

State-of-the-art teaching and research...

...across all aspects of pharmaceutical sciences...

University College Cork (UCC) is located at the heart of a major cluster of multinational pharmaceutical companies – nine of the top 10 companies have sites in Ireland and seven of the top 10 blockbuster drugs are manufactured in Ireland. Indeed, the importance of the pharmaceutical industry to the Irish economy cannot be overstated, with over 50% of exports in recent years deriving from this sector.

While the sector in Ireland has traditionally focused on manufacturing, over the past decade there has been increasing focus on R&D activities, especially in the context of a 'Development and Manufacturing' model, where process development and manufacturing are co-located, leading to synergies and efficiencies in terms of time to market. A growing emphasis on secondary processing is evident, building on the existing strength in Active Pharmaceutical Ingredient (API) production. In parallel, significant investment in the infrastructure for research within the third level system in Ireland over the past decade has resulted in the development of research capacity within the universities to undertake effective research collaboration with companies, such as the leading pharmaceutical companies located in Ireland. Accordingly, the research landscape in Ireland, and, in particular, activity at the university-industry interface, is currently very exciting, and despite economic challenges, continues to underpin government strategy in terms of development of a smart economy.

Opened in 2006, UCC's Cavanagh Pharmacy Building (CPB) is widely recognised as a state-of-the-art building for teaching and research across all aspects of pharmaceutical

sciences. Co-location of the School of Pharmacy (established in 2003), the Analytical and Biological Chemistry Research Facility (ABCRF, supported through the Higher Education Authority's Programme for Research in Third Level Institutions PRTL13), together with unique industry focused facilities, have resulted in an exceptional building where undergraduate and postgraduate education, research and collaboration with industry interweave seamlessly.

The CPB has a dual mandate: firstly, to educate pharmacists to the highest standard, preparing them for critical roles in healthcare provision and in the pharmaceutical industry; and secondly, to contribute to development of the pharmaceutical industry, which is critically important to the Irish economy, which is particularly focused in the Cork area.

Significant reform of pharmacy education in Ireland is envisaged in the next few years – CPB will play a central role in these new and welcome developments to ensure graduate pharmacists are well prepared to maximise their contribution to healthcare, leading to benefits for patients and the economy. Continuing professional development of pharmacists in the community, hospital and industrial sectors is a rapidly expanding area of focus; the facilities and expertise in the CPB provide an excellent basis for the delivery of leading CPD programmes in the region.

The ABCRF brings together researchers from across the chemistry-biology interface, linking groups with expertise in chemistry (synthetic, organic, medicinal, pharmaceutical, bioinorganic, analytical) and biochemistry in a seamless manner, sharing equipment

and expertise in interdisciplinary research programmes. The synergies with the new research teams established in the School of Pharmacy (pharmaceutics, clinical pharmacy and pharmacology) are very clear, and ABCRF and School of Pharmacy researchers in the CPB work together in a collaborative fashion, each bringing their own expertise to a range of different research programmes. The challenge of the discovery and development of new drugs in the global pharmaceutical sector requires interdisciplinary research to address complex challenges; the interdisciplinary nature of CPB provides an ideal interface with the industry, both within Ireland and internationally.

In addition to teaching, research and external engagement (with pharmaceutical industry and healthcare sectors), staff from CPB play a leading role in informing national policy, for example, in the development of pharmacy practice and strategic enhancement of the industry-academic interface.

While CPB was opened less than four years ago, the activities it houses have had a significant impact, both within UCC and nationally. Nationally, the building is identified as a key element of research infrastructure underpinning the development of the pharmaceutical industry. A number of research teams within the building have international profiles, while younger research teams are growing and are envisaged to achieve this status in the next five years.

