Description Assistant or Associate Professor in Computational Systems Biology

**Name:** Computational Systems Biology  
**Appointment:** 1,0 fte  
**Level:** Assistant (tenure track) or Associate Professor

1. **Field of research**  
The position for a professor at the level of Tenure Track Assistant or Associate Professor is within the field of Computational Systems Biology.

2. **Vacancy**  
The research aim of the new faculty member is to understand complex and dynamic interactions of molecular networks in biological cells, using computational analyses and mathematical modelling, and eventually the computational design of new functionality in molecular networks. The position is embedded within the Groningen Biomolecular Sciences and Biotechnology Institute (GBB) of the Faculty of Mathematics and Natural Sciences (FMNS) of the University of Groningen. The institute has 13 vibrant research groups, targeting biological questions in the two focal areas “Molecular Mechanisms of Biological Processes” and “Physiology and Systems Biology”, strongly contributing to the FMNS theme “Molecular Life and Health”. The position has been approved by the Faculty Board with communication FB13/00341.

3. **Selection committee**  
- Prof. dr. Bert Poolman (Director GBB), chair  
- Prof. dr. Peter J.M. van Haastert (head research group Cell Biochemistry, GBB)  
- Prof. dr. Matthias Heinemann (head research group Molecular Systems Biology, GBB)  
- Prof. dr. Barbara M. Bakker (head research group Medical System Biology, UMCG)  
- Prof. dr. Jorg Stelling (Computational Systems Biology, ETH Zurich)  
- Prof. dr. Ria Broer-Braam (head research group Theoretical Chemistry, Zernike)  
- Student member: Neus Mestre Farràs (MSc student)

   **Additional advisors**  
   - Prof. dr. Ernst C. Wit (Statistics and Stochastics, JBI)  
   - Prof. dr. Siewert Jan Marrink (Molecular Dynamics, GBB)  
   - Prof. dr. Marco W. Fraaije (Molecular Enzymology, GBB)  
   - Mrs. Yvonne Folkers (HR-advisor FMNS)  
   - Dr. Engel G. Vrieling (Managing director GBB), secretary committee

4. **Research area**  
Biological research is getting more and more quantitative as well as large-scale, and consequently computational approaches are getting increasingly important in biology. This is the case at different levels of biological research, i.e. on the atomistic & molecular level, on the level of complex molecules (i.e. proteins, RNA), on the cellular level (i.e. molecular networks) and beyond (i.e. on the multicellular, evolutionary or eco-systems level). This structure report describes a vacancy to be filled in by a candidate entertaining high-level research on the cellular level.

Molecular network of cells are inherently complex, i.e. many biomolecules interact with each other dynamically, often in a non-linear manner. These interactions ultimately give rise to biological behavior, which we would like to understand, manipulate or engineer. To understand how such behavior emerges, mathematical models and computational tools are required. Here, one can
distinguish between two different research approaches: (i) the “bottom-up” systems biology approach aimed at understanding complex biological behaviour through mathematical models, and (ii) the “top-down” systems biology approach, where information is extracted from large data sets through computational/statistical tools. As the computational tools and methodologies for these two approaches are still relatively new, further method and tool development is needed. The envisioned candidate follows the aforementioned bottom-up systems biology approach, i.e. employing mathematical models and computational methods, to understand (and eventually design) complex biological behavior on the cellular (or sub-cellular) level.

Several scientific areas could be envisioned, to which the candidate could apply the bottom-up systems biology approach - ideally connecting to wet-lab groups of the GBB. The research area of this candidate could be in the microbial realm, but also investigation of mammalian or mammalian-microbial systems (e.g. host-microbe interaction networks) are possible, with the institute expanding into these directions. Further, the topic of the research could involve, for instance, research on gene circuits, signalling or metabolic networks, and the applied computational tools could, for instance, be ODE-type, Boolean- or any other models. Engineering of circuits and networks (“synthetic biology”) could also be a relevant research direction. While it is absolutely necessary that this candidate’s research is geared towards generating novel understanding of complex biological systems, it would be ideal if he/she could also further push the development of new computational algorithms/methods.

5. Research group and institute
When the position is filled at the level of associate professor, it will form a new research group within GBB. When the position is filled on the assistant professor level, the position will be embedded in the research group Molecular Systems Biology within the Research Institute GBB. This research group is housed in the Chemistry and Physics building (Nijenborgh 4) and entertains a combined wet- and dry-lab systems biology research programme. Per of August 2015, the research group comprises one member of staff – Prof. dr. M. Heinemann (1,0 fte full professor)-, 12 PhD students and 3 postdoctoral fellows. The group has significant external research funds, from which the new assistant professor can also profit at the beginning.

Foreseen research collaborations are those with research groups at GBB such as Molecular Genetics (i.e. modelling of genetic circuits, synthetic cell), Molecular Microbiology (cell engineering), Microbial Physiology (host-microbe interactions), Membrane Enzymology (synthetic cell), and Cell Biochemistry (modelling of signalling transduction networks). Further, this position would strengthen the Groningen systems biology activities also beyond GBB, because at this moment neither at the UMCG nor at FMNS is there a person with such a research agenda. Interaction possibilities for the new staff members can also be foreseen in larger (inter)national research programmes such as the NWO Centre for Systems Biology on Energy Metabolism and Ageing (SBC-EMA), ESF Sysmo and Synbio programmes, BE-Basic, and the NWO GP programme Synthetic Biology for Advanced Metabolic Engineering.

