

Research & Innovation
in Making Medicines

rinn

Pharma &
Biopharma

Recruitment Pack



Taighde Éireann
Research Ireland

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1 Introduction

Rinn Pharma & Biopharma marks a new chapter in Ireland's pharmaceutical research leadership, building on the strong foundations established by SSPC. The Centre represents a €60.3 million investment as part of the wider €460 million Research Ireland Rinn network, launched in June 2026.

The Centre has been established to address some of the most significant healthcare, societal, and environmental challenges of our time. Rinn Pharma & Biopharma will drive excellence in pharmaceutical and biopharmaceutical research and innovation. Through pioneering science, collaboration, and talent development, the Centre aims to contribute to the next generation of positive societal, economic, and environmental transformation in Ireland and globally.

The Rinn network enables a systemic and strategic approach that aims to deliver solutions with real-world impact. Rinn empowers radical collaboration that operates across multiple research bodies in partnership with industry, government and wider stakeholders to create a unique research and innovation ecosystem of international significance and scale.

1.1 Transforming the Future of Medicines

Rinn Pharma & Biopharma is Ireland's flagship national research initiative, delivering a transdisciplinary programme that combines expertise across pharmaceutical and biopharmaceutical sciences, engineering, biotechnology, data science, materials science, and the social sciences to transform how medicines are developed, manufactured, and delivered to patients. By bringing together these diverse disciplines, the Centre will address two critical challenges facing modern drug development: patient-centred medicines and sustainable pharmaceutical innovation.



The first challenge is the development of patient-centred medicines, including advanced formulations and therapeutic products that improve drug effectiveness, acceptability, delivery, and dosing for diverse patient populations.

The second is the integration of sustainability across the pharmaceutical lifecycle, reducing the environmental impact of processes spanning synthesis, bioprocessing, formulation, and manufacturing.

Through its transdisciplinary and collaborative approach, Rinn Pharma & Biopharma will build the scientific foundations, talent pipeline, and partnerships needed to accelerate the development of safer, more effective, patient-centred, and sustainable medicines.

1.2 Centre Overview

Award Value: €60,324,450

Host Institution: University of Limerick

Partner Institutions: 12

Principal Investigators: 73 leading researchers distributed across Ireland

A Unified National Asset: Delivered by a World Leading Team



Partner Institutions

- University of Limerick (UL)
- Trinity College Dublin (TCD)
- University College Cork (UCC)
- University College Dublin (UCD)
- Dublin City University (DCU)
- Royal College of Surgeons in Ireland (RCSI)
- Maynooth University
- Southeast Technological University (SETU)
- Tyndall National Institute
- Munster Technological University (MTU)
- University of Galway (UoG)
- National Institute for Bioprocessing Research and Training (NIBRT)

Together, these institutions form a national research community with internationally recognised expertise across pharmaceutical and biopharmaceutical science, engineering, manufacturing, and innovation.

1.3 Research with Real-World Impact

The innovations developed within Rinn Pharma & Biopharma aim to improve patient outcomes while supporting a more sustainable pharmaceutical future. Research undertaken by PhD students may contribute to:

- Next-generation medicines and therapeutic technologies
- More sustainable pharmaceutical manufacturing processes
- Advanced drug delivery and formulation approaches
- Data-enabled and digitally driven pharmaceutical development
- Enhanced access to and effectiveness of medicines
- Improved economic competitiveness within Ireland's life sciences sector and around the world

1.4 Research Themes Overview

A Unified National Asset: A Future Focused Research Programme & Talent Incubator



Research opportunities are available within 12 specialised themes, embedded across four interconnected pillars:

- **Therapeutic Modalities Pillar**
 - Cell-Expressed & RNA Therapeutics (CERT)
 - Advanced Bioanalytics & Omics (A&O)
 - Drug Conjugates & Hybrids (C&H)
 - Sustainable Selective Synthesis (SSS)
- **Formulation & Delivery Pillar**
 - Drug Particle Engineering (DPE)
 - Dosage Form Design (DFD)
 - Innovation in Patient-Centred Products (PCP)
 - Transforming Engaged Research in (Bio)Pharma (TERB)

- **Modelling & Materials Pillar**
 - Predictive Materials Design & Model-Driven Process Control (PMC)
 - Foundry for Functional Materials (F3M)
- **Process Engineering Pillar**
 - Novel & Modular Platforms (NMP)
 - Biologics Manufacturing (BM)

1.5 Why Join Rinn Pharma & Biopharma?

As a PhD researcher within Rinn Pharma & Biopharma, you will become part of one of Ireland's largest and most ambitious pharmaceutical research programmes. You will benefit from:

- Access to a national network of leading researchers and research facilities
- Collaboration across disciplines, institutions, and sectors
- Engagement with pharmaceutical, biopharmaceutical, healthcare, and public-service partners
- Opportunities to address global healthcare and sustainability challenges
- International research and networking opportunities
- Structured professional and leadership development
- A vibrant cohort-based doctoral community

Most importantly, you will contribute to research that has the potential to shape the future of medicines and healthcare.

