

Faculty of Science and Engineering, University of Groningen

Profile report: Design of Targeted Pharmaceuticals (Het ontwerp van gerichte geneesmiddelen)

- Discipline: Advanced drug delivery, Drug targeting, Nanomedicine, Controlled drug delivery, Advanced pharmaceuticals
- Level: Tenure-track Assistant Professor or Associate Professor
- Focus: Research
- Fte: Full time (1.0)

1. Scientific discipline

This position fits in the discipline *Advanced Drug Delivery*, which addresses the development of innovative strategies for the design, synthesis and delivery of pharmaceutical compounds to their target. *Nanomedicine* and *Drug Targeting* are two key areas in this discipline. Research on Nanomedicine focuses on the use of nanosized materials as drug carriers, whereas the area of Drug Targeting covers the technology to deliver drugs to target cells using an active delivery strategy. The key aim of the discipline is to modify the pharmacokinetic profile of compounds to enhance their effectivity and safety.

2. Vacancy

This position was created in the context of the sector plan Pharmaceutical Sciences and will be embedded in the Groningen Research Institute of Pharmacy (GRIP), in the research group Nanomedicine and Drug Targeting (NDT). The position falls within the framework of the newly instated career development program, [Career Paths in Science and Engineering](#). As the focus domain of the position is research, the criteria of the career path with a focus on research apply. Please see the link for more information.

3. Selection committee (BAC):

Prof. dr. G.J. Poelarends, Scientific Director GRIP, Chair of the Selection Committee.

Prof. dr. E. Hak, Education Director cluster Pharmacy.

Prof. dr. K. Poelstra, Professor of Drug Targeting

Prof. dr. A. Salvati, Associate Professor of Nanomedicine

Prof. dr. I.S. Zuhorn, Professor of Drug Delivery across Cellular Barriers, UMCG

Prof. dr. E. Mastrobattista, Professor of Pharmaceutical Biotechnology and Delivery (external member, Utrecht University)

Student-member: Sjoerd Idzerda

Advisors: F. Salverda (HR advisor); Dr. R.V. van Calck (scientific coordinator)

4. Research area

The new position is focused in the area of material design and more specifically on the synthesis of complex targeted constructs and targeted nanomedicines for the delivery of small chemical

entities and/or biological compounds such as RNA or related products, CRISPR-Cas, cytokines, or other therapeutic proteins. Key challenges in this field are the design of new moieties to achieve active tissue or cell-specific targeting, and methods for a well-controlled functionalization of different nanocarriers. In order to achieve this, specific issues such as the efficient attachment of targeting moieties to the carrier, controlling the density and orientation of such moieties and homogeneity of the constructs should be taken into account. Also the development of innovative carriers by application of stimulus-responsive materials, or other local compound-activating strategies to induce a local controlled activation of drug carriers can be a relevant research area. As such, it is clear that the incorporation of these concepts at the design-stage of targeted constructs and nanomedicines is crucial in order to improve their safety and the activity profile of drugs, and this position will strengthen the GRIP's leading role in the development of dosage forms, drug targeting and nanomedicine.

5. Embedding: institute

The Groningen Research Institute of Pharmacy (GRIP) is positioned within the Faculty of Science and Engineering (FSE) and physically located within the University Medical Centre Groningen (UMCG) of the Faculty of Medical Sciences (FMS); hence, in an ideal position to benefit from collaborations between the two faculties. Together with Medical Sciences, GRIP participates in the Research Institute GUIDE (Groningen University Institute for Drug Exploration). Pharmaceutical and medical research within GRIP is highly multidisciplinary. It bridges clinical and biomedical sciences on the one hand and chemistry, mathematics (statistics) and physics on the other. The interaction between the pharmaceutical sciences with these fundamental and clinical sciences offers excellent opportunities for cutting-edge research.

The new assistant professor will be embedded in GRIP's research group Nanomedicine and Drug Targeting (NDT), which uses multidisciplinary approaches for the design and development of drug delivery systems using innovative nanomedicines and drug targeting strategies. Currently, the group focuses on (I) development and testing of innovative nanocarriers and its routing across biological barriers, cells or intracellular compartments (Prof. Salvati) and (II) the design of protein-based carriers for the active delivery drugs and proteins to key pathogenic cells (Prof. Poelstra). The group combines chemical expertise with cell-biology, medical-biology, and knowledge on *in vitro* and *in vivo* disease models. The new position will bring new expertise in the design of materials and/or the coupling of functional ligands to carriers to the research group, simultaneously strengthening and supporting the existing research lines within the group.

