

The Research Ireland Centre for Pharmaceuticals
Innovation Through Collaboration

IMPACT INDICATOR

SSPC, hosted at University of Limerick, is a world leading, interdisciplinary hub for (bio)pharmaceutical research and innovation. Through our reputation for scientific excellence, close industry partnerships and talent pipeline we solve industry and societal challenges. Our unique ecosystem sets us apart placing Ireland as a trailblazer in (bio)pharma research and talent development.

Scientific Excellence

SSPC's research impacts society by improving and advancing the **sustainable** production and the availability of **medicines** globally.

Investment

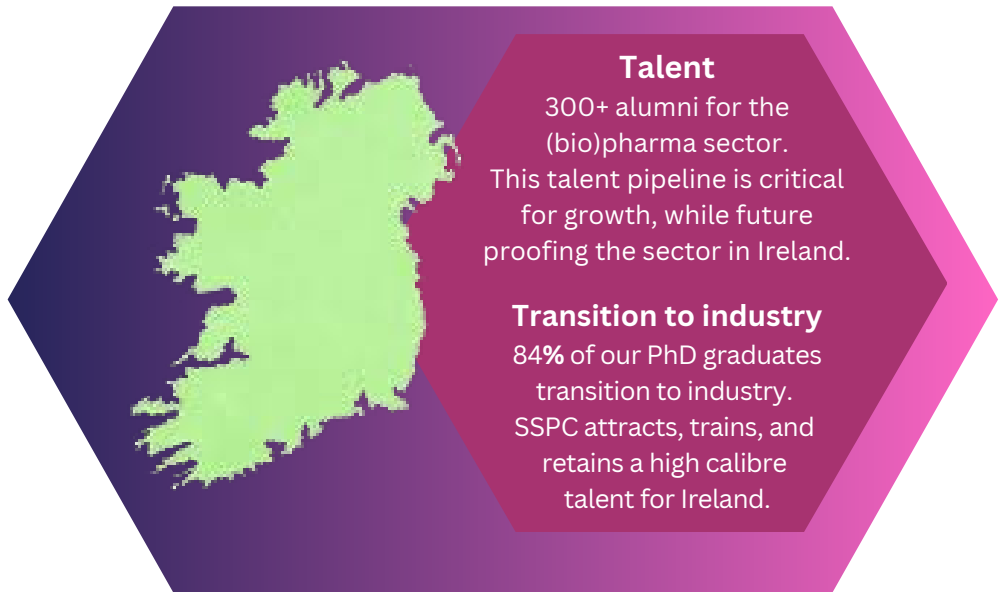
SSPC has leveraged an additional >€165 m investment from industry and other competitive sources, delivering significant economic and human capital impacts.

Industry

SSPC works with >50 industry partners including **Pfizer, J&J Innovative Medicines, Sanofi, Eli Lilly, BMS, MSD**. SSPC supports a strong indigenous community including **APC Ltd., Scale Up Systems, Serosep**.

Societal Impact

SSPC's Education & Public Engagement programme has a global reach of >5.6 m people. Informed by research & in partnership with public stakeholders, the programme supports perception, understanding and trust in (bio)pharma research.



SSPC is uniquely positioned to tackle complex problems and challenges through fundamental science informed by a rich and diverse knowledge base, across our SSPC community as well as sector-wide stakeholders within the larger ecosystem.



HOST INSTITUTION



PARTNER INSTITUTIONS



Global Partners

Over 1,400 International Co-Authors in **48 countries** across **6 continents**

◆ Top Institute Collaborations Globally
 ◆ Top 25 World University Collaboration



Oxford University	UK
Massachusetts Institute of Technology	US
University of Cambridge	UK
Imperial College London	UK
ETH Zurich	Switzerland
National University of Singapore	Singapore
University College London	UK
Cornell University	US
University of Melbourne	Australia
Peking University	China
The University of New South Wales	Australia
The University of Sydney	Australia
University of Toronto	Canada
The University of Edinburgh	UK
Columbia University	US
Université PSL	France
Tsinghua University	China

INDUSTRY MEMBERS



INDUSTRY PARTNERS



Discover Our Impacts

<https://sspc.ie/sspc-research-discover-our-impacts/>

Exemplar Industry Collaborations



Prof. Lidia Tajber, Trinity College Dublin and **Dr Peter Byrne**, University College Dublin, in collaboration with **MSD Ballydine Ireland** and **Merck Rahway, NJ USA**.