1.6 The Doctoral Programme Experience

Alongside their individual research projects, PhD researchers will participate in a cohort-based doctoral programme designed to develop highly skilled, adaptable, and impactful graduates. The programme aims to equip students with:

- Deep disciplinary expertise
- Knowledge of the pharmaceutical and biopharmaceutical R&D continuum
- Leadership and teamwork capabilities
- Innovation and entrepreneurship skills
- Expertise in sustainability and responsible research
- Data science and digital competencies
- Communication and stakeholder-engagement skills

Researchers will participate in a structured programme of training and professional development focused on both technical excellence and future-facing transferable skills. Students will also benefit from:

- Industry training placements as applicable
- Research visits to internationally renowned collaborating institutions as applicable
- Exposure to innovation and entrepreneurship activities
- Dedicated mentoring and career-development support
- Networking opportunities with academic, industry, healthcare, and policy leaders

1.7 Funding

Each PhD scholarship covers a 4-year stipend of €25,000 per annum tax free, travel budget for conference attendance and research visits to collaborators, computing facilities, total fee allocation of €23,000, competitive allocation for project running costs and allocation for Doctoral Programme attendance.

1.8 How to apply:

Applications are invited for PhD researchers across Rinn Pharma & Biopharma's partner institutions and research programmes.

Apply now and join a national community of researchers working to shape the future of medicines, advance sustainable pharmaceutical innovation, and deliver lasting impact for patients and society.

To apply, complete the application form and indicate the research theme, supervisor and institute that you are interested in. The form should be completed in one sitting so please prepare your answers in advance. The list of questions is included in this document Appendix.

[2026 PhD Application Form: Rinn Pharma & Biopharma – Fill out form](#)

2 Research Themes & PhD Opportunities

The research areas for each PhD position are as follows:

2.1 Cell Expressed & RNA Therapeutics

Cell Expressed & RNA Therapeutics (CERT) vision is to bring about a step-change in the design of medicines that are more potent and effective, and the provision of new cell expression systems for their manufacture. The CERT team will generate a transformative shift in our understanding of the limitations upon the design of advanced biotherapeutics and the expression systems used to produce these, applying modern engineering biology approaches to design and deliver more efficient, predictable and sustainable modalities and cell expression systems. **Key skills:** biotherapeutic medicine production from mammalian expression systems, genetic engineering of recombinant therapeutic proteins, drug-DNA interactions, hybrid therapeutic nucleic acids, chemotherapeutic drug development, click chemistry and DNA damage & repair. Cross-theme contributors bring expertise in stabilising proteins, RNA protection, scale up of RNA production, AAV processing, exosome production and stabilising circRNA.

Code	Title	Supervisor	Email
CERT 1	Unlocking novel properties of RNA molecules through chemical modification of circRNAs.	Piotr Kowalski, UCC	piotr.kowalski@ucc.ie
CERT 2	Reversible Structure-Engineered mRNA Prodrugs for Enhanced Formulation Stability and Programmable In-Vivo Pharmacokinetics	Elizabeth Topp, NIBRT	elizabeth.topp@nibrt.ie
CERT 3	Chemical Modification and Functional Screening of Synthetic mRNA for Therapeutic Applications beyond Vaccines	Steven Ferguson, NIBRT	steven.ferguson@ucd.ie
CERT 4	New antisense oligonucleotide (ASO) technology to extend the boundary of existing ASOs.	Andrew Kellett, DCU	andrew.kellett@dcu.ie
CERT 5	Novel ways to cage RNA will be explored to improve stability during synthesis and storage in collaboration with Drug Conjugates & Drug Hybrids and Biologics Manufacturing.	Joanna McGouran, TCD	jmcgoura@tcd.ie
CERT 6	Identification of novel cell line engineering routes to limit retro-transduction and to enhance the production of therapeutic lentiviral vectors.	Niall Barron, NIBRT	niall.barron@ucd.ie

