

Faculty of Science and Engineering

Profile report: Microbial Ecology and Evolution (Microbiële ecology en evolutie)

- Discipline: Microbiology
- Level: tenure-track assistant or associate professor
- Fte: full time (1,0)

1. Scientific discipline

Microbial ecology and evolution is a sub-discipline of microbiology that focuses on the ecology and evolution of microbes and their interactions with the environment aiming at understanding fundamental principles in ecology and evolution at micro scale and the potential use of these principles for societal applications.

2. Vacancy

This position is opened by the Board of the Faculty (ref. JK/gl/16/00664) and will be embedded in the Groningen Institute for Evolutionary Life Sciences in the expertise group "Genomics Research in Ecology and Evolution in Nature (GREEN) (with research on microbial ecology, as well as marine biology and ecophysiology of plants). 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. Ton Groothuis (Director GELIFES)

Dr. Louis van de Zande (Deputy director teaching programme)

Prof.dr. Joana Falcao-Salles (Microbial community ecology)

Prof.dr. Martien Kas (Behavioural Neurobiology, member Adaptive Life advisory board)

Prof.dr. Irene Tieleman (Animal Ecophysiology)

Prof.dr. George Kowalchuk (Environmental and rhizosphere microbiology, University of Utrecht)

Mevr. Maaike Hoog Hiemstra (Student member)

Advisors:

Linda Bosveld-Verburg (HR)

4. Research area

Microbes are present everywhere, in all, even extreme, ecological conditions on this globe. They are outside and inside organisms, in soils and in the air, often in large biomass and diversity. They have also a large impact on many biological and chemical processes. Microbial ecology and evolution is the field in which the adaptations, interactions and evolutionary dynamics of microbe species are studied in a community and ecosystem context. Due to their fast life span, microbes are often excellent models to study fundamentals of ecology and evolution but the field yields also societal applications for combatting disease, increase food production and

understanding global change. A currently important topic concerns, among others, the causal role of the microbiome in health and disease, neurobiology and behaviour. The rapid development of the field of Bio-informatics has strongly facilitated the study of the diversity, composition, ecology and evolution of the microbiome.

5. Embedding: institute

Microbial ecology and evolution is a field that integrates both mechanistic and functional/evolutionary approaches. In Groningen, the integration of physiological and ecological mechanisms with evolutionary theory is at the heart of the Groningen Institute for Evolutionary Life Sciences (GELIFES). It is also the core of one of the four Faculty strategic themes called Adaptive Life, that the institute is coordinating.

The institute has 6 expertise groups, each consisting of several professors and tenure-trackers, with a non-hierarchical internal structure. The current and strong research in microbial ecology (Prof. J. Falcao-Salles, Dr. M. de Vos), is part of the expertise group *GREEN (genomic research in ecology and evolution in nature)*. It provides the main embedding for the new staff member. Prof. Falcao-Salles focuses on the role of the microbiome in the plant rhizosphere, collaborating with the plant physiology group (prof. Elzenga). New initiatives are now undertaken by her in collaboration with several other groups to study the microbiome in relation to behaviour and ecology. This field, as well as the microbiology group as a whole, needs strengthening, also due to the retirement of prof. Van Elsas. Moreover, with the leave of Dr. Fontaine the institute urgently needs expertise in Bio-informatics. Apart from the GREEN group, the *Neurobiology group* and the new program in Evolutionary Medicine provide excellent collaborations, especially with those PI's interested in the role of the microbiome in the neurobiology of social behaviour, and neuroendocrinology of metabolism and eating disorders in rodents. In addition, the *Behavioural and physiological ecology* group provides excellent opportunities for embedding of the ecological approach, especially concerning birds. Other expertise groups are *Theoretical Research in Evolutionary Life Sciences*, (focusing among a variety of topics on eco-evolutionary dynamics) and *Evolutionary Genetics, Development and Behaviour*, (focusing among others on behavioural and molecular genetics and behavioural development from an evolutionary perspective). Finally, in Groningen microbial research, including work on the microbiome of animals, is conducted outside the institute in the bordering Groningen Biomedical Science and Biotechnology Institute (GBB) and the Medical Faculty with which we both collaborate.