Mechanochemistry

Drug Substance



MSD



Friedl Crafts Reaction

This project collaboration investigates Friedel-Crafts acylation reactions using mechanochemical approaches. Mechanochemistry allows the activation of chemical transformations by the application of mechanical forces to solids. Such reactions can be conducted under solvent-free processing conditions, providing the chemical industry with an effective strategy to reduce greenhouse gas emissions, waste and pollution, allowing cleaner and cheaper manufacturing processes. The objectives of this project are to develop Friedel-Craft acylation (or similar) reactions using mechanochemistry, investigate the reaction conditions on the regioselectivity, reaction time and yield of the product, evaluate compatibility of the reaction conditions with material of construction of ball mills and extruders, and determine the impact of the process condition on the particle properties of the reactants and products.

“Working with SSPC allowed us to collaborate with world experts and rapidly explore uncharted chemical territories. This collaboration has enabled us to learn about mechanochemistry, applying this technology to challenging chemical transformation and rapidly gain knowledge of tools that are rarely utilized for the synthesis of active pharmaceutical ingredient.” **Francois Levesque Merck US**



Prof. Abina Crean, University College Cork, led a collaboration with **Alkermes Ireland, Belgium & U.S.** to embed modelling in development with SSPC and PMTC Research Centres in Ireland.

Drug Product



Platform Modelling Approach to support Tablet Development, Scale-up and Technology transfer

The project established a platform approach to inform the design of direct compression tablet formulations for future commercial products. A platform approach is the application of common processes that can be used to streamline development activities. The use of a platform approach during product development has the potential to decrease development time and cost, decrease time to market, and simplify scale up and process transfer. A passable flow formulation if commercialised will have a maximum output on a Modul P tablet press of 132 million tablets/year.

“Alkermes is delighted to be involved in a project that demonstrates an important collaboration between industry and academia capable of producing a practical and tangible business outcome. Such a collaboration serves to strengthen both parties and provides an example for future opportunities.”

Mark Tawa, Vice President, Pharmaceutical Development, Alkermes

SSPC Industry Placement Programme

SSPC enhances its talent development through the provision of an Industry Placement Programme with its partner companies. To date, **83 researchers** from the Centre have undertaken a 3-month placement at over **44 partner company sites**.

The programme facilitates enhanced learning by the researchers and bridges the learning gap between academia and the pharmaceutical sector. Researchers are provided with hands-on experience and invaluable insights into the cutting-edge field of drug discovery and development. This programme equips PhD and postdoctoral researchers with the skills and industry knowledge to thrive in a dynamic and constantly evolving field.

Upstream Processing

- Molecular Modelling
- Synthetic Chemistry
- Novel & Optimised Synthetic Routes
- Asymmetric Synthesis
- Catalysis; Bio-, Organo- & Transition-
- Chemistry: Green-, Electro-, Fluoro- & Photo-, Organometallic, Glyco- & Carbohydrate
- Mechano- Chemistry & Synthesis
- Flow Chemistry & Synthesis
- Supramolecular Chemistry
- Click Chemistry
- Hybrid Inorganic & Organic materials
- Molecular Sensing & Screening.
- Conjugation & Self Assembly
- Physicochemical & Structural Characterisation

Downstream Processing

- Crystal & Anti-Crystal Engineering
- Material & Formulation Science
- Single & Multi-component crystals
- Thermodynamics
- Solid State Characterisation
- Particle & Nano-particle Engineering
- Amorphous Materials
- Polymer Chemistry
- Pre-formulation & Formulation
- Bioavailability Enhancement
- Permeability & Solubility Enhancement
- Novel Drug Delivery Technologies
- Site Specific Targeting Technologies
- Nanomedicines
- Topical and transdermal drug delivery
- *In-vivo* & *In-vitro* Models & correlations
- Dissolution & *In-vivo* Toxicity

Process Engineering

- Process Chemistry & Engineering
- Computation Fluid Dynamics
- Multivariate Data Analysis
- Hybrid & Mechanistic Modelling
- Statistical Analysis & Data Modelling
- PAT & *In-situ* Process Control
- DS & DP Continuous Manufacturing Process Scale Up and Out
- Process Intensification
- Reactor Engineering
- Nano-manufacturing
- Powder Processing
- Disruptive Manufacturing Platforms
- Decentralised & Modular Manufacturing
- Additive Manufacturing
- Crystallization processes
- Hydrodynamic cavitation

Exemplar Industry Collaborations



Prof. Sarah Hudson, University of Limerick, is leading a partnership with **MSD, Pfizer, Eli Lilly, JnJ** and **BMS** on the reusability of Protein A Resin.



