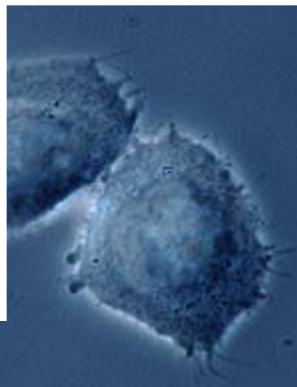
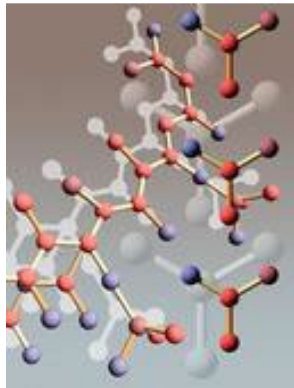
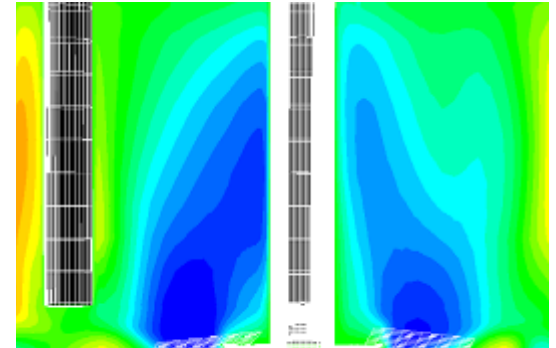


# UCD Chemical & Bioprocess Engineering



...bringing science to life

# UCD Chemical & Bioprocess Engineering



**‘Make your mind up’ time.....**

**Dr Ioscani Jimenez Del Val**  
[ioscani.jimenezdelval@ucd.ie](mailto:ioscani.jimenezdelval@ucd.ie)

# UCD Chemical & Bioprocess Engineering

- **Ireland's oldest & largest Chemical Engineering School**
  - 70<sup>th</sup> Anniversary in 2026!
- **BE Chemical & Bioprocess Engineering**
  - 4-year programme
  - accredited at Master level by IChemE
  - ~10 graduates per annum
- **ME Chemical & Bioprocess Engineering**
  - 5-year programme
  - IChemE accredited at Master level
  - 25-35 graduates per annum
- **MEngSc in Biopharma Engineering**
  - Full- & part-time
  - 250+ graduates since 2007



Dr Jessica Whelan  
Head of School



Graduating Class & Staff, 2022

# Chemical & Bioprocess Engineering Research

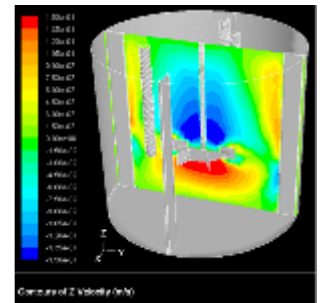
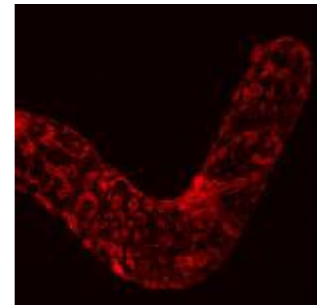
- **Research Strengths**

- Bioprocess Engineering & Multiphase Systems
- Materials Design
- Computational Nanotechnology
- Energy Conversion Systems Engineering
- Pharmaceutical Process Engineering



- **Teaching & Research Personnel**

- **14.5** full-time Academic Staff
- 4 Adjunct Professors
- 10+ Research Fellows
- 20+ PhD students
- 6 Technical Staff