CERT 7	Glycoengineering rAAV to modulate tissue tropism and transduction activity	Ioscani Jimenez del Val , UCD	ioscani.jimenezdelval@ucd.ie
CERT 8	Model-based control for improved downstream processing of recombinant proteins.	Jessica Whelan, UCD	jessica.whelan1@ucd.ie
CERT 9	New tuneable bioengineered CHO host cell and vector systems for enhanced expression, quality, and authenticity of multi-specific biotherapeutic proteins.	Mark Smales, NIBRT	mark.smales@nibrt.ie

2.2 Advanced Bio-analytics & Omics

Advanced Bio-analytics & Omics (A&O) will develop new tools for characterisation and fundamental understanding of cellular performance and process–product interplay of advanced therapeutic modalities. They will utilise techniques for the evaluation of biopharmaceuticals in the native state, particularly characterisation of highly heterogeneous or large molecular weight analytes where individual charge state determination is not feasible, for example, highly glycosylated therapeutic proteins or AAVs for gene therapy delivery. This work will be supported by advanced omics. In addition, in-line process monitoring will be developed using mobile sensors or functionalisation of surfaces that can be integrated with standard manufacturing unit operations. **Key skills:** liquid phase separations, mass spectrometry (LC-MS and CE-MS), proteomic characterisation of CHO cells, statistical methods to study CHO transcriptomic, proteomic expression datasets, clinical proteomic analysis of uveal melanoma and pancreatic cancer disease progression, nano, photonic and ICT enabled sensor platforms for novel bioprocessing applications. Cross-theme contributor brings expertise in flow synthesis.

Code	Title	Supervisor	Email
A&O 1	A systems chemistry approach to understand process variability	Jonathon Bones, NIBRT	jonathan.bones@nibrt.ie
A&O 2	Quantification of product quality attributes for oligonucleotides and mRNA using single-molecule nanopore sensing	Casey Platnich, TCD	PLATNICC@tcd.ie
A&O 3	Native MS and I2MS for characterisation of complex therapeutic entities. Note: Scheduled to start Sept 2027	Jonathon Bones, NIBRT	jonathan.bones@nibrt.ie
A&O 4	Development of autonomous wireless multiparameter sensor capsules for PAT	Paul Galvin, Tyndall	paul.galvin@tyndall.ie
A&O 6	Improving codon optimisation of therapeutic antibody transgene sequences by analysis of the Chinese hamster ovary translome.	Colin Clarke, NIBRT	colin.clarke@nibrt.ie

A&O 7	Improving the annotation of the Sf9 cell line proteome using ribosome footprint profiling. Note: Scheduled to start Sept 2027	Colin Clarke, NIBRT	colin.clarke@nibrt.ie
A&O 9	Proteomic analysis of exosomes from CHO cells in bioprocess stress related conditions. Note: Scheduled to begin Sept 2027	Paula Meleady, DCU	paula.meleady@dcu.ie

2.3 Drug Conjugates & Drug Hybrids

Drug Conjugates & Drug Hybrids (C&H) will bridge large and small molecule drugs and address gaps in sustainability, functionality and scalability. It will focus on developing methods for enabling sustainable synthesis either on a small scale, in bulk, in flow or through (non-covalent or covalent) self-assembly methods and processes as well as through directed organic and biochemical modifications/synthesis. Emphasis will be on developing a means of achieving a range of bioconjugations and hybrid drug structures, through molecular design, optimal synthetic routes, novel reaction conditions, reduction of impurities and automated synthesis. **Key skills:** organic synthesis including self-assembly to form novel soft materials with optical and self-healing properties, bioconjugation and characterisation including labelling, imaging and spectroscopy, development of novel probes and imaging agents, glycan therapeutics including radical chemistry in bio-conjugations, peptides and bio-inspired derivatives including solid phase synthesis of novel peptidomimetics and anion transporters, nano-bio interactions, bio-inorganic chemistry development of novel conjugation methods and structures. Cross-theme contributor brings expertise in microbial metabolomics.