The key areas of research in drug discovery, development and application within UCC are outlined below. Many collaborations exist with the pharmaceutical companies in the

area and research infrastructure is used extensively by these companies:

Organic and Pharmaceutical Chemistry – includes eight distinct research teams incorporating 38 PhD students and 10 postdoctoral researchers, covering a broad range of research programmes in synthetic and medicinal chemistry including the development of novel synthetic methods, biocatalysis, asymmetric synthesis, and design and synthesis of bioactive compounds including projects focused on compounds with potential as antiviral and anticancer agents;

Pharmaceutical formulation and drug delivery – research spans pre-formulation studies, formulation design and characterisation, through to biopharmaceutics and pharmacokinetics. The candidate drugs under investigation include poorly water soluble compounds, and macromolecules such as peptides, proteins, vaccines, plasmid DNA and siRNA. Platform technologies have been developed based on modified cyclodextrins, lipid-based drug delivery systems, nanoparticle engineering, micro-needles, controlled/modified release formulations and use of pre-clinical models. The focus of the research is mainly on oral and parenteral administration with an emphasis on targeted delivery to specific sites including the colon, intestinal lymphatics and the CNS;

Pharmacology – the school is active in two areas: neuropharmacology and immunopharmacology. The Neuropharmacology Research Group is focused on developing novel strategies for disorders of the central nervous system including depression, anxiety, drug dependence and cognitive dysfunction. It is also focused on brain-gut-immune interactions in the context of obesity, visceral pain and irritable bowel syndrome. A multidisciplinary and translational focus from molecules to man is central to its approach. The central aim of the Immunopharmacology Research group is to develop and translate

innovative vaccines and therapies to treat or prevent autoimmune or infectious diseases. Research extends from basic cellular immunology to clinical translation;

Clinical Pharmacy Practice – has a wide range of research interests encapsulated by the theme ‘Appropriate use of medicines’. Under this banner, the group has addressed the appropriate use of medicines in the elderly, in patients requiring anticoagulants and in postoperative patients. Challenges with health literacy in patients are being addressed by the researchers. Inappropriate antibiotic use has major societal ramifications with the emergence of resistance of bacteria ‘superbugs’ to many medicines. Studies are being carried out to minimise this problem in Ireland.

Pharmaceutical Solid State – has become a very significant research area, reflecting its critical importance for the pharmaceutical industry in Ireland. The majority of drug substances are crystalline solids and their solid state properties have a huge impact on many issues, such as secondary manufacturing, dissolution and bioavailability, intellectual property rights, and many other technical and regulatory issues. The industry in Ireland views developing the depth of expertise in Pharmaceutical Solid State as an important strategic goal, both to strengthen the case for attracting new API manufacturing activity to Ireland and as a vital component of the ‘Development and Manufacturing’ model. The ABCRF has responded to this need by developing a major research programme into the Pharmaceutical Solid State involving over 10 postgraduate and postdoctoral researchers, and focusing on issues such as crystal engineering, co-crystallisation, polymorphism, crystal morphology and particle size, and crystallisation process control.

The impact of research within the CPB was highlighted by the inclusion of research teams in two national Strategic Research Clusters funded by

SFI in 2007 – a Solid State Research Cluster coordinated by the University of Limerick and the Irish Drug Delivery Network led by University College Dublin. In addition, researchers at CPB are engaged in many EU research programmes. Licensing agreements with companies emanating from research within the CPB have already commenced. Active collaborations exist with many companies including Pfizer, Lilly, Novartis and Almac. A major focus of PhD education within the CPB is the preparation of researchers for exciting and challenging careers in the pharmaceutical sector; for example, PhD students have the chance to undertake three month placements in pharma companies in the region during their postgraduate studies, an excellent opportunity to develop skills and underpin future careers.

The past six years have been very exciting involving the design and start-up of the CPB – the original vision of the building as a focus for research across all aspects of the pharmaceutical sciences is beginning to be realised, and extensive engagement with the pharmaceutical industry both nationally and internationally is already clearly visible. The researchers in the building are its key asset, and look forward to the next decade with opportunities for future research and partnership with the pharmaceutical industry in Ireland as it continues strategic development of research activities within the Irish sites.



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