



Faculty of Science and Engineering

Profile report: Natural Product Discovery and Engineering

- Discipline(s): Biology (domain microbial biotechnology)
- Level: Assistant Professor
- Fte: Full time (1.0)

1. Scientific discipline

Within the realm of microbiology many different research areas are covered to unravel the physiology and molecular processes of microbes, from single cells to microbiomes and entire ecosystems. The molecular and 'omics' tools that have been developed over the past decades have also enhanced research on mastering molecular and cellular processes for exploiting microbes (as cell factories) or their enzymes, commonly known as microbial biotechnology. Recent developments in synthetic biology, CRISPR-based gene editing and cell engineering also have opened avenues to discover yet unknown gene cluster for metabolic pathways and subsequently engineer these for developing truly sustainable bioproduction strategies synthesizing chemical building blocks, drugs (e.g. antimicrobials), biofuels, or other molecules.

2. Vacancy

A position for a Tenure-track Assistant Professor in Natural Product Discovery and Engineering is opened at the Faculty of Science and Engineering (FSE) of the University of Groningen. This position will be embedded in the Groningen Biomolecular Sciences and Biotechnology Institute (GBB) and will be open to applicants who aim to develop a (potentially) world-leading research line in any relevant subfield and who have a demonstrable capability in leading fundamental discoveries towards societal applications. Candidates also have affinity to academic teaching. The position will further strengthen the biotechnology focus of the research institute GBB and fits well with the Faculty's strategic foci within the national Sector Plans for the discipline Biology as well as the FSE research themes (e.g. Molecular Life and Health), and the University's impact domains Health, Sustainable Society and Energy. The position also connects well to the University's ambition to contribute to the Netherlands Growth Fund programmes FutureCarbonNL, Cellular Agriculture and Biotech Booster. The position falls within the framework of 'Career Paths in Science' ('Bèta's in Banen').

3. Selection committee

- Prof. Dirk Slotboom (Scientific Director, GBB), chair
- Prof. Dirk-Jan Scheffers (Director of Education, GBB)
- Prof. Arnold Driessen (Professor in Molecular Microbiology, GBB)
- Prof. Ida van der Klei (Molecular Cell Biology, GBB)
- Prof. Gert-Jan Euverink (Professor in Applied Microbiology and Biotechnology, ENTEG)
- Prof. Laura van Niftrik (Ecological Microbiology, Radboud University)
- Dr. Sonja Billerbeck (Assistant Professor in Synthetic Biology, GBB)
- Student member (to be assigned)



Additional (external) advisors:

- Ms. Mariska Laning (Human Resources, FSE)
- Dr. Engel G. Vrieling (Managing Director of GBB), secretary

4. Research area

The use of biology as a technology is essential in achieving a sustainable future, most importantly in making the necessary transition from fossil-based to bio-based in industrial production. Adapted or even completely new microorganisms (so-called designer microbes or microbial cell factories) will increasingly be used, for example to fix carbon dioxide or to convert organic material into new compounds through fermentation processes (white biotechnology). Synthetic cells with optimized genomes will be designed based on biological principles and used for specific applications, such as building completely new metabolic pathways. Adapted organisms will also be used to make, for example, new antibiotics, nutritional supplements, and immune-modulating and therapeutic proteins (biosimilars). Technological breakthroughs such as high-throughput synthesis of DNA, high-throughput phenotypic characterization at the single cell level and gene modification based on the CRISPR system, in combination with advanced computational and analytical methods, will take the development of designer microbes to unprecedented levels. Microbial biotechnology plays a crucial role in solving major societal challenges, such as the development of new antibiotics to address the urgent global problem of resistance. Because of the large microbial diversity present on this globe, microbes as of today remain largely unexplored for novel natural compounds. Through biotechnology and smart screening methods, new natural compounds (and involved enzymes) can be discovered and these can be further adapted for specific applications; for instance, combinatorial methods can be used to (re)design natural products to also aid natural product diversification and effectiveness and eventually improved production. The GBB is ideally positioned to tackle the associated scientific challenges, using microbiology (strain collections), bioinformatics (metagenomic methods to discover metabolic pathways), analysis (mass spectrometry and high-throughput screening), as well as enzyme, metabolic pathway, and cell engineering (genome editing, route construction and directed evolution). The expertise available at the GBB – ranging from metabolic engineering and synthetic biology to biocatalysis and supported with advanced analytical techniques for structure-function analysis – forms an excellent basis for tackling the associated scientific challenges.