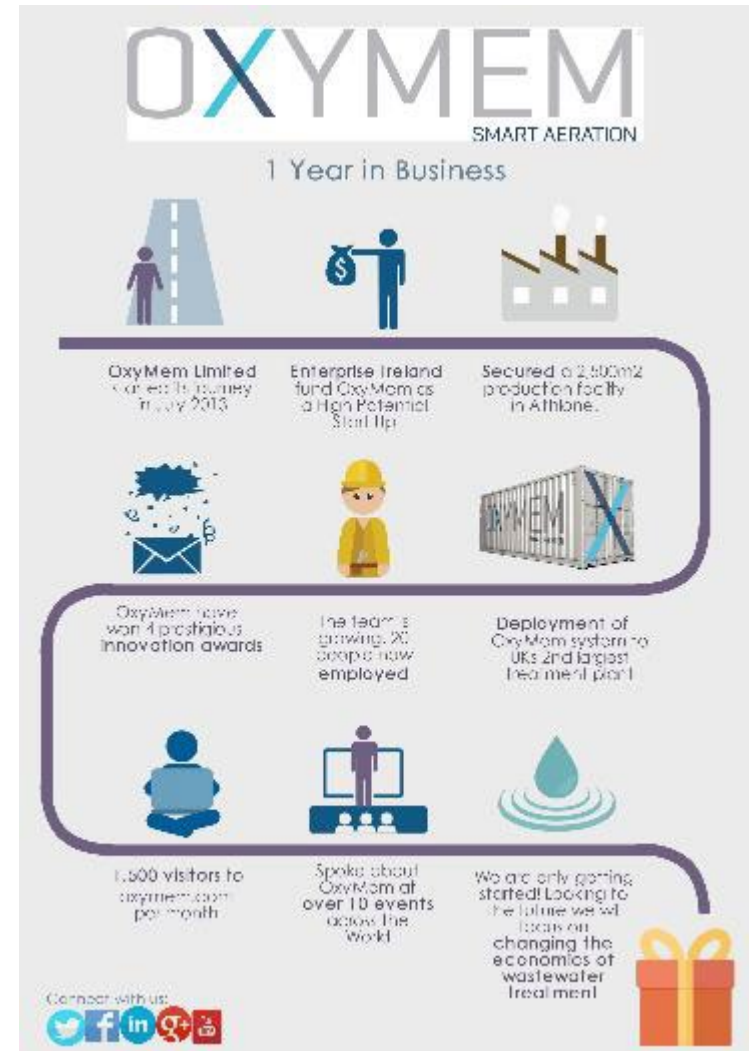


# OxyMem

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



THE IRISH TIMES  InterTradeIreland  
**INNOVATION**  
OVERALL AWARDS WINNER 2014  
**INNOVATION OF THE YEAR**  
**OXYMEM**



# APC: partners in pharmaceutical engineering

- Campus company, est. 2011
- Founders: **Prof Brian Glennon & Dr Mark Barrett**
- Purpose-built Cherrywood facilities, 2016
- >100 full-time employees
- Largest Irish employer of PhD-qualified Chemical Engineers
- Works with pharma/biopharma manufacturers to develop chemical/biological processes to produce medicines



[L-R]  
Dr. Mark Barrett CEO  
Prof. Brian Glennon CTO



# Chemical & Bioprocess Engineering Education

- **Preparation for life-long learning**
  - scientific, mathematical & engineering competencies
  - engineering problem-solving skills
  - effective teamwork & professional awareness
- **Strong industrial links**
  - Adjunct Professors
    - ▣ **Dr. David O'Reilly**, formerly CEO Chevron
    - ▣ **Brendan O'Callaghan**, VP Biologics, Sanofi
    - ▣ **Dr. Mark Barrett**, CEO APC
    - ▣ **Prof. Mike Bulter**, former CSO, NIBRT
  - 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



# UCD Chemical & Bioprocess Engineering

## ME degree in Chemical & Bioprocess Engineering

- 5-year Integrated Master's degree programme
- With extended (8-12 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
- **ME:** accredited by IChemE to Master level, accredited by Engineers Ireland to Master level

## Chartership!

\* Current GPA for admission to ME  $\geq 2.8$ , based on 70% Stage 3 GPA + 30% Stage 2 GPA

# ChemE: BE & ME Programme Structures

Year 1 Engineering (Omnibus)



Year 2 Chemical & Bioprocess Engineering



Year 3 Chemical & Bioprocess Engineering

BE Pathway



Year 4



BE DEGREE  
Level 8

ME Pathway



Year 4



Year 5



ME DEGREE  
Level 9

← Which discipline for ME?

← Study Abroad?

← BE/ME? [GPA  $\geq$  2.80]

**ME Internship**  
6-8 month: Jan–Aug  
or  
12 month: Jan-Dec  
[w/ in-company project]

**Optional: Minor in Biochemical Engineering**  
for BE or ME: Years 3-4



Where to next?



