

## Faculty of Science and Engineering

### PROFILE REPORT

**Discipline: Pharmaceutical Biology**

**Level: Tenure-track Assistant/Associate professor**

**Fte: 1.0**

#### 1. Scientific discipline

Pharmaceutical Biology is the science and knowledge of the use of living cells as a producer of pharmaceutically relevant products. Although exploiting natural diversity, e.g. plant cells, has a long standing tradition in drug discovery, in recent years the discovery and design of pharmaceuticals have been strongly driven by new developments in molecular biology. The genomics and proteomics revolution identifies numerous novel receptors and other cell components, for which interacting ligands are sought as potential therapeutics. Biodiversity and biotechnology are very complementary to combinatorial chemistry in providing complex ligand molecules that can be the start for the development of a new therapeutic. The understanding of the molecular basis of biosynthesis has become a core activity of pharmaceutical research allowing the design of novel biosynthetic pathways and compounds. Novel techniques such as combinatorial biosynthesis and directed evolution have proven their value in creating new leads for drugs. Here, secondary metabolites from plants or microorganisms play an essential role in drug discovery and lead optimisation. The use of genetic and molecular biology techniques can be considered as future research areas for pharmaceutical biology.

#### 2. Vacancy

This position is opened by the Board of the Faculty of Science and Engineering (PT/gl/19/00006) and will be embedded in the Groningen Research Institute of Pharmacy (GRIP), department Chemical and Pharmaceutical Biology. 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)

##### *Members*

Prof.dr. H.W. Frijlink, research director GRIP, chairman

Dr. H.J. Woerdenbag, deputy program director, BSc Pharmacy

Prof.dr. G.J. Poelarends, professor of Pharmaceutical Biotechnology, member of GRIP board

Prof.dr. W.J. Quax, head department Chemical and Pharmaceutical Biology

Prof.dr. O.C.M. Sibon, professor of Molecular Cell Biology, UMCG

External member: Prof.dr. A.K.H. Hirsch, head department Drug Design and Optimisation, Helmholtz-Zentrum für Infektionsforschung, Germany

Student: Julian Voet, MSc student Pharmacy

##### *Advisors*

Mr. H. Haagsma, personnel advisor

Dr. A.J. Lexmond, scientific coordinator GRIP

Prof.dr. M. Schmidt, head department Molecular Pharmacology

#### 4. Research area

The research group Chemical and Pharmaceutical Biology has as its central aim the exploration of the living cell as a source of pharmaceutically relevant products. Natural and directed diversity of microorganisms, plants and plant cells are investigated as a source of natural products including protein therapeutics.

(1). The plant biotechnology research line is concentrated on the production of bioactive compounds of natural origin using plant cell cultures and plants. Next to phytochemical analysis, molecular-biological techniques are applied to gain insight into biosynthetic routes and to control the formation

of bioactive compounds (pathway engineering). Current projects that involve this work are (i) the production of cytostatic lignans in cell suspensions, organ cultures and plants from *Anthriscus sylvestris* (ii) the production and isolation of the antimalarial drug artemisinin with the use of plants and plant cell cultures from *Artemisia annua*. (2). The molecular-biological research line concentrates on biotechnologically produced pharmaceutical proteins, enzymes and cell surface receptors. The efficacy of biopharmaceuticals is being improved by the application of new techniques of combinatorial biology, protein mutagenesis and ultimately, computational design. The engineering of more selective cytokine variants is at the core of this research line. New biocatalysts for stereoselective reactions are being engineered including enantioselective proline-based biocatalysts for general alkylation, Michael addition, and aldol reactions. (3). The cell biology research line concentrates on the expression and especially on the secretion of pharmaceutical proteins from cells. Protein ligands as potential therapeutics -being macromolecules- present special problems with respect to production. The production of complex natural products is also a huge challenge in the drug development phase, and major bottlenecks are being addressed by developing cell factories. (4) Gene-therapy for in situ expression of therapeutics is being pursued using the adenovirus as a vector. The research focuses on the targeted delivery and expression of the transgene product. Techniques as cloning, protein expression and cell culture are central to this research. (5) Modulation of epigenetic modification is a relatively new tool for therapies and with the development of inhibitors for histone acetylation and deacetylation the research group is contributing to the development of novel cures for cancer.

## 5. Embedding: institute (and department)

The department Chemical and Pharmaceutical Biology (CPB) is part of the Groningen Research Institute of Pharmacy (GRIP) of the Faculty of Science and Engineering. GRIP participates in the Undergraduate School and Graduate School of Science and Engineering. For its PhD students GRIP joins the educational program offered by the research institute GUIDE (Groningen University Institute for Drug Exploration) of the Faculty of Medical Sciences/University Medical Center Groningen (UMCG).