6. Local and (inter)national position

Local: The Microbial Ecology group at the University of Groningen has a strong tradition in soil and plant microbiology, where ecological theories and concepts are used to understand and explore these microbial communities. The group has a strong reputation in linking microbial diversity in soils to functional aspects, such as understanding the N cycle. With the recent appointment of Dr. de Vos the group extended in the direction of the importance of microbes for Evolutionary Medicine focusing on urinary tract infection. Also recently, the group has expanded to include

the microbiomes of birds, insects, rodents and also humans (prof. Salles-Falcao). The group is well known for its ability to combine high throughput molecular data, bioinformatics and modelling approaches to unravel the ecological principles driving microbial communities, a unique combination in Europe. Current work includes soil microbial succession, microbial invasions, microbial consortia for lignocellulose degradation, plant-microbe interactions, bacterial-fungal interactions, horizontal gene transfer, the microbiome of birds and the importance of the gut microbiome in depression and cognitive disorders. In addition to collaborations within the institute, there are strong links with the Groningen Biomolecular and Biotechnology institute (GBB) on plant-associated bacteria. GBB recently started to work on the microbiome of animals too. Finally, the institute is internationally renowned for its ecological and evolutionary research, and has at the same time tight connections with the Medical Faculty and the University Medical Centre Groningen. It coordinates top master programs in Evolution and Ecology, including the international top master Erasmus Mundus (MEME), the top master Behavioural and Cognitive Neurosciences, and the high profile master in Marine Biology. We substantially teach in the large programs Behavioural Neurosciences and Medical Biology. The institute has its own Research School in Ecology and Evolution.

Nationally, the research focus on integration of mechanistic and evolutionary approaches to adaptation characterizes the institute. Microbial Ecology research has strong ties with Universities of Wageningen, Utrecht, and Amsterdam, and with the National Institute for Public Health and the Environment (RIVM) and the Royal Netherlands Institute for Ecology (NIOO), as well as with the companies EcoStyle (Dr. Doornbos) and Corbion (Dr. Ruijssenaars). The aforementioned labs cover the ecology of fungi, insects and viruses (Wageningen), the ecology of soil and plants (Utrecht), biotechnology-oriented microbiology (Amsterdam, Delft) and societal (antibiotic resistance) and marine microbiology (RIVM, NIOZ). The Microbial Ecology research in Groningen has unique complementary expertise that enables productive collaborations with these labs.

Internationally, major collaborative partners (not exclusive) are situated in Europe (Germany, France, the UK, Sweden, Slovenia, Portugal, the Czech republic, Iceland, and >5 more), the USA and Canada (several partners), China (several partners), Brazil (>6 collaborative partners) and Australia. Both PI's in the Microbial Ecology group have served or are serving as leaders of diverse international collaborations, including EU-sponsored projects (METAEXPLORE, VITISMART and >8 others). They are also [leading] members of the International Society for Microbial Ecology (ISME) and the International Society for Environmental Biogeochemistry (ISEB). Finally, they serve on the boards of a number of International congresses, i.e. the two-yearly BAGECO, the two-yearly SYMBIOSIS, and the ISEB conferences.

7. Expected contributions to research

The new staff member is expected to set up an independent research line within the field of microbial ecology and evolution, focussing on the ecology and evolution of the animal microbiome. The new staff member is expected to strengthen the collaboration between microbiology and the other research groups mentioned,

including the bordering institute GBB and the Medical Faculty. This should result in publications in high ranking journals, substantial external funding and successful supervision of PhD students. In addition, the new staff member is expected to provide state of the art bio-informatics expertise to other researchers in the institute.

8. Expected contributions to teaching

The candidate is expected to contribute to teaching in microbiology and other fields, at the bachelor level, (both general biology and the program for ecology and evolution, the program for medical biology) and at the master level (both courses and research projects) and at the level of PhD education.

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.