Code	Title	Supervisor	Email
C&H2	Sustainable synthesis of peptide nucleic acid conjugates	Marc Devocelle, RCSI	mdevocelle@rcsi.com
C&H3	Stimuli-Responsive Supramolecular Drug Hybrids for Controlled and Targeted Drug Delivery	Rob Elmes, MU	robert.elmes@mu.ie
C&H7 /DPE2	Programmable Supramolecular Platforms for Targeted Antimicrobial Drug Delivery – Chemistry led	Rob Elmes, MU	robert.elmes@mu.ie
C&H8	Synthetic Siderophore Conjugated Antimicrobial as Modified 'Bioconjugated Peptides'	Darren Griffith, RCSI	dgriffith@rcsi.com
C&H9	Novel Bio-nanomaterials Formation through Structural and Surface Charge Modifications of Lipid NPs and their Bio-conjugated Glycans	Marco Monopoli, RCSI	marcomonopoli@rcsi.com

C&H11	Development of By-product-Free Bioorthogonal Transformations for use in Competitive Media and Live Cells	Donal O'Shea, RCSI	donalfoshea@rcsi.ie
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2.4 Sustainable Selective Synthesis

Sustainable Selective Synthesis (SSS) will collectively develop a diverse array of synthetic methodologies and approaches critical to advancing API synthesis in a sustainable and stereoselective manner, leveraging advances in technology to maximise benefit for synthesis. This will be achieved, by advancing flow chemistry, immobilisation of reagents and enzymes, photochemistry, and electrochemistry techniques, and incorporating real time monitoring to enable telescoping with effective process control. This approach enables new ways to: (i) replace 'at risk' metals and design new ligands for high enantioselectivity, (ii) discover, develop and engineer novel organocatalysts. **Key skills:** Enantioselective transition metal catalysis, organocatalysis, biocatalyst/enzyme engineering; sustainable synthesis; design and synthesis of bioactive compounds; antimicrobial resistance and biofilms; biosynthetic production of peptides; continuous flow process and synthesis; electrochemistry, biocatalysis biosensors and bioenergetics. The cross-theme contributors bring expertise in porous material engineering, electrochemistry, modelling, intensification and process analytical technology.

Code	Title	Supervisor	Email
SSS 6	Asymmetric synthesis of chiral building blocks exploiting biocatalysis in flow Note: Scheduled to start Sept 2027	Marcus Baumann, UCD	marcus.baumann@ucd.ie
SSS 8	Uncovering green chemistry biocatalytic transformations through Molecular Metagenomics for a more sustainable future	Jerry Reen, UCC	J.Reen@ucc.ie
SSS 12	Telescoping Pd and Cu catalysed coupling reactions in pharmaceutically relevant processes Note: Scheduled to start Sept 2027	Ger McGlacken, UCC	g.mcglacken@ucc.ie
SSS 13	Copper catalysis in enantioselective synthesis – sustainable transition metal catalysis. Note: Scheduled to start Sept 2027	Anita Maguire, UCC	a.maguire@ucc.ie
SSS 14	Developing asymmetric methodology using chiral transition metal complexes	Pat Guiry, UCD	patrick.guiry@ucd.ie

2.5 Drug Particle Engineering

Drug Particle Engineering (DPE) will enable the design of Innovative drug delivery particles to overcome identified biological barriers and challenging physicochemical properties of therapeutic modalities. These designs will enable patient-centred medicines with increased therapeutic effectiveness and patient compliance. **Key skills:** Polymer, lipid and bio- based drug delivery particles,

crystal engineering for (bio)pharma, mRNA drug delivery, peptide delivery across intestinal and buccal epithelia, cell targeting molecules, novel antimicrobial agents and in vitro testing models to investigate therapeutic efficacy. The cross-theme contributors bring expertise in porous material engineering, modelling, process intensification, crystal engineering, and conjugation.

Code	Title	Supervisor	Email
DPE 1	Carbohydrate based novel delivery particle designs with optimised surface chemistry to manipulate interactions at the biological interface	Paul Murphy, UoG	paul.v.murphy@nuigalway.ie
DPE 3	Oral delivery of nucleic-acid therapeutics	Piotr Kowalski, UCC	piotr.kowalski@ucc.ie
DPE 4	Antimicrobial peptide and conventional antibiotic nanoparticle designs for the treatment of drug-resistant bacteria (Chemistry-Led).	Sarah Hudson, UL	Sarah.hudson@ul.ie
DPE 6(2)	HAWC nanocomplexes as a platform to mediate oral delivery of peptides using insulin as a prototype	David Brayden, UCD	david.brayden@ucd.ie
DPE 7	Bio-based nanoparticle drug delivery designs for efficient RNA/CRISPR delivery	Eliana Souto, UCD	eliana.souto@ucd.ie
DPE 8	MultiDrug Solutions	Matteo Luisi, UL	Matteo.Lusi@ul.ie
DPE9/ NMP6	Sustainable manufacturing of lipid nanoparticle targeted drug delivery designs (Engineering-Led) Note: Scheduled to begin July 2027	Sarah Hudson, UL	Sarah.hudson@ul.ie
DPE 11	Advanced Intestinal Models - investigating the potential role of endoplasmic reticulum stress in the observed responses in an intestinal in vitro model	Finbarr O'Sullivan, DCU	finbarr.osullivan@dcu.ie

