UCD Chemical & Bioprocess Engineering

...bringing science to life
‘Make your mind up’ time.....

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UCD Chemical & Bioprocess Engineering

• Ireland’s oldest & largest Chemical Engineering School
  – 60th Anniversary – 2016!

• BE Chemical & Bioprocess Engineering
  – 4-year programme
  – accredited at Master level by IChemE
  – 35-45 graduates per annum
  – 1300+ graduates to date

• MEngSc in Biopharma Engineering
  – Full- & part-time
  – 100+ graduates since 2007

• MEngSc in Chemical Engineering
  – non-EU students
Chemical & Bioprocess Engineering Research

• **Research Strengths**
  - Bioprocess Engineering & Multiphase Systems
  - Materials Design
  - Computational Nanotechnology
  - Energy Conversion Systems Engineering
  - Pharmaceutical Process Engineering

• **Teaching & Research Personnel**
  - 11.5 full-time Academic Staff
  - 4 Adjunct Professors
  - 10+ Research Fellows
  - 20+ PhD students
  - 6 Technical Staff
OxyMem

- Campus company, est. 2013
- Founders: **Prof Eoin Casey & Dr Eoin Syron**
- Solves energy-intensive wastewater treatment with smart aeration
APC: partners in pharmaceutical engineering

- Campus company, est. 2011
- Founders: Prof Brian Glennon & Dr Mark Barrett
- Purpose-built Cherrywood facilities, 2016
- 60 full-time employees
- Largest Irish employer of PhD-qualified Chemical Engineers
- Works with pharma/biopharma manufacturers to develop chemical/biological processes to produce medicines
Chemical & Bioprocess Engineering Education

• Preparation for life-long learning
  – scientific, mathematical & engineering competencies
  – engineering problem-solving skills
  – effective team work & professional awareness

• Strong industrial links
  – Adjunct Professors
    ❑ Dr. David O'Reilly, formerly CEO Chevron
    ❑ Dr. Michael Egan, formerly Director PM
    ❑ Brendan O’Callaghan, VP Biologics, Sanofi
    ❑ Dr. Mark Barrett, CEO APC
    – Industrial Internships (>85%)

• Excellence in Teaching & Learning
  – Awards/Funding: ExxonMobil, National Forum, NAIRTL, UCD
UCD Chemical & Bioprocess Engineering

BE degree in Chemical & Bioprocess Engineering

- 4-year (8 semester) degree programme
- typically 35-45 graduates
- professionally, internationally accredited:
  - IChemE (Master level)

Chemical & Bioprocess Engineering?

- One curriculum for Stages 2, 3, 4

Internships?

- Optional, non-credit bearing
- Typically, Summer at end of Year 3; increasing employer & student interest in longer Internships
- Support from School in applying for positions
NEW FOR SEPT 2016!
ME degree in Chemical & Bioprocess Engineering

• 5-year Integrated Master’s degree programme
• Phased introduction from Sept 2016
• With extended (6-12 month) Internship from Jan of Stage 4

BE or ME?

• Same Stage 2 & Stage 3 programmes for BE & ME
• BE/ME Decision: At end of Stage 3*

Accredited? YES!

• BE: accredited by IChemE to Master level, to 2018/19 intake
• ME: will be IChemE-accredited to Master level, will also be eligible for Engineers Ireland accreditation.

* Current GPA for admission to ME > 2.8, based on 70% Stage 3 GPA + 30% Stage 2 GPA
BE & ME Programme Structures

Stage 1 Engineering (Omnibus)

Stage 2 Chemical & Bioprocess Engineering

Stage 3 Chemical & Bioprocess Engineering

BE Pathway

Stage 4

BE DEGREE
Level 8

ME Pathway

Stage 4

Stage 5

ME DEGREE
Level 9

Internship
Jan–Aug

UCD Chemical & Bioprocess Engineering...bringing science to life
Stage 2

Semester 1
- CHEN20020 Chemical & Bioprocess Engineering Measurement
- CHEN20040 Chemical & Bioprocess Engineering Laboratory 1 (10 credits)
- CHEN20030 Chemical Engineering Thermodynamics & Kinetics
- CHEN20050 Biotechnology for Engineers
- MATH20240 Multivariable Calculus for Engineers

Semester 2
- CHEN20010 Inorganic and Physical Chemistry for Engineers
- CHEM20060 Organic Chemistry for Engineers
- CHEN20060 Transport Phenomena
- CHEN20070 Computers in Chemical & Bioprocess Engineering
- Elective
- Elective
Stage 2 Laboratory/Project Work

CHEN20040 Chemical & Bioprocess Engineering Laboratory 1
• Engineering & Chemistry experiments
• Computing Sessions
• Group project
  - Problem-based learning, e.g.
  - Design, Construction & Evaluation of a Heat Exchanger
  - ‘Heart-Lung Machine’

CHEN20050 Biotechnology for Engineers
• Group-based poster presentation

CHEN20070 Computers in Chemical & Bioprocess Engineering
• EXCEL, Matlab, Visio

Winning team
PBL HXCR Project 2008-09
(L-R) Matthew Perron, Phillip Roche, Meabh Doyle, James Robinson
Pat McAdam Scholarship in Chemical & Bioprocess Engineering

Martin McAdam
UCD BE (ChemE) 1982
CEO Aquamarine Power Ltd

- Established in memory of Pat McAdam, at the request of Mr Martin McAdam, to celebrate and honour the life and work of his late wife, Pat, a much-loved teacher.
- €4,000.00
- to cover Summer Research Internship, Colorado School of Mines
Mark Carthy Travel Award in Chemical & Bioprocess Engineering

