymes, macrophage migration inhibitory factor and glutamate transporters, the research group is contributing to the development of novel cures for several diseases including inflammatory diseases and cancer.

Currently, various research lines within CPB already make limited use of CRISPR/Cas technology, however, by embedding a position with a specific research focus on Genome Editing in this research group, the tremendously versatile CRISPR/Cas technology can be incorporated in GRIP's pharmaceutical research as a research line in its own right. As such, collaborations are foreseen on topics such as modulation of the epigenetic code (Prof. Dekker), protein engineering (Prof. Poelarends), and manipulating biological pathways in microbial hosts (Dr. Schmidt, Dr. Haslinger). Apart from collaborations within CPB, potential interaction with relevant groups in the faculty of medical sciences (e.g. Prof. Fojier and prof. Van de Sluis), and the FSE, including the GRIP groups Molecular Pharmacology, Pharmaceutical Technology & Biopharmacy, and Drug Design offer excellent opportunities for leading-edge research.

## 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 highly multidisciplinary and interdisciplinary, and takes a central position in the life sciences. It 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.

The position will be embedded within the research group [Chemical and Pharmaceutical Biology](#), which participates in the GUIDE program “Biologicals: Discovery, Design and Delivery (BDDD)”. There are numerous interactions with other GRIP research groups and within the faculty there are collaborations with the research groups Molecular Genetics, Membrane Enzymology and Molecular Enzymology. Within GUIDE there are notable collaborations with the units Medical Microbiology and Clinical Oncology. Apart from this proposed position, the scientific staff of CPB currently includes two full professors (Prof. dr. W.J. Quax, who will retire by September 1<sup>st</sup> 2022, and Prof.dr. G.J. Poelarends), one associate professor (Dr. F.J. Dekker), and two assistant professors (Dr. S. Schmidt and Dr. K. Haslinger). In addition, 2 postdocs, 4 technicians and >20 PhD students are members of the research group.

With this vacancy, GRIP aims to strengthen its research on the development of efficient genetic-based strategies to combat human diseases.

## 6. Local and (inter)national position

With a strong interest to develop CRISPR/Cas-based strategies to fight human diseases, and the drive to collaborate with different (inter)national groups, the assistant professor can take advantage of the local [iPSC CRISPR Facility available at the UMCG](#) (Profs. Foijer and Van de Sluis). Further collaborations can be imagined with the [CRISPR Expertise Center in Amsterdam UMC](#) and [Genome Editing Centre at Utrecht University](#).

## 7. Expected contributions to research

The assistant professor is expected to develop an internationally leading, independent research line focusing on the development of efficient genetic-based strategies, based on CRISPR/Cas systems, to combat human diseases. Apart from gene targeting and genome editing research, the discovery and creation of CRISPR/Cas systems with improved and new functionalities, enabling diverse applications, may be investigated. Integral to this is the acquisition of external funding to maintain a level of funding which allows the assistant professor to perform world-class research in this field. 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. The research is expected to strengthen the existing efforts on the application of RNA-guided strategies to battle human diseases.

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

Teaching provided by the Chemical and Pharmaceutical Biology research group covers a range of courses in the bachelor and master phase of the Pharmacy and Medical Pharmaceutical Sciences programmes. The candidate is expected to contribute to these teaching activities, especially the Genetics, Innovative Therapeutics, Applied Biotechnology, and Infectious diseases and Oncology courses. The candidate will also be actively involved in the development of new courses and/or modernization of existing courses. 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. Furthermore, the candidate will be involved in coaching of bachelor and master students during electives and research projects.

### **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.