2.6 Dosage Form Design

Dosage Form Design (DFD) will develop dosage forms of enabling formulations for poorly bioavailable APIs, as well as an improved understanding of approaches to ensuring stability of dosage forms on processing and storage. Research will be developed for the generation of co-processed materials suitable for sustainable downstream drug product manufacture, utilising (*in situ*) crystallisation/precipitation processes while also aiming to develop solvent-free approaches to transform poorly soluble BCS class II and IV molecules into effective dosage forms. It *will* investigate the utilisation of ionic liquids (ILs) in drug products, the solidification of drug substance ILs to overcome handling challenges while preserving bioavailability-enhancing properties and interrogating how API

ionisation can be modulated in ILs by counterion selection and the subsequent impact on API solubility and hence bioavailability. **Key skills:** Pharmaceutical material science, particle engineering for pulmonary drug delivery, mechanochemistry, multicomponent pharmaceutical solids, dissolution testing, simulation, imaging and AI analysis and enhancing oral bioavailability of poorly soluble drugs and nanoparticle-based drug delivery system. The cross-theme contributors bring expertise in vaccines, product design, advanced analytics, process engineering and statistical modelling.

Code	Title	Supervisor	Email
DFD 2	Impact of counterion selection on the pharmaceutical properties of antimicrobial drug-based ionic liquids. Note: Scheduled to start Sept 2027	Lidia Tajber, TCD	LTAJBER@tcd.ie
DFD 3	Bioenabling formulations in the 'Beyond rule of 5 space' – PROTAC formulations for improved delivery Note: Scheduled to start Sept 2027	Brendan Griffin, UCC	Brendan.Griffin@ucc.ie
DFD 4	Towards rational design of ASD co-precipitation processes Note: Scheduled to start Sept 2027	Steven Ferguson, UCD	steven.ferguson@ucd.ie
DFD 5	Crystal engineering-guided design of multicomponent pharmaceutical systems for stable amorphous solid dispersions	Lidia Tajber, TCD	LTAJBER@tcd.ie
DFD 8	Integrating API-exciipient matching with formulation strategies to address physical and chemical instability in enabled solid dosage forms	Emmet O Reilly, UL	Emmet.OReilly@ul.ie
DFD 9	Stability-enhancing formulation approaches for enabled BCS Class II API solid dosage forms. Note: Scheduled to start Sept 2027	Anne Marie Healy, TCD	HEALYAM@tcd.ie
DFD 10	Formulation approaches to mitigate moisture-induced instabilities in enabled solid dosage forms. Note: Scheduled to start Sept 2027	Abina Crean, UCC	a.crean@ucc.ie
DFD 11	Optimising solid state stability of advanced biologic therapies using spectroscopic and advanced analytic approaches. Note: Scheduled to start Sept 2027	Michael McAuliffe, MTU	michael.mcauliffe@mtu.ie

2.7 Innovation in Patient-centred Products

Innovation in Patient-centred Products (PCP) team will design innovative drug products for enhanced patient adherence and acceptance by enabling self-administration, reduced frequency, multi-drug systems and improved palatability, for specific patient cohorts. It will aim to improve the ease of taking the medicine, minimising the impact of disease, improving health outcomes due to better adherence, and minimising environmental impact of drug wastage. This core team's focus of designing effective and acceptable medicines for patients will be achieved by close collaboration with the TERB team via exploration of mechanisms to enhance patient participation during the medicine design process. **Key skills:** expertise in the design of oral, pulmonary, ocular and intradermal dosage forms, advanced spectroscopy enabling quality assurance for personalised drug products manufactured at the point of care to delivery. Cross-theme contributors bring expertise in engaged research, dosage form design, pharmacokinetics, and process analytical technology.