- €1000 bursary
- To support travel for personal and/or professional development purposes

Mark Carthy
UCD BE (ChemE) 1982
Managing Partner
Orion Healthcare Equity Partners

Martin McAdam Travel Bursary in Chemical & Bioprocess Engineering

- €1000 bursary
- To support travel for personal and/or professional development purposes
Student Scholarship: Stage 3

Abbvie Achievement Award in Chemical & Bioprocess Engineering Practice

- €1000 bursary
- Awarded to the Stage 3 student receiving the highest accumulated grade in
  - Chemical & Bioprocess Engineering Laboratory 2
  - Chemical & Bioprocess Engineering Design
  - Unit Operations in Chemical & Bioprocess Engineering
Stage 3

Semester 1

- CHEN30010 Chemical & Bioprocess Reaction Engineering
- CHEN30020 Unit Operations
- CHEN30030 Chemical & Bioprocess Engineering Thermodynamics
- MEEN30140 Professional Engineering (Finance)
- ACM30030 Multivariable Calculus for Engineers II
- Elective

Semester 2

- CHEN30050 Chemical & Bioprocess Engineering Laboratory 2 (10 credits)
- CHEN30130 Heat Transfer and Fluid Mechanics
- CHEN30150 Chemical & Bioprocess Engineering Design (10 credits)
- CHEN30160 Computational Methods in Chemical & Bioprocess Engineering
Stage 3 Laboratory/Project Work

**CHEN30050 Chemical & Bioprocess Engineering Laboratory 2**
- Pair-based experimental work
- Laboratory/pilot-scale equipment
- Distillation, evaporation, drying....
- Complements CHEN30020 Unit Ops

**CHEN30150 Chemical & Bioprocess Engineering Design**
- Process & equipment design
- Factors to consider: purpose, chemical design, material, equipment, safety, environmental, cost
Stage 3 – Industrial Internships

- Stage 3 students encouraged to secure Summer Internships
- No academic credit awarded
- Assisted by School
  - Stage 2 Mock Interviews (2016: Abbvie)
  - Professional preparation:
    - **CHEN30040 Commercial Pharmaceutical & Bioprocessing Technology** (In-programme elective)
- Companies recruiting for Summer 2016 or year-long 2016-17

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Year Abroad?

- Managed by UCD International Office
  - Open to students from all Engineering disciplines
- Recent ChemE Erasmus exchanges…
  - ENSIACET, Toulouse, France
  - Technical University of Berlin (TU Berlin) in Germany
- Recent, ChemE Non-EU University Exchanges
  - University of California, Santa Barbara
  - University of California, Berkeley
  - University of Connecticut
  - University of Texas, Austin
  - University of Virginia
  - University of Boulder, CO
  - For 2016-17: 7 ChemE students offered places, to date
# Stage 4 (BE & ME) & Stage 5 (ME)

## STAGE 4 - Semester 1 – BE & ME
- Adv. Separation Processes
- Process Design, Safety & Economics
- Chemical Engineering Processes
- Adv. Experimental Design

## STAGE 4 - Semester 2 – BE
- Research Project
- Process Control
- Applied Chemistry
- Option

## STAGE 4 - Semester 2 ME
- Internship

## STAGE 5 - ME
- **Summer Sem.** Internship (cont.)
- **Semester 1** Research Project
- **Semester 2** Core & Option modules

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**BE Degree**

**ME Degree**

UCD Chemical & Bioprocess Engineering

...bringing science to life
Research Project

- Individually, or in pairs (different credits for BE & ME)
- Laboratory-based or PC-based; some industrially-linked
- Closely linked to School research activities

- Effect of oxygen level on the ex vivo generation of fully mature human red blood cells
- Assessment of mixing in an aerated stirred tank reactor
- Nanoparticles for fuel cells
- Mixing and mass transfer in external loop airlift reactor
- Thermal conductivity of methane hydrate from equilibrium MD simulation
- Residence time distributions in continuous stirred tank and plug flow reactors
- Investigation of Ionic Liquids systems under zero and e/m field conditions
- Application of probiotic bacteria (*Lactobacillus casei*) for production of biosurfactants
- Scale up and economic analysis of a novel bioplastic production process
- Integrating DynoChem into the ChemE curriculum
Life after graduation......?

- BE degree
- Accredited by IChemE at Master level

2015 BE Chemical & Bioprocess Engineering
Life after graduation……?

- What are the current Stage 4 students planning?

**Offers accepted:**

- APC, BMS, DPS, MSD, Jacobs, Pfizer (Cork), Pfizer (Grangecastle), P66, PM Group

**Actively recruiting:**

- Diageo, GlanBia, GSK, Irish Cement, Kingspan, PwC

- Fully-funded PhD programmes in UCD

**Other options:**

- Funded PhD programmes in other high-ranking Universities

- Post-graduate courses in Biopharmaceutical Engineering, Energy, Process Control, Teaching, Pharmacy, Maths, Business…
Additional Information...

- Chemical & Bioprocess Engineering Videos
  http://www.ucd.ie/eacollege/chembioeng/undergraduateprogrammes/prospectivestudents/videowall/

- IChemE ‘Why Not Chem Eng?’
  http://www.whynotchemeng.com

- Talk to our staff and students!
UCD Chemical & Bioprocess Engineering

...for Lilly sponsorship of IChemE Student Membership
November 2014

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