



# Mohammed Bahey-El-Din

**Technology Centre:** PMTC  
**Academic Mentor:** Prof. Cormac Gahan  
**Company Partner:** Janssen  
**Company Mentor:** Dr. Adam O'Driscoll

Mohammed Bahey-El-Din obtained his Bachelor degree in Pharmaceutical Sciences from the Faculty of Pharmacy, Alexandria University, Egypt in 2000. He obtained a Master degree in Pharmaceutical Microbiology from the same institution in 2004. In 2009, he obtained a Ph.D. degree in Microbiology from the School of Pharmacy, University College Cork (UCC), Ireland. He, then, worked as a Post-doctoral researcher at the Department of Microbiology, UCC, Ireland till July 2010. From August 2010 to date, Dr. Bahey-El-Din has been a Lecturer then an Associate Professor at the Department of Microbiology and Immunology, Faculty of Pharmacy, Alexandria University, Egypt. He also was a Fulbright Visiting Scholar at University of Illinois at Chicago (UIC), USA from Oct. 2017-July 2018. From October 2021, Dr. Bahey-El-Din started a Career-FIT PLUS/Marie Sklodowska-Curie Fellowship in Ireland.

## Professor Cormac Gahan

Prof. Cormac Gahan has outstanding scientific and academic achievements. He has published more than 150 peer-reviewed international publications and book chapters (Scopus h index=56, Google scholar h index= 67). He is among the world's top 2% highly cited researchers. Prof. Gahan has a strong academic record in microbial pathogenesis research and animal modelling and has published in renowned journals such as PNAS, Microbiome, Molecular Microbiology, Infection and Immunity, Vaccine and Journal of Bacteriology. Prof. Gahan is a funded researcher and PI in APC Microbiome Ireland with well-established research team and available research resources from APC and UCC. Prof. Gahan has supervised more than 23 Master/PhD students and has mentored 22 post-doctoral fellows. He has previously collaborated with the pharmaceutical industry, specifically with Janssen.

## Dr. Adam O'Driscoll

Dr. Adam O'Driscoll is a Team Lead scientist at Janssen Sciences Ireland UC, Barnahely, Ringaskiddy, Co. Cork, Ireland. His work involves clinical release and stability of Janssens clinical portfolio as well as analytical development activities such as analytical technology transfer, bioassay optimization, antibody binding assays, bioassay data reduction, stability trending and reporting. He is also involved in technical coaching/training of area personnel. His work includes bioassay validation /qualification for various new molecular entities (NMEs) in a GMP (good manufacturing practices) environment.

## PMTC

The **Pharmaceutical Manufacturing Technology Centre (PMTC)** ([www.pmtc.ie](http://www.pmtc.ie)) has a clear aim of boosting innovation and investment in the pharmaceutical industry sector in Ireland. It has outstanding infrastructure, equipment and technical expertise relevant to pharmaceutical development.

The **Biopharmaceutical Equipment Suite (BioPOINT)** of PMTC is an industry-tailored infrastructure suite for biologicals process engineering, process development and biologicals analysis which are all relevant to the current project.

## Janssen Sciences Ireland UC

**Janssen Sciences Ireland UC**, is a renowned biopharmaceutical company which has excellent biopharmaceutical manufacturing facilities in Ireland. The facility in Ringaskiddy, Cork is producing biologics for the treatment of a wide variety of immune-related diseases and cancers. Three products are currently manufactured in Ringaskiddy, along with a range of other products currently in development and undergoing clinical trials. Indeed, all stages starting from biopharmaceutical drug development, characterization, analysis, and production exist in Janssen's facilities in Ireland. The expertise and real-world environment of biopharmaceutical drug development present in Janssen will be extremely useful to the current project.

## Host Institution - University College Cork (UCC)

**University College Cork (UCC)** is a prestigious and highly ranked university. UCC is one of the top-rated Universities in Ireland, being named as the Sunday Times University of the Year for 2015-16 and 2016-17. It is a public institution with more than 1500 academic and research staff and over 21,000 students. UCC aims to enhance research and innovation where it has the highest national annual industry investment into university research. UCC has an established record in technology management being the first Irish university to establish a trading campus company based on one of its own developed technologies (<https://www.ucc.ie/en/techtransfer/industry/>). UCC's published research strategy proposed to create "Centres of Excellence" for "world class research" in which the researchers and research teams would be given "freedom and flexibility to pursue their areas of research".

UCC has state-of-the-art facilities and equipment, these include advanced microbial culture and bioprocessing units, molecular biology instruments, in-vivo imaging, advanced microscopic imaging units, flow cytometry and advanced chromatographic separation instruments.

## Mohammed's project

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### **“Development of novel monoclonal antibody candidates against *Pseudomonas aeruginosa* for theranostic applications”**

The prevalence of antimicrobial resistance among bacteria is an overwhelming problem that poses a serious threat to mankind. An important approach to overcome the antibiotic resistance crisis is to use biological antimicrobials mainly antibodies. Several monoclonal antibodies have been approved against infectious diseases while others are in preclinical and clinical trials.

In the present project, single domain antibodies will be developed against the notorious multi-resistant pathogen *Pseudomonas aeruginosa*. *P. aeruginosa* can cause serious infections in cystic fibrosis patients, burn patients and diabetic wounds. It can also cause ventilator-associated pneumonia, urinary tract infection and septicemia. Unfortunately, Europe has a high prevalence of cystic fibrosis patients and Ireland has the highest prevalence record. Up till now, there is no effective vaccine against *P. aeruginosa*.

Single domain antibodies are composed of heavy chains only without light chains. This is different from the conventional human antibody. These heavy chain antibodies are naturally present in members of family camelidae like camels and alpaca. The variable region of heavy chain antibodies is called VHH domain or nanobody. The nanobodies have small molecular weight, high solubility, and tissue penetration. All these advantages support the clinical use of VHH antibodies.

In the current project, VHH antibodies will be developed using molecular biology techniques. The proposed novel approach will enable targeting *P. aeruginosa*, which can be used for therapeutic and/or diagnostic applications i.e. “theranostic” uses.