Code	Title	Supervisor	Email
PCP 1	Patient Informed Therapeutic Development for Ophthalmic Diseases of Oxidative Stress	Laurence Fitzhenry, SETU	Laurence.Fitzhenry@setu.ie
PCP 2	LAI dissolution: pharmacokinetic modelling and image analysis	Deirdre D'Arcy, TCD	ddarcy@tcd.ie
PCP 3	Inhaled Drug Products & Patient Centric Design Note: Scheduled to start Sept 2027	Katie Ryan, UCC	katie.ryan@ucc.ie
PCP 5	Microneedle Delivery Systems: Biologic Therapeutics Note: Scheduled to start Sept 2027	Anne Moore, UCC	anne.moore@ucc.ie
PCP 6	Aerosol Jet Printing of Biomolecule Microneedle Delivery Systems	Niall O Reilly, SETU	Niall.OReilly@setu.ie
PCP 8	Reducing Geriatric Patients' Pill Burden: Enabling formulations Note: Scheduled to start Sept 2027	Anne Marie Healy, TCD	HEALYAM@tcd.ie
PCP 9	Formulations to enhance the Palatability/Acceptability of Paediatric Medicines Note: Scheduled to start Sept 2027	Abina Crean, UCC	a.crean@ucc.ie
PCP 10	Chemometric and process models for point of care manufacture of RNA therapies PhD2	Michael McAuliffe, MTU	michael.mcauliffe@mtu.ie

2.8 Transforming Engaged Research in (Bio)pharma (TERB)

Transforming Engaged Research in (Bio)pharma (TERB) is envisioned as a 'seed' that will generate cutting edge knowledge to normalise engaged research in the Centre and (bio)pharma sector. It advances the state-of-the-art by: **(i)** investigating innovative methodologies for inclusive engaged research in participatory spaces relating to formulation and delivery of drug products; **(ii)** advancing knowledge about ways to build capacity across community, pharma and education sectors for meaningful research partnerships. **Key skills:** Historical analysis of engaged research, testing the

applicability of participatory concept and methods, implementation of change in health and educational settings, conceptual and methodological innovation in engaged research with people who experience marginalisation and social exclusion and health and educational policy reform. The core groups skills will be complemented by the EPE programme. The cross-theme contributors bring expertise in product design and ocular drug delivery.

Code	Title	Supervisor	Email
TERB 1	Sustainability in STEM curriculum and policy: qualitative case study analysis	Orla McCormack, UL	Orla.McCormack@ul.ie
TERB 2	Methodologies for diversifying PPI partners using arts-based research.	Anne McFarlane, UL	Anne.MacFarlane@ul.ie
TERB 3	Analysis of trust dynamics in coproduction partnerships for biopharma research: mixed methods social network analysis	Jon Salsberg, UL	Jon.Salsberg@ul.ie

2.9 **Novel & Modular Platforms**

Novel & Modular Platforms (NMP) will develop innovative platforms for decentralised manufacturing with improved productivity and agility for making medicines accessible to patients with varying needs, producing less waste per unit mass of medicines. This will be achieved by developing novel process intensification technologies guided by multi-scale computational models. New methods, sustainability metrics and models will be developed to assess the impact of novel and modular platforms on the manufacturing of pharmaceuticals. The focus will be on the entire life cycle, from cradle to grave, of zero-discharge pharmaceutical processes to determine the environmental footprints of the products and processes. **Key skills:** Sustainable energy (anaerobic digesters, biomass to energy & value added chemicals, gasification), water (cavitation for effluent treatment & dis-infection), fine & specialty chemicals (continuous processing, multiphase reactors & scale-up and process intensification), interfacial phenomena in multiphase flows in the pharmaceutical, mining, agriculture, and water treatment industries, particle engineering technologies, continuous nanocrystallization and (Bio)pharmaceutical processing, biomolecular simulation, nanobubbles, high-performance computing, microscale and accelerated MD and ab initio simulation on various novel architectures, engineering of surfaces to enhance their performance, additive manufacturing using 3D printing, the economics of innovation, R&D subsidies, human capital and green innovation. The cross-theme contributors bring expertise in scale up of bioprocesses, particle drug delivery, and flow chemistry.