# Stage 2

## Semester 1

- CHEN20020 Chemical & Bioprocess Engineering Measurement
- CHEN20030 Chemical Engineering Thermodynamics & Kinetics
- CHEN20050 Bioprocess Engineering Principles
- CHEN20080 Chemical & Bioprocess Engineering Laboratory 1 (10 credits)
- MATH20290 Multivariable Calculus for Engineers

## Semester 2

- CHEM20060 Organic Chemistry for Engineers
- CHEM20070 Inorganic and Physical Chemistry for Engineers
- CHEN20060 Transport Phenomena
- CHEN20070 Computers in Chemical & Bioprocess Engineering
- CHEN20090 Biotechnology Principles
- Elective
- Elective

# Stage 2 Laboratory/Project Work

## CHEN20080 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 Bioprocess Engineering Principles

- Group-based poster presentation

## CHEN20070 Computers in Chemical & Bioprocess Engineering

- EXCEL, Matlab, Visio

### Winning team PBL HXCR Project

(L-R) Matthew Perron, Phillip Roche,  
Meabh Doyle, James Robinson

# Student Scholarships: Stage 2

## Pat McAdam Scholarship in Chemical & Bioprocess Engineering



**Martin McAdam**

UCD BE (ChemE) 1982

**CEO Aquamarine Power Ltd**



GREEN ENERGY OUT OF THE BLUE

- 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

# Student Travel Bursaries



**Mark Carthy**

UCD BE (ChemE) 1982

**Managing Partner  
Orion Healthcare  
Equity Partners**



## **Mark Carthy Travel Award in Chemical & Bioprocess Engineering**

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

## **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

- ACM30030 Multivariable Calculus for Engineers II
- CHEN30010 Chemical & Bioprocess Reaction Engineering
- CHEN30020 Unit Operations
- CHEN30030 Chemical & Bioprocess Engineering Thermodynamics
- CHEN30040 Commercial Pharmaceutical & Bioprocessing Technology
- Elective

## Semester 2

- CHEN30130 Heat Transfer and Fluid Mechanics
- CHEN30200 Chemical & Bioprocess Engineering Design (10 credits)
- CHEN30210 Chemical & Bioprocess Engineering Laboratory 2 (10 credits)
- MEEN30140 Professional Engineering (Finance)



# Stage 3 Laboratory/Project Work

## CHEN30210 Chemical & Bioprocess Engineering Laboratory 2

- Pair-based experimental work
- Laboratory/pilot-scale equipment
- Distillation, evaporation, drying....
- Complements CHEN30020 Unit Ops

## CHEN30200 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 (2019: Abbvie)
  - Professional preparation:
    - **CHEN30040 Commercial Pharmaceutical & Bioprocessing Technology** (In-programme elective )
- Companies recruiting for Summer 2022 or year-long 2022-23

**Abbvie**

**BMS**

**FDT**

**Jacobs**

**Pfizer**

**Roche**

**APC**

**DPS**

**GSK**

**MSD**

**Phillips 66**

**Biomarin**

**Eli Lilly**

**Helsinn**

**Mylan**

**PM Group**

# Year Abroad?

- **Managed by UCD International Office**
  - Open to students from all Engineering disciplines
- **Recent ChemE Erasmus exchanges...**
  - University of Edinburgh, UK
  - Technical University of Berlin (TU Berlin) in Germany
- **Recent, ChemE Non-EU University Exchanges**
  - University of California, Santa Barbara
  - University of Connecticut
  - Georgia Tech
  - Queen's University Ontario
  - NUS, Singapore
  - **For 2023-2024:** 6 ChemE students

# Stage 4 (BE & ME) & Stage 5 (ME)

## STAGE 4 - Semester 1 – BE & ME

- CHEN40150 Adv. Separation Processes
- CHEN40160 Adv. Heat Transfer & Fluid Mechanics
- CHEN40210 Adv. Experimental Design
- CHEN40620 Adv. Process Design
- Option

## STAGE 4 - Semester 2 – BE

- CHEN40010 Environ. Eng.
- CHEN40200 Research Project
- CHEN40560 Process Control
- Option

**BE Degree**

## STAGE 4 - Semester 2 ME

- Internship

## STAGE 5 - ME

**Summer Sem.**

Internship (cont.)

**Semester 1**

Research Project

**Semester 2**

Core & Option modules

**ME Degree**

# 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 (*Lactobaccillus 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



2018 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 (Grange Castle), Eli Lilly, 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 & Blog**  
<http://www.ucd.ie/chembioeng/study/prospectivestudents/>
- **IChemE 'Why Not Chem Eng?'**  
<http://www.whynotchemeng.com>
- **Talk to our staff and students!**



# Experience of a Chemical Engineering Student

Eva Wall

# A bit about me

- Eva Wall
- Co. Dublin
- 5<sup>th</sup> Year Chemical & Bioprocess Engineering student
- Half-French
- Swimming, knitting, choir, EngSoc, jewellery making
- Severely injury prone – banned from mini-golf, boxing, surfing, climbing trees...