Current state in the Netherlands: While bioinformatics is strong (TU Delft, Netherlands Cancer Institute (NKI), Wageningen University, CMBI Nijmegen), relatively few groups engage in mechanistic mathematical modelling of molecular biological systems with a strong root in the computational side (exceptions are Frank Bruggeman (Free University Amsterdam (VU)) and Natal van Riel (TU Eindhoven)). Excellent opportunities for such a group will soon emerge from activities in the Dutch Techcentre for Life Sciences (DTL).
6. Local and (inter)national position. At FMNS, computational approaches in biology are well covered on the atomistic & molecular level by the research and teaching of Prof. Marrink (GBB), and at the evolutionary and eco-system levels by Profs. Weissing and van Doorn (GELIFES). Beyond, on the population level, computational research is done with regards to epigenetics by Prof. Wijmenga (University Medical Centre Groningen, UMCG) and researchers at the European Research Institute for the Biology of Aging (ERIBA). In fact, however, computational research at the cellular level is missing.

Examples of international colleagues entertaining such research are: Prof. Edda Klipp (Berlin), Prof. Jörg Stelling (ETH Zurich), Prof. Peter Swain (Edinburgh), Prof. Markus Covert (Stanford), Prof. Roland Eils (DKFZ), Prof. Eytan Ruppin, Prof. Bernhard Palsson (USCD), Prof. Jens Timmer (Freiburg), Prof. Julio Banga (Vigo), Prof. Mustafa Karamash (ETH Zurich), Prof. Thomas Höfer (Heidelberg) and Prof. Adam Arkin (UC Berkeley).

7. Expected contribution to research
The research tasks entail (i) fundamental scientific studies that result in publications of high impact, appearing in internationally renowned scientific journals, and (ii) the supervision of PhD students and postdoctoral fellows in their research. External fund raising is essential to accomplish the aforementioned tasks. The research activities should further result in the strengthening of the international position of GBB in computation biology in general.

8. Expected contribution to teaching
The successful candidate organizes and presents lectures as well as computer-based practicals to students at both the BSc and MSc levels. He/she also supervises students during research and thesis projects. The educational tasks comprise the development of courses and teaching in computational systems biology predominantly within the study programmes affiliated to Life Sciences (e.g. BSc Life Science and its majors Molecular Life Science and Biomedical Sciences, the MSc Molecular Biology and Biotechnology, and the Top programme Biomolecular Sciences). Generally, the envisioned professor teaches courses in using models and computational tools.

It is envisioned that the current bachelor course Bioinformatics will be extended to cover the broader use of computers/mathematical models in biology. The envisioned professor could teach a Master course in Computational Systems Biology, where students, after the existing Master course “Tools and Approaches of Systems Biology” (taught by Prof. M. Heinemann), could further deepen their capabilities in modelling and use of computational tools. Involvement of the new professor in the GBB-coordinated iGEM course is also envisioned. Furthermore, excellent opportunities for teaching exist in the bio-related teaching branch of the physics curricula of the Zernike Institute for Advanced Materials (ZIAM).

9. Expected contribution to the organization
It is expected that the candidate will play an active role in the general organization of research at national and international levels and within the institute and the faculty, e.g. the overarching activities within the faculty themes, in particular Molecular Life and Health. Contributions to existing and new teaching programs within USS and GSS are also expected.

10. Career perspectives
The position will be offered as tenure-track assistant or associate professor, according to the document "Career Paths in the Sciences" of the FMNS. The offered position will be filled according to the actual University Function Ordering (UFO) system and regulations. The following applies for:

- Level Assistant Professor (Universitair Docent; UD): After five years, the performance of the assistant professor will be assessed according to the criteria as outlined in the aforementioned document. A positive assessment will lead to a tenured appointment and a
promotion to adjunct (associate) professor. A negative assessment after the first 5 years will result in the termination of the appointment after a total duration of six years.

- Level Associate Professor (Adjunct professor, Universitair Hoofddocent; UHD): An adjunct professor has the *ius promovendi*, i.e., the legal right to formally complete the supervision of PhD students. After 4-7 years the associate professor may apply for a promotion to full professor.

11. Profile of the candidate
The candidate meets the following qualifications:

- Doctorate in Physics, Engineering, Computer Science, Computational Biology, or a related discipline;
- Experience with or demonstrable interest in solving biological problems;
- Two or more years of international experience through postdoctoral research at a university different from where the candidate obtained the PhD, or at an independent research institute, or in industry;
- Outstanding research with excellent track record and publications of high-impact in international peer-reviewed journals;
- Excellent teacher who can motivate students of different disciplines and has demonstrable affinity for and quality in teaching;
- Excellent communicative, organisational, and management skills;
- Experienced in acquisition of research funds;
- Excellent command of the English language, with a clear ambition to obtain a good command of Dutch within two years;
- Willing to fulfil the obligatory requirement for obtaining a University Teaching Qualification ('Basiskwalificatie Onderwijs'; BKO).

11. Supportive information:

- The university and the institutes:
  - University of Groningen: [www.rug.nl](http://www.rug.nl)
  - Groningen Biomolecular Science and Biotechnology Institute: [www.rug.nl/gbb](http://www.rug.nl/gbb)
  - European Research Institute for the Biology of Ageing: [http://www.umcg.nl/EN/Research/Eriba/Pages/eriba.aspx](http://www.umcg.nl/EN/Research/Eriba/Pages/eriba.aspx)
  - University Medical Centre / Faculty of Medical Sciences: [http://www.rug.nl/umcg/research/](http://www.rug.nl/umcg/research/)
- Promotion conditions defined in the Career Paths in Science: ([www.rug.nl/fwn/careerpathsinscience](http://www.rug.nl/fwn/careerpathsinscience))
- Standard salary levels according to Union of Dutch Universities (VSNU): [http://www.vsnu.nl/cla](http://www.vsnu.nl/cla)