Drug Substance

Advanced Manufacturing

Advanced Analytics

Multi-Product Resin Reuse for Biopharmaceutical Manufacturing

The collaboration has the potential to revolutionize manufacturing practises for antibody-based products. Biopharmaceutical industries are currently reluctant to adopt resin reuse procedures, despite the enormous cost saving it could introduce. This research could massively support industry partners and their endeavours to bring down the cost of medicines.

"This innovative project has brought multiple industry and research partners together to take on the industry relevant challenge. This has been a very beneficial collaboration, driving the feasibility of extending resin reuse to a second product which would significantly support our biopharmaceutical manufacturing industry. We have agreed to extend the project into a second phase of activity demonstrating the value and success of the partnership." **Pamela O'Brien, Director, Manufacturing Science and Technology BMS, Cruisrath, Dublin.**



Dr. Jessica Whelan, University College Dublin, is currently collaborating with US & Ireland based **J.M. Canty** to develop a novel PAT solution.



Drug Substance

Advanced Manufacturing

The monitoring and optimization of cell culture medium preparation to support bioprocess intensification

The aim of the research is to develop a PAT method using the Canty image analysis based MiniCell, for the monitoring and characterization of media preparation with the aim of optimizing media preparation steps supported by a digital twin. The enhanced process understanding delivered by the use of the Canty system will be used to determine the optimal process conditions needed to address the current challenges.

"It has been a delight to collaborate with such an enthusiastic and dedicated team at UCD. The group's research knowledge and expertise has greatly benefited the program. The combination of UCD under the SSPC structure allows us to engage in research that we are unable to do anywhere else worldwide."
Tod Canty, JM Canty, Inc.

Alumni spotlight



Dikshitkumar Khamar

Head of Analytical Science and Technology, Sanofi, Waterford



Originally from India, Dikshitkumar Khamar joined the SSPC as a Post Doctoral Researcher working with the crystallisation and engineering teams. He joined Sanofi in 2015 and is the industry lead on several collaborative projects with SSPC.

Upstream Processing

- Molecular Modelling
- Vaccines
- mAbs & ADCs
- Nucleic Acid & Anti-Sense Therapeutics
- Protein Chemistry & Engineering
- Peptide Synthesis & Modification
- Enzyme Therapeutics
- Synthetic & Semi-Synthetic biologics
- Cell Line Selection & Development
- Bacterial & Mammalian Fermentation
- Synthetic & Systems Biology
- Protein Crystallization
- Glycosylation
- PEGylation
- Omics
- Self Assembly & Oligomerisation
- Microcarrier Systems
- Bio-Conjugation & Chemical Ligation

Downstream Processing

- Purification
- Filtration & Separation
- Chromatography
- Lyophilisation
- Characterisation
- Particle & Nano-particle Engineering
- Aggregation Control
- Pre-formulation & Formulation
- Bioavailability Enhancement
- Stability Control & Enhancement
- Permeability & Solubility Enhancement
- Site Specific Targeting Technologies
- Non-viral Delivery Systems
- Novel Drug Delivery Technologies
- Topical and transdermal drug delivery
- *In-vivo* & *In-vitro* Models & Correlations
- *In-vivo* Toxicity
- Dissolution

Process Engineering

- Process Chemistry & Engineering
- Computation Fluid Dynamics
- Multivariate Data Analysis
- Hybrid & Mechanistic Modelling
- Statistical Analysis & Data Modelling
- Process Analytical Technologies.
- Process Modelling & Control
- *In-situ* Process Control
- DS & DP Continuous Manufacturing
- Process Scale Up and Out
- Process Optimisation & Intensification
- Reactor Design
- Powder Processing
- Disruptive Manufacturing Platforms
- Decentralised & Modular Manufacturing