CPB participates in the program “Biologicals: Discovery, Design and Delivery” of GUIDE. Within GRIP there are interactions with the research groups Drug Design; Pharmacokinetics, Toxicology and Targeting; Analytical Biochemistry and Pharmaceutical Technology and Biopharmacy. Within the Faculty of Science and Engineering there are collaborations with the research groups Molecular Genetics, Membrane Enzymology and Protein Crystallography. There are collaborations with the units Medical Microbiology and Clinical Oncology of the UMCG. Apart from the vacant position, the scientific staff of CPB includes three full professors (Prof. dr. W.J. Quax, Prof.dr. H.J. Haisma and Prof.dr. G.J. Poelarends) and one adjunct professor (Prof.dr. F.J. Dekker). In addition, four postdocs, four technicians and 28 PhD students are member of the department.

GRIP consists of the following departments (chairperson)

Analytical Biochemistry (Prof.dr. R.P.H. Bischoff)

Drug Design (Prof.dr. A.S.S. Dömling)

Molecular Pharmacology (Prof.dr. M. Schmidt)

Pharmaceutical Analysis (Prof.dr. E.M.J. Verpoorte)

Chemical and Pharmaceutical Biology (Prof.dr. W.J. Quax)

Pharmaceutical Technology and Biopharmacy (Prof.dr. H.W. Frijlink)

Pharmacotherapy, Pharmacoepidemiology and Pharmacoeconomics (Prof.dr. B. Wilffert)

Pharmacokinetics, Toxicology and Targeting (Prof.dr. K. Poelstra)

Pharmaceutical research is interdisciplinary and takes a central position in life sciences. It bridges medical sciences on the one side and chemistry, biology and physics on the other side.

## 6. Local and (inter)national position

In the Netherlands three Institutes of Pharmacy are responsible for training to the level of a Master degree in Pharmacy (Dutch: apothekersdiploma): University of Groningen, Utrecht University and Leiden University. Only Groningen has a chair in Pharmaceutical Biology. In Utrecht and Leiden, the chairs of Pharmacognosy have disappeared with the retirements of Prof. Labadie and Prof. Verpoorte respectively. In Leiden the Department of Metabolomics (Dr. Choi) is active in a similar research field. As a non-pharmaceutical institution Plant Research International (Wageningen) is active in the field of

natural products and medicinal plant biotechnology (Prof.dr. H. Bouwmeester). This group is interested in particular in plant metabolites and does not set its focus in general on pharmaceutical biology.

The department of Chemical and Pharmaceutical Biology is involved in various national and international research networks.

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

The assistant/associate professor is expected to develop a strong and independent research line on the characterization and elucidation of biosynthesis pathways for pharmaceutically relevant natural products. Apart from the analysis of genes and enzymes involved in biosynthesis, the production of defined natural products in heterologous hosts by metabolic pathway engineering may be investigated. Pathways of natural products that are complicated to isolate, or that are of limited amount and high demand (like paclitaxel, artemisinin, Vinca-alkaloids) may be in focus. Biosynthetic knowledge and enzymatic tools may be used for the engineered assembly of 'unnatural' natural products through combinatorial biosynthesis. In the future new genomic approaches, including metabolomics, may be expanded to the area of medicinal plants and the development of novel pathways may be considered for tailor made production of natural products.

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

The department provides a range of course units (compulsory, elective) in the bachelor and master programs of Pharmacy and the master program Medical Pharmaceutical Sciences (MPS). The following formal educational programs (course units) are actively given by the research group directly (#) or in cooperation with other research groups (\*).

- Molecular Biology of the Cell 1 Theory (#)
- Molecular Biology of the Cell 2 Theory (#)
- The Cell: a practical approach Practical Course (#)
- Organic and Biosynthesis (#)
- Pharmaceutical Biology Practical Course (#)
- Phytotherapy (#)
- Medicinal Natural Products (#)
- Pharmaceutical Biotechnology (#)
- Medicine group Infections and Tumours (\*)
- Capita selecta Pharmaceutical Biology (#)
- Pharmacy, Technology, Ethics and Society (\*)
- Biotechnology (\*)

Members of the staff also participate in the MPDI (Medical Pharmaceutical Drug Innovation) master program and supervise students who perform their bachelor or master research project (BSc Pharmacy, MSc Pharmacy, MPS, MPDI).

The candidate is expected to contribute to these teaching activities, especially the Biosynthesis theory part of the Organic and Biosynthesis course unit, the Pharmaceutical Biology practical and Medicinal Natural Products practical, and the lectures phytotherapy. He/she will also be actively involved in the development of new courses and/or modernization of existing courses. Furthermore the candidate will be involved in coaching of bachelor and master students during electives and research projects. He/she is expected to supervise PhD students. Final responsibility for the successful completion of their theses lies with the full professors until tenure is granted.

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

The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. The candidate will contribute to the organization of CPB and GRIP, 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.