

Faculty of Science and Engineering

Profile report: Bioinformatics, Bioinformatica

- Discipline: Life Sciences, bioinformatics, omics, Ecology, Evolution
- Level: Tenure-track assistant professor with education profile
- Fte: 1,0 fte

1. Scientific discipline

Bioinformatics is a discipline that focuses on the analyses and interpretation of large, biological dataset. The importance of bioinformatics for fields such as ecology and evolution has increased dramatically in the past 10 years, due to the development of cheaper sequencing technologies, which made the application of omics approaches more feasible. The result is the generation of large and complex data sets that can only be understood and fully explored through software development and bioinformatic approaches.

This position will predominantly focus on further strengthening and implementing new bioinformatics approaches in various courses in the Biology Bachelor and Master programs taught in GELIFES as well as contribute to ongoing research with bioinformatics. The appointed candidate's research should preferably contribute to current research lines in the Groningen Institute for Evolutionary Life Sciences that involve bioinformatics.

2. Vacancy

This position is opened by the Board of the Faculty (PT/gl/21/00115) and will be embedded in the institute Groningen Institute for Evolutionary Life Sciences (GELIFES). The criteria and conditions pertaining to the position are described in the document [‘Assistant professor with an education profile’](#).

3. Selection committee (BAC)

- Prof.dr Rampal Etienne (Scientific Director GELIFES)
- Prof.dr Theo Elzenga (Education director; Chair)
- Prof.dr Bregje Wertheim (Program Director Master Ecology and Evolution)
- Prof.dr Joana Falcao Salles (Professor Microbial Community Ecology)
- Prof.dr Per Palsboll (Professor of Marine Evolution and Conservation)
- Prof.dr Eiko Kuramae (Professor Microbial Community Ecology & Environmental Genomics; NIOO/Utrecht University; external member)
- *student member, t.b.d.*

Advisors: Linda Bosveld-Verburg (Hr), Prof.dr Sander van Doorn (Program Director Bachelor Biology), Prof.dr Roelof Hut

4. Area of expertise

Recent methodological advances are allowing scientists to collect large amounts of omics data from a broad range of biological systems. The result is the generation of large and complex data sets that can only be understood and fully explored through software development and bioinformatic approaches. At GELIFES we study evolutionary and ecological aspects in a wide variety of organisms spanning from viruses to whales in marine and terrestrial ecosystems, and across multiple organizational levels; molecular,

cellular, individual, populations and communities as well as entire ecosystems. General topics addressed in GELIFES are: microbiome interactions (amplicon sequencing, metagenomics, meta-transcriptomics) in soils or in association with hosts (plants, birds, insects, rodents and humans); genome evolution; insect immune responses; genomics of sex determination, population; ecological and evolutionary genomics. Part of this research is based on large molecular data sets, from which the biological interpretation requires the use of bioinformatic approaches. Given the broad and integrative nature of the research conducted in GELIFES, the institute would benefit from a bioinformatician with a strong ecological or evolutionary background.

The research and teaching program should focus on the application and development of bioinformatic tools for 'omics' data. The candidate will be able to develop their own research line, but is also expected to interact with current PIs to provide bioinformatic support to postdocs and PhD students, for instance, by developing bioinformatic pipelines or retrieving data retrieval from public databases (e.g., NCBI-SRA, Genome, Ensembl, 1000G projects) for 'omics analyses (e.g., epigenomics, comparative genomics, virome, microbiome, transcriptome). With respect to teaching, any modern biology curriculum is unthinkable without a strong background in bioinformatics. Many biological, and particularly evolutionary and ecological, questions are currently approached with molecular techniques generating massive amounts of data that require the use of bioinformatics techniques to interpret. Preparing our students for these challenges requires a solid understanding of and training in bioinformatics. Also at advanced-level education, at the MSc/PhD level students that choose to specialize in bioinformatics, courses need to be available. All of these initiatives require a high commitment to education, educational innovation and didactic skill development to train students in biology and life sciences, and to create coherence between bioinformatics elements everywhere in the curriculum across different biological specializations.

5. Embedding: institute (and expertise group)

The Groningen Institute for Evolutionary Life Sciences (GELIFES) aims to enhance the understanding of adaptive processes and the maladaptive consequences of their limitations, across all levels of biological organization (from molecules and genes to individuals and ecosystems), to inform the society and contribute solutions to societal problems. The institute has tight connections with the Faculty of Medical Sciences (FMS) and University Medical Centre Groningen (UMCG). It coordinates master programs in evolution and ecology as well as in medical and behavioural neurobiology.

GELIFES is organized in a non-hierarchical manner, and staff associate with one (or more) informal expertise groups. The tenure-track assistant professor is free to choose their expertise group. GELIFES currently has six expertise groups, each consisting of several professors and assistant professors with their groups: *Genomics Research in Ecology & Evolution in Nature* (GREEN), *Theoretical Research in Evolutionary Life Sciences* (TRES), *Evolutionary Genetics, Development and Behaviour* (EGDB), *Behavioural and Physiological Ecology* (BPE), *Conservation Ecology* (CONSECO) and *Neurobiology*.

