

# LEVERAGING BIOPHARMACEUTICAL R&D AT UGENT

Biopharmaceuticals are pharmaceutical products of biological nature, most often proteins, and their use in medicine is rapidly expanding. Ghent University harbors vast expertise in the molecular biotechnological aspects of pharmaceutical protein research. The University now wants to further reinforce its R&D capabilities in the biopharmaceutical field by recruiting 3 new professors in important areas of long-term strategic interest, i.e. in research on protein drugs for delivery through non-injectable routes, in computational protein design and in production process/formulation science.

*Leading scientists:*

*Interfaculty Center for Medical Biotechnology - Faculty of Sciences & Faculty of Medicine and Health Sciences (CMB, Prof. Nico Callewaert, scientific director)*

*Faculty of Pharmaceutical Sciences (Prof. Stefaan De Smedt and Prof. Kevin Braeckmans)*

*Interfaculty Center for Molecular Modeling - Faculty of Sciences & Faculty of Engineering & Architecture (CMM, Prof. Veronique Van Speybroeck)*

*# new professorships: 3*

## **Project description**

Everyone gets ill at certain times in life, sometimes seriously so. Apart from improved capabilities in prevention and early detection of disease, our capabilities for treating disease are currently being revolutionized by biopharmaceuticals. Well-known examples of biopharmaceuticals are insulin to treat type I diabetes, the human papilloma virus (HPV) vaccine to prevent cervical cancer and the new immunotherapy antibodies for cancer. The common denominator of this very broad range of pharmaceuticals is that the Active Pharmaceutical Ingredient (API) is a molecule of biological origin, mostly a protein molecule. This class of pharmaceuticals is currently the fastest growing category, but we are facing both societal and technological challenges when looking ahead to the next decades of medical practice, in which we will increasingly depend on these drugs.

Societal challenge:

Biopharmaceuticals are now already responsible for 25% of all drug expenditure, with a compound annual growth rate of about 10%. Hundreds of such drugs are now in the pipeline, and healthcare providers are rightfully worried as to how this trend will stress their reimbursement models. A current example of this challenge are the extremely expensive immunotherapies for cancer. If we do not want to forego the rather indisputable therapeutic advantages that these drugs bring, part of the answer to this challenge will be to invest in the fundamental research needed to discover methods that fundamentally innovate the way in which biopharmaceutical drugs are designed, produced and formulated, to achieve order-of-magnitude improved drug characteristics at strongly reduced cost.

Another societal challenge is that biopharmaceutical drugs are only slowly reaching the poorer regions in the world, although the most effective response to health threats in those areas often comprises a biopharmaceutical component (think of rapidly responding to Ebola outbreaks with antibody therapy). Issues such as requirements of a continuous cold supply chain, limited shelf life and requirement of needle-based injection make biopharmaceutical treatment often impracticable in resource-poor settings. Also here, innovation in biopharma drug design, production and formulation is needed.

Scientific-technological challenge:

Protein drugs are complex macromolecules that recognize their targets with exquisite selectivity. Because of their very specific mode of action and potency, biopharmaceuticals can often achieve therapeutic success in cases where traditional, chemically produced small molecule drugs fail. The first recombinant protein drugs became available just 30 years ago, and the majority of them have been available on the market for less than 10 years. Consequently, the technology used to design and produce these drugs can often still be considered as a 'first generation' as compared to the high level of maturity of the technology used in chemical synthesis. Their production is still very complex and expensive, and most need to be injected. Fundamental improvements will be needed for their sustainable use.

In this important area of biopharmaceuticals, UGent has strong expertise in molecular biotechnology for novel biopharmaceuticals (Faculty of Sciences), advanced formulations of biopharmaceuticals (Faculty of Pharmaceutical Sciences) and analytics of proteins both at the molecular level and in disease models (expertise spread over several life sciences faculties). Moreover, the Center for Molecular Modeling has strong expertise in computational analysis of macromolecular systems.

We have recently started up the 'ProteinTECH' UGent IOF Consortium. The consortium groups 12 professors from the Faculties of Sciences, Medicine and Health Sciences, Bioengineering and Pharmaceutical Sciences, totalling 130 researchers that actively work in the biopharmaceutical research field.

To further reinforce a fully integrated UGent R&D hub for biopharmaceutical discovery, testing and early-stage development we are now recruiting three new professors. This expansion of our biopharmaceutical R&D capabilities will be highly leveraged by the existing infrastructure and R&D capabilities that are already in place.

### **Proposed impact**

Long-term fundamental biopharmaceutical research is aimed at contributing to sustainably enabling access of as many people as possible to the rapidly expanding and increasingly effective bio-therapies. Scientific breakthroughs in design, production, formulation often have strong impact across the field of medicine rather than in any particular disease area. Apart from the academic potential, an important additional factor that deserves to be mentioned, is that Ghent (and in particular the Technologiepark campus) hosts the most vibrant cluster of biopharmaceutical biotechnology companies in the wide region (Ablynx, ArGenX, Complix, Oxyrane, Orionis Biosciences, MyCartis, Inbiose etc.). Moreover, several very large biopharmaceutical corporations have key global R&D and manufacturing sites in our country (UCB, Janssen Pharmaceuticals, Genzyme-Sanofi, Glaxo Smithkline Biologicals etc.). This environment provides for unique opportunities also for the new professors to collaborate and to make their discoveries and inventions have a real impact. It also provides for excellent professional opportunities for the graduates from the UGent biopharmaceutical R&D programmes.

It is the intention of the Faculties that support the present application to install an educational programme at Master's and/or post-graduate level, together with the local biotech industry, and it is especially the cross-faculty professors of the present initiative who will be the leaders of this new advanced educational/training programme.