5. Embedding: institute (and base unit)

The position will be embedded in the institute GBB and the candidate will lead his/her independent research line focusing on Natural Product Discovery and Engineering. The envisaged expertise of the new GBB member will make it possible to cover the teaching activities currently addressed in molecular microbiology, microbial genetics and cell engineering. The GBB institute has 13 vibrant research units, targeting challenging biological questions in the focal areas 'Molecular Mechanisms of Biological Processes' and 'Physiology and Systems Biology'. The newly appointed staff member will be able to connect to ongoing studies in molecular microbiology (Profs. Arnold Driessen, Dirk-Jan Scheffers, and Tessa Quax), microbiomes (Prof. Sahar El Aidy, Dr. Frans Bianchi), molecular systems biology (Profs. Matthias Heineman, Andreas Miliadis), molecular enzymology and biotechnology (Prof. Marco Fraaije and Dr. Max Fürst), chemical biology (Profs. Giovanni Maglia), and synthetic biology (Dr. Sonja Billerbeck). Furthermore, the work connects to structural-function research (Profs. Siewert-Jan Marrink, Albert Guskov, Dirk Slotboom, Bert Poolman and Dr. Tych) as well as research activities at the Stratingh Institute for Chemistry (e.g. Prof. Adri



Minnaard), the Groningen Research Institute for Pharmacy (GRIP; e.g. Prof. Gerrit Poelarends, Dr. Sandy Schmidt), the Groningen Ecology and Evolutionary Life Sciences Institute (Prof. Joana Falcao Salles, Dr. Marjon de Vos), and the Engineering and Technology institute Groningen (ENTEG; Prof. Gert-Jan Euverink).

6. Local and (inter)national position

The Faculty of Science and Engineering, and particularly its research institutes GBB, Stratingh, GRIP and ENTEG has a strong emphasis on microbial biotechnology and biocatalysis, aimed at understanding and unlocking both the structure-function relationships and (bio)synthetic pathways of molecules. This knowledge drives the design of creative concepts towards producing new (bioactive) natural compounds and improving their performance (in view of specificity, yield, etc.); all connected to providing sustainable bio-based solutions for societal challenges, such as antimicrobials to circumvent resistance or novel chemical building blocks. Synthetic biology is firmly integrated for (re)designing and engineering of enzymes, metabolic pathways and microbial cells; not only in research, but also in the BSc and MSc programmes as well-demonstrated by participation of student teams in the international Genetically Engineered Machine (iGEM) competition.

(Inter)nationally, (industrial) microbiology and synthetic biology are research areas for which long-standing collaborations occur between research groups at the University of Groningen (i.e. the institute GBB) and those of the universities in Delft, Leiden, Nijmegen, Utrecht, and Wageningen. Exemplary are former large research programmes such as BE-Basic and the Kluyver Centre for Industrial Fermentation, whereas in the area of synthetic biology the Gravitation programme BaSys is running. Natural compound research also links to national initiatives such as the NCOH programme on OneHealth. International hubs at which natural product discovery and engineering are intensively studied are located in Germany (e.g. Jena), Denmark (e.g. DTU), Belgium (e.g. VIB), Japan (e.g. Kobe University), Singapore (e.g. SINERGY), China (various CAS institutes and State key laboratories), and the US (EBRC consortium incl. MIT, Berkely and others)

The fundamental biomolecular and microbial research in Groningen is very strong and links to SMEs and industry (e.g. DSM, EnzyPep, Genentech, Corbion, Avebe, Gecco Biotech, Portal Biotech) are excellent. For example, the work on biocatalysts, membrane proteins and transporters, host-microbe interactions as well as antimicrobials was boosted through public-private partnerships. Also, honorary professors (e.g. R.A.L. Bovenberg; DSM) and spin-off companies originating from GBB (e.g. CarbExplore, Gecco Biotech, Portal Biotech, Omnicin Therapeutics) provide successful examples of bringing fundamental knowledge to application.

7. Expected contribution to research

The new staff member will conduct fundamental research resulting in publications appearing in influential internationally leading scientific journals. The research activities will contribute to the strengthening of the international position of GBB's microbial and biotechnological research as well as the research institute's activities in (inter)national research programmes, such as those funded by the National Growth Funds, the Netherlands Science Agenda, and the European Union. Furthermore, the research will have the potential to lead to collaborations with private parties in the life sciences. Acquiring external funding is vital, and it is encouraged that funding will partially come from industrial partners. Supervision of PhD students is a crucial part of the research activities.



8. Expected contribution to teaching

The new staff member will contribute to the relevant teaching programmes at the levels of bachelor, master and PhD of the Faculty of Science and Engineering, predominantly in Biology, Life Science & Technology and Chemistry, appropriate to the career stage. The requirements for the University Teaching Qualification will have to be fulfilled.

9. Expected contribution to the organization

An active input is anticipated in order to provide a valuable contribution to the management and organizational tasks of the institute GBB and the Faculty of Science and Engineering, appropriate to the career stage. At the level of the faculty, the staff member may participate in working groups and committees in the fields of teaching, research and management. The candidate is also encouraged to participate in relevant national and international science forums.