Code	Title	Supervisor	Email
NMP 1	Nanobubbles as optical and mass-transfer enhancers in light-diffusing flow photoreactors	Niall English, UCD	niall.english@ucd.ie

NMP 2	Intensified reactor platforms and multi-scale models of continuous synthesis of porous particles via reactive precipitation	Vivek Ranade, UL	vivek.ranade@ul.ie
NMP3 /SSS10	Intensifying multistep transformations in flow embedding photochemical steps	Anita Maguire, UCC	a.maguire@ucc.ie
NMP4	Nanoparticle formation via spray nozzles	Luis Padrela, UL	Luis.Padrela@ul.ie
NMP 5	Miniaturized and Automated Printed Reaction Platforms for distributed manufacturing	Denis Dowling, UCD	denis.dowling@ucd.ie
NMP 8	Solid-state control using mechanochemistry-based continuous processes Note: Scheduled to start Sept 2028	Lidia Tajber, TCD	LTAJBER@tcd.ie
NMP 9	High-fidelity computational modelling of crystallisation including polymorphism	Orest Shardt, UL	Orest.Shardt@ul.ie
NMP10/BM9	Digitalization of Downstream Processing of Recombinant Protein Based Biotherapeutics	Ioscani Jimenez del Val, UCD	ioscani.jimenezdelval@ucd.ie
NMP 11/B M8	Multi-Scale Models for Translating Lab-Scale Cell Culture Development to Bioreactors	Orest Shardt, UL	Orest.Shardt@ul.ie
NMP 13	Sustainable Sorbents for Emerging Contaminant Mitigation in Pharmaceutical Wastewater	Soumya Mukherjee, UL	Soumya.Mukherjee@ul.ie

2.10 **Biologics Manufacturing**

Biologics Manufacturing (BM), digital, sustainable, and highly scalable manufacturing platforms for biopharmaceutical therapeutics will be developed, It will create upstream and downstream manufacturing platforms that will enable novel mRNA derivatives to be produced reliably at a significant scale beyond tens of kilograms, which will ensure that production capacity will not hinder deployment of such therapies globally. It aims to implement downstream separation approaches. that will facilitate end to end processing of multi-specific recombinant protein based biotherapeutics and AAVs. Multi-scale process and hybrid modelling techniques will be employed to enable process digitisation with a view to improve scalability through process understanding, facilitating agile, more resilient supply of large molecule therapies. **Key skills:** Advanced manufacturing, flow synthesis and formulation of novel pharmaceutical products, advanced experimentation and computational strategies to optimise the production of biopharmaceuticals, including monoclonal antibodies and gene therapy viral vectors; formulation and stability of protein drugs, with an emphasis on peptides and proteins in the amorphous solid state, biomanufacture of biologics and advanced therapies, improving process engineering and development across the process life cycle, process analytical technology, process modelling, advanced process control, scale up/down/out strategies, process

optimisation and intensification. The cross-theme contributors bring expertise in mRNA, oligonucleotides, reactor modelling and computational fluid dynamics.

Code	Title	Supervisor	Email
BM 1	Modelling, Optimisation and Characterisation of RNA Ligation Processes for mRNA Assembly	Steven Ferguson, NIBRT	steven.ferguson@ucd.ie
BM 2	Novel Phosphoramidite enabled Liquid-Phase RNA Oligonucleotide Synthesis Processes for Scalable, Intensified and more Sustainable Oligonucleotide Therapeutics.	Steven Ferguson, UCD	steven.ferguson@ucd.ie
BM 3	Determination and quantification non-enzymatic degradation of RNA in manufacturing and formulation relevant environments	Elizabeth Topp, NIBRT	elizabeth.topp@nibrt.ie
BM 4	Enzymatic synthesis of modified therapeutic nucleic acids	Andrew Kellett, DCU	andrew.kellett@dcu.ie
BM 5	Integrated Systems Modelling and Optimisation of Biopharmaceutical Downstream Processes	Steven Ferguson, UCD	steven.ferguson@ucd.ie
BM 6	Model supported design of scalable cost-effective tangential flow filtration (TFF) purification for the biomanufacture of glycoengineered and optimised viral vectors	Jessica Whelan, UCD	jessica.whelan1@ucd.ie
BM 7/NMP12	Generative Design of Fluidic Elements for Continuous Spatially Distributed Diafiltration in Biopharmaceutical and Flow Chemistry Applications	Steven Ferguson, UCD	steven.ferguson@ucd.ie

