# PharmaChem Sector in Ireland

## Global Market

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2020</th>
</tr>
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<tbody>
<tr>
<td>Global Market</td>
<td>$1.08T</td>
<td>$1.6 T</td>
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<tr>
<td>(annual growth 7.8%)</td>
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</table>

## Exports

- 50% of Irish **goods** Exports (€50B 2013)
- 52% of all Global Medicines

## Corporation Tax

- €1 Billion (25% of total corporation tax)

## Employment

- 25,000 direct + 25,000 Indirect

## Education

- 50% are 3rd level graduates
- 25% of all PhDs in Irish industry

## Companies

- Over 120 companies – 13 of top 15
- 6 of top 10 blockbusters manufactured in Ireland

## Compliance

- Unrivalled record globally

## Investments

- €3Bn investment 2016/7, 2,000 new jobs

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**Pharma - the Jewel in Ireland’s economy today**
TO POSITION IRELAND AS A GLOBAL HUB FOR PROCESS INNOVATION AND ADVANCED MANUFACTURING IN THE PHARMACEUTICAL INDUSTRY
Building on Success

SSPC1
10 Industry
5 RPOS
€8M

SSPC2
24 Industry
9 Irish RPOS
€45M

Molecule to Material to Medicine
# SSPC Team

<table>
<thead>
<tr>
<th>9</th>
<th>Research Performing Organisations</th>
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<tbody>
<tr>
<td><img src="image1" alt="University of Limerick" /></td>
<td><img src="image2" alt="UCD Dublin" /></td>
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<tr>
<td><img src="image3" alt="O'Gallaghi NUI Galway" /></td>
<td><img src="image4" alt="Trinity College Dublin" /></td>
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<td><img src="image5" alt="DCU" /></td>
<td><img src="image6" alt="AIB" /></td>
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<td><img src="image7" alt="NIBRT" /></td>
<td><img src="image8" alt="Waterford Institute of Technology" /></td>
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<thead>
<tr>
<th>24</th>
<th>Industry Partners</th>
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<tbody>
<tr>
<td><img src="image9" alt="Pfizer" /></td>
<td><img src="image10" alt="Janssen" /></td>
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<tr>
<td><img src="image11" alt="Lilly" /></td>
<td><img src="image12" alt="GSK" /></td>
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<tr>
<td><img src="image13" alt="Roche" /></td>
<td><img src="image14" alt="Bristol-Myers Squibb" /></td>
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<td><img src="image15" alt="AbbVie" /></td>
<td><img src="image16" alt="GlaxoSmithKline" /></td>
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<tr>
<td><img src="image17" alt="Amgen" /></td>
<td><img src="image18" alt="Alkermes" /></td>
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<tr>
<td><img src="image19" alt="Genzyme" /></td>
<td><img src="image20" alt="Johnson &amp; Johnson" /></td>
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<tr>
<td><img src="image21" alt="BioMarin" /></td>
<td><img src="image22" alt="Rusal" /></td>
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<tr>
<th>12</th>
<th>International Academic Collaborators</th>
</tr>
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<tbody>
<tr>
<td><img src="image23" alt="Université de Rouen" /></td>
<td><img src="image24" alt="University of Manchester" /></td>
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<tr>
<td><img src="image25" alt="Manchester 1834" /></td>
<td><img src="image26" alt="The Hong Kong Polytechnic University" /></td>
</tr>
<tr>
<td><img src="image27" alt="Purdue University" /></td>
<td><img src="image28" alt="University of South Florida" /></td>
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<tr>
<td><img src="image29" alt="University of Toronto" /></td>
<td><img src="image30" alt="CoEBio3" /></td>
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INNOVATION THROUGH COLLABORATION
Research Programme

Molecule to Material to Medicine

• 3 Research Strands
  • New Frontiers in Pharma Synthesis
  • Crystal Growth & Design
  • Drug Product Formulation & Manufacturing

• Research Program
  • 9 Platform Projects
  • 8 Spoke Projects
  • 2 Linker Projects

• 3 Spoke projects
  • MOMEnTUM
  • Continuous Crystallisation Isolation & Drying
  • Advanced Biopharmaceutical Technologies
Education, Training & Outreach

**EDUCATION**
- **Post-Primary**
  - ‘Innovations in Medicine’
    - (TY Module)
- **Third Level**
  - Structured PhD
    - 3 accredited, discipline-specific modules

**TRAINING**
- **Masterclass Series**
  - Chemical Safety Masterclass
  - 100 industrial H&S site leaders
  - Keynote by John Bresland
    - Former CEO US Safety Board

**OUTREACH**
- National Crystal Growing Competition
  - >500 entries nationally annually
  - RTE’s *The Late Late Show*

**H2020**
- €500K+ for E&O
People & Knowledge

**SFI PROFESSOR**

- Attracting international leaders
- First SFI Research Prof
- Featured in *Science*

Prof. Michael Zaworotko

**SSPC SPIN OUT**

APC has created **160 new jobs in Ireland**

**INDUSTRY-RELEVANT**

- **70% PhD** graduates to industry;
- National avg. **32.3%**
- **45** Student Placements in industry

**GLOBAL SOLUTIONS**

- Importing Problems
- Exporting Solutions

International Benchmarking

SSPC is competitive with leading international centres with regard to:

- Publications
- Industry collaborations
- High-calibre research teams

- SSPC is a leader in promoting greater gender equality
- SSPC Research Performing Organisations are members of the Athena SWAN charter
SSPC Workshop Series

Nov 2013  Marine Institute/Pfizer/Eli Lilly  94 attendees
“1st SSPC Continuous Processing Workshop”

Jun 2015  UL/Roche  105 attendees
“PAT in Pharmaceutical Processing”

Feb 2017  Druids Glen/APC  133+ attendees
“CM2017: Adoption of continuous manufacturing in the Pharmaceutical industry”
SSPC in continuous processing

SSPC in continuous processing

NEW FRONTIERS IN PHARMA SYNTHESIS

CRYSTAL GROWTH AND DESIGN

DRUG PRODUCT FORMULATION AND MANUFACTURE

INNOVATION THROUGH COLLABORATION

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Progress Towards Continuous

Upstream Reaction Chemistry

Crystallization, Isolation & Drying

Powder Blending & Granulation

Compression & Coating

Molecule

Material

Medicine
Continuous - SSPC 2013-19

- Continuous Azide Chemistry (2015 UCC)
- Upstream Reaction Chemistry
- Continuous Grignard Reactions, (2016 UCD)
- Integrated continuous process design & construction using 3D printing (2015 UCD)
- Automated Self Seeding of Batch Crystallizations via Plug Flow Seed Generation (2014 UCD)
- Modelling of continuous plug flow crystallization (2015 UL)
- Continuous Crystallisation, Isolation and Drying (2015 UL)
- SFI/NSF C2C Project €500K (2016 UL)
- SFI Infrastructure CIDT² €2.5M (2016 UL)
- Infrastructure award – powder extrusion suite (2014 UL)
- MOMENtUM SSPC Spoke project (Automation) €2.3M (2016 UL)
- Compression & Coating

Molecule
Material
Medicine

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INNOVATION THROUGH COLLABORATION
SSPC by Numbers

6 Years of Funding
9 Research Performing Organisations
12 International Collaboration Centres
21 Funded Projects
24 Companies supporting the research
43 Post-Doctoral Researchers
38 Principal Investigators
45 €Million euro direct Funding
33 €Million euro leveraged funding (€8.6M EU)
63 PhD Studentships
350 Community
7 Operations support

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INNOVATION THROUGH COLLABORATION