With this vacancy, GRIP's ambition is to further build on the scientific knowledge generated by its preclinical and clinical research groups (e.g. Pharmaceutical Technology and Biopharmacy, Chemical and Pharmaceutical Biology, Pharmaceutical Analysis, Molecular Pharmacology). Collaboration and exchange of knowledge and facilities with the fields of translational models, analytical methods, proteomics, and biotechnological production of proteins will be relevant for the new position. Outside of GRIP, strong collaborations are foreseen with the research groups of Prof. H. Santos and Prof. I.S. Zuhorn of the W.J. Kolff institute at the UMCG, accommodating expertise in the fields of the production of nanomedicine and the crossing of biological barriers. Collaboration between FSE and UMCG in the field of Advanced materials is the mission of the

Health Technology Research & Innovation Cluster (HTRIC) and perfectly fits with the vision of GRIP (“From Bench to bedside and Back”).

6. Local and (inter)national position

The Netherlands has always had a strong international reputation in the field of Advanced Drug Delivery and Drug Targeting, with many researchers working and collaborating in this area. In Utrecht, research is carried out within the group of Prof. dr. R. Schiffelers (Nanomedicine lab at UMC Utrecht) with special focus on the delivery of siRNA molecules and extracellular vesicles. Furthermore, at Utrecht University within the Department of Pharmaceutics (chair Prof. Dr. E. Mastrobattista), various researchers are active on Advanced Drug Delivery and Drug targeting strategies. At the University of Leiden, Prof. dr. M. Barz (Division of BioTherapeutics, Leiden Academic Center for Drug Research) is working on the use of nanoparticles for the delivery of biotherapeutics. At the University of Twente, Prof. dr. J. Prakash (Dept. Advanced Organ Engineering and Therapeutics) focuses on the development of cell-specific targeting strategies to re-program the tumor microenvironment, while Dr. R. Bansal (Dept. Medical Cell Biophysics) is working on the delivery of anti-fibrotic drugs to fibrotic livers. At Eindhoven University of Technology, the group of Prof. W. Mulder and Dr. R. van der Meel (Group Precision Medicine, Dept. Biomedical Engineering) develops new therapeutic strategies based on the cell-specific delivery of therapeutics.

At the UMCG, the groups of Prof. dr. H. Santos and Prof. I.S. Zuhorn (both dept. of Biomedical Engineering) have an international reputation in the field of the development of new nanoparticles, therapeutic applications of nanomedicines for crossing biological barriers. The UMCG has furthermore a long-standing history on the development of liposomes (Dr. J.A.A.M. Kamps, Dept. Nanotechnology and Biophysics in Medicine).

The group Nanomedicines and Drug Targeting at GRIP has an international profile in the area of cell-specific drug targeting to the liver, with special focus on the fibrotic liver and the use of modified proteins as drug carriers (Prof. Poelstra), and studies of the mechanisms by which nano-carriers interact with and are processed by cells, including their modification in biological fluids (the biomolecular corona) in order to guide nanomedicine design (Prof. Salvati). Beyond successful local, regional and national collaborations, researchers from NDT are actively involved in the France-BeNeLux chapter of the Controlled Release Society (CRS) and the European Technology Platform on Nanomedicine (ETPN).

The new position in the Design of Targeted Pharmaceuticals will create an internationally relevant position through its embedding in the group Nanomedicine & Drug Targeting within the Faculty of Science & Engineering with expertise on pharmacy and advanced materials and the close proximity of the UMCG with medical and immunological expertise.

7. Expected contributions to research

The assistant professor is expected to develop an internationally leading, independent research line on the *Design of Targeted Pharmaceuticals*, focusing on the optimal design of targeted constructs or drug carriers that allow a well-controlled incorporation of homing ligands, drugs or

diagnostics. The drugs of interest should be state-of-the-art compounds with a preference for biologicals such as RNA, CRISPR-Cas or other proteins. Furthermore, a clear vision is expected on the key challenges in this field which comprises pharmaceutical, medical and immunological aspects.

A strong ability to collaborate locally with relevant groups in the FSE and the faculty of Medical Sciences, and with colleagues on both a national and international level is expected. An important aspect of the function will involve the acquisition of substantial external funding and the supervision of PhD students.

8. Expected contributions to teaching

The candidate is expected to participate in the organization and teaching of courses within the degree programs of Pharmacy and Medical Pharmaceutical Sciences. These courses comprise, for instance, the Bachelor course *Introduction to Nanomedicine and Drug Targeting* and the Master courses *Innovative Therapeutics*, and *Nanomedicine and Nanosafety*. Supervision of bachelor and master research projects is an essential part of the teaching tasks. The candidate will also be actively involved in the development of new courses and/or revision of existing courses.

9. Expected contributions to the organization

The candidate is expected to have an active interest in and 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.