2.11 Predictive Materials Design & Model-driven Process Control

Predictive Materials Design & Model-driven Process Control (PMC) will bridge the gap between atomic-level understanding and rapid decision-making during drug development through development of multi-scale modelling tools to help optimise stability study designs, reducing costs and improving safety. Spanning from first principles quantum mechanics and meso scale dynamics to numerical and analytical models, the developed methods will integrate appropriate machine learning throughout and will be benchmarked against available literature data. Once benchmarked, the modelling tools will be tested in the experimental themes and then either deployed to guide further experiments. **Key skills:** Design of biomolecular crystals, including multi-component forms, pharma manufacturing materials, and solvated drug delivery, predictive materials modelling, peptide engineering, molecular dynamics simulation, statistical models for complex data, modelling of drug

diffusion, mechanistic models and mathematical models. The cross-theme contributors bring expertise in computational fluid dynamics, reactor modelling, biocatalysis, DNA damage, bioprocess modelling and porous materials.

Code	Title	Supervisor	Email
PMC 2	Design of multivalent molecular inhibitors of DNA	Damien Thompson, UL	Damien.Thompson@ul.ie
PMC 3	Development of meso scale models to stabilise biologics under complex processing conditions and biological environments Note: Scheduled to start Sept 2027	Damien Thompson, UL	Damien.Thompson@ul.ie
PMC 4	Development of accelerated sampling methods to predict excipient-API-cell molecular interactions	Damien Thompson, UL	Damien.Thompson@ul.ie
PMC 6	Mathematical modelling of drug release: from drug delivery platforms into tissue	Michael Vynnycky, UL	Michael.Vynnycky@ul.ie
PMC 7	Development of hybrid modelling approaches for in-depth (bio)pharmaceutical process understanding, monitoring and control to enhance resilience and sustainability	James Gleeson, UL	James.Gleeson@ul.ie
PMC 9	Mechanistic modelling (transitions from micro to macro states) using population balance models, Monte Carlo method and DEM approach for crystallization processes and pharmaceutical manufacturing	Mehakpreet Singh, UL	Mehakpreet.Singh@ul.ie

2.12 Foundry for Functional Materials (F³M)

Foundry for Functional Materials (F³M) will design and develop bespoke porous materials and cages to enhance the sustainability of pharmaceutical manufacturing and drug delivery by addressing sustainable feedstocks, energy-efficient conversions and elimination of unwanted by-products. Emphasis will be placed on utilisation of reagents that can be sourced from water, CO₂, N₂, and O₂ in the atmosphere, purification of solvents and water (to enable continuous manufacturing) and controlled drug delivery. In essence, three C's, **capture** (purification), **conversion** (synthesis) and **control** (over drug delivery and product specificity, including stereoselectivity) are key to enabling more efficient or even fully sustainable processes for manufacture of drug substance and drug product. **Key skills:** Materials design and characterization, biocatalytic and/or electrocatalytic conversions, water/solvent purification, controlled drug delivery and molecular modelling. The cross-theme contributors bring expertise in particle drug delivery, proteomics, organic synthesis, and flow chemistry.

Code	Title	Supervisor	Email
F3M 1	Advanced Adsorbents for Trace-Level Persistent Organic Contaminant Removal	Soumya Mukherjee, UL	Soumya.Mukherjee@ul.ie
F3M 3	Enhancing Gaseous Waste Capture using Bespoke PCN Sorbents	Soumya Mukherjee, UL	Soumya.Mukherjee@ul.ie
F3M 4	Molecular Modelling of adsorption and separation of chemicals and drug solutions in porous materials	Matthias Vandichel, UL	Matthias.Vandichel@ul.ie
F3M 5	Advanced sorbents for CO ₂ capture and conversion into useful Products	Michael Zaworotko, UL	Michael.Zaworotko@ul.ie
F3M 6	Computational design and engineering of enzymes in confined spaces	Matthias Vandichel, UL	Matthias.Vandichel@ul.ie
F3M 7	Electrocatalysis at functionalized polarisable liquid/liquid interfaces for sustainable electrosynthesis of pharmaceutical precursors	Micheal Scanlan, UL	Micheal.Scanlon@ul.ie
F3M 10	Catalysis in Confined Space: A Gateway to Pharmaceutical Precursors	Elaine O'Reilly, UL	elaine.oreilly@ucd.ie

Appendix: 2026 PhD Application Form: Rinn Pharma & Biopharma

The following section provides an overview of the 2026 PHD Application Form for Rinn Pharma and Biopharma. This is the document you will be required to complete when applying for an PhD opportunity within the Centre.