The candidate will have access to GELIFES' excellent facilities, including IT facilities for large data processing.

6. Local and (inter)national position

Local:

Within FSE we teach bioinformatic tools to address questions in ecology and evolution in the Biology and Life Science & Technology bachelor programs. Our institute has strong links with the medical sciences at the UMCG as we educate medical biology students in evolutionary medicine and animal physiology. A hallmark of our educational profile is the integration of mechanistic with functional approaches, to understand diversity and adaptation.

National:

GELIFES has a strong reputation in research and education in ecology, evolution, behaviour and neurobiology. GELIFES is the only life science institute in the Netherlands that specifically aims at integrating the study of physiological mechanisms with those of ecology and evolution. Many collaborations exist with other universities and research institutes in The Netherlands on a wide variety of topics, including the universities of Wageningen, Utrecht and Amsterdam and the Royal Dutch Academy Institutes Netherlands Institute for Ecological Research and the Netherlands Institute for Sea Research as well as the Naturalis Biodiversity Center.

International:

There is no other institute in the Netherlands, and only very few in the world, that specifically aim at the integration of ecological and evolutionary approaches with neurobiology and physiology in the Life Sciences. Our international collaborations are too many to list but our research topics that are internationally very well recognized and relevant for the new staff member are among others the genetics and evolution of insect reproduction, the evolution and physiology of animal personalities, sociability and ageing, microbial genetics and ecology, evolutionary genomics, biological clocks, maternal effects, and theoretical biology.

7. Expected contributions to teaching

The candidate will teach at all levels within the Life Sciences and Biology curriculum, with focus on the Bachelor level. They will coordinate or contribute to bachelor courses (Ecological and evolutionary genomics, microbiome, Big Data Management in Ecology and Evolution) and master courses (Genomics in Ecology and Evolution, Molecular Methods in Ecology and Evolution, Practical Bioinformatics for Biologists) and will be expected to develop new course materials, new courses and/or innovations in teaching in general. The candidate will coordinate the educational activities in the fields of bioinformatics, and maintain contacts with colleagues that teach related fields such as microbial ecology, genetics and genomics, phylogenetics, evolutionary biology and behavioural genetics.

The candidate will stay up to date with the latest developments in the fast-developing field of bioinformatic approaches to ecology and evolution, and integrate these developments in their teaching program. This includes the coordination and organization of bachelor research projects and ensuring that these projects are embedded in state-of-the-art research programs within GELIFES. This also entails the expansion of institute-driven student research projects into project-laboratories run by SSE staff, a cross-organizational structure that spans the different majors (i.e., cross-curricular activities) of the BSc Biology. The candidate will apply for grants to further develop and apply novel teaching techniques.

Specifically, the candidate will be involved in the following (non-exhaustive list of) teaching activities, and improve the coherence between them:

- Comparative genomics
- Amplicon sequencing analyses
- Principles of metagenomic analyses
- Genome structure
- Genome toolbox
- Pipeline development
- Population genomics
- Phylogenomics
- Statistical analyses and interpretation of large, omics (metatranscriptomics, metabolomics, epigenomics) based, datasets

8. Expected contributions to research

The new staff member is expected to associate with an existing research line of ecology and evolution in GELIFES. This embedding in a research program ensures that their teaching is fueled by modern research in the field and includes the translation of research activities into the teaching program (e.g., practicals) as well as instruction and co-supervision of Master and PhD students. The candidate is expected to contribute to the bioinformatic data analysis and interpretation of other staff members in the institute, especially in the fields of microbial ecology and evolution, life-history traits, theoretical biology, plant physiology, behavioural ecology, marine biology, and community ecology. They will have a clear affinity with modern bioinformatic approaches for ecological and evolutionary research.

GELIFES is known for its strong research in the field of microbial ecology and evolution, focusing on soil microbiome in the context of invasion ecology and ecosystem functioning, as well as the contribution of the microbiome to the adaptation of plants in an agricultural setting, and the role of microbiome in the ecology and evolution of birds and insects. There is also a strong link with evolutionary medicine, focusing on the role of microbial interactions on urinary tract infections, and on neurological disorders. The research in microbial ecology and evolution has recently been expanded to viral components. The microbiome field acts as overarching discipline across several disciplines in GELIFES, and as such is involved in several collaborative projects financed by Adaptive Life program (RUG), as well as coordinators or partners in several EU (ITN, Era-Net programs on plant microbiome interactions and sustainable agriculture) and Dutch programs (NWO_NWA Insectfeed, NWO biobased economy MicroWaste and WhyCareMore). This represents one potential research field with which the candidate may associate.

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 FSE, the candidate will contribute to the organization of the faculty, for example by participating in working groups and committees in the area of education. The candidate will participate in relevant national and international organizations.