EngSoc



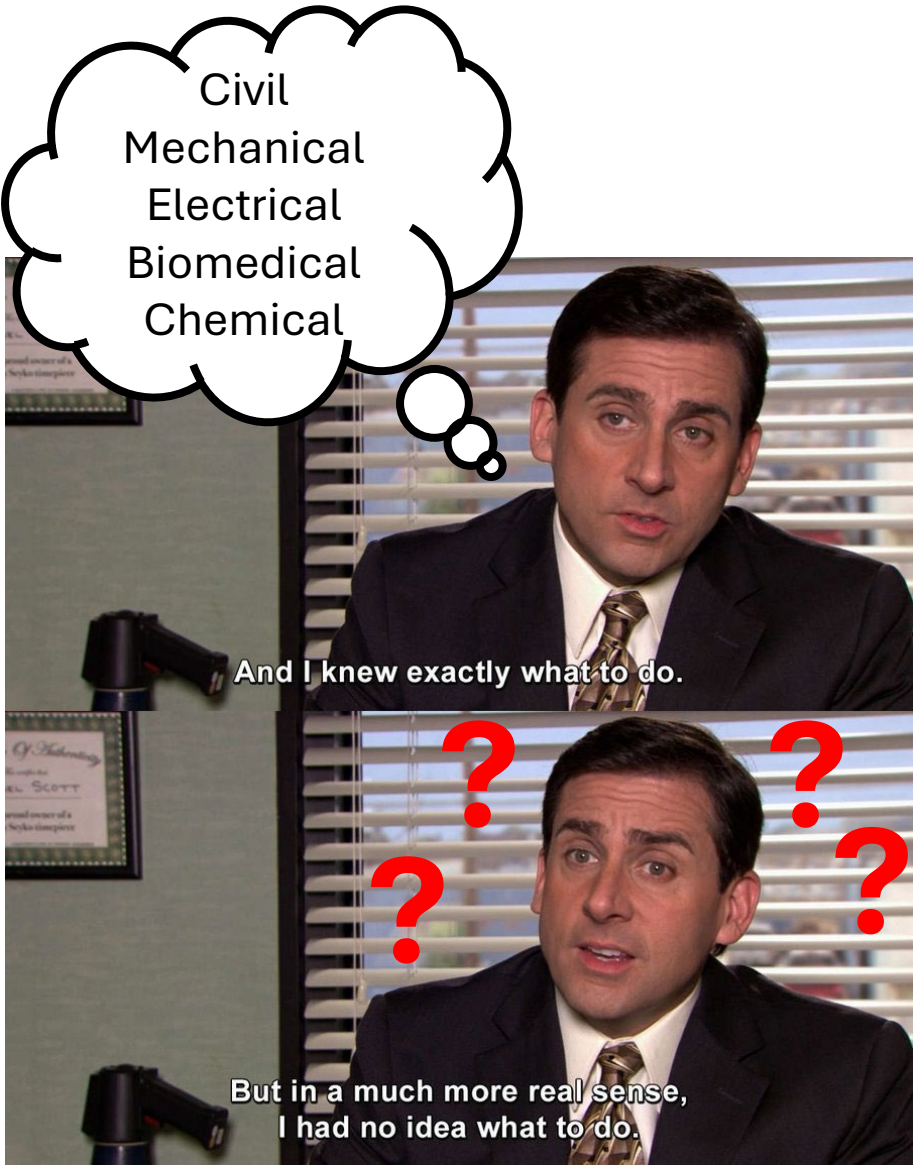
DYC

# Why am I here?



I have no idea how I got here

Ah yes! I am here to enlighten you about Chemical Engineering!!



# Why did I choose Chemical Engineering

I was between  
civil & chemical  
engineering

I liked Maths,  
Chemistry and  
Biology

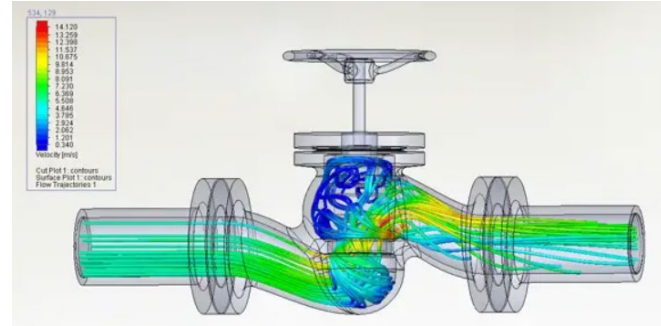
Enjoyed the 1<sup>st</sup>  
Year Chem Eng  
Module

Elec just wasn't  
for me

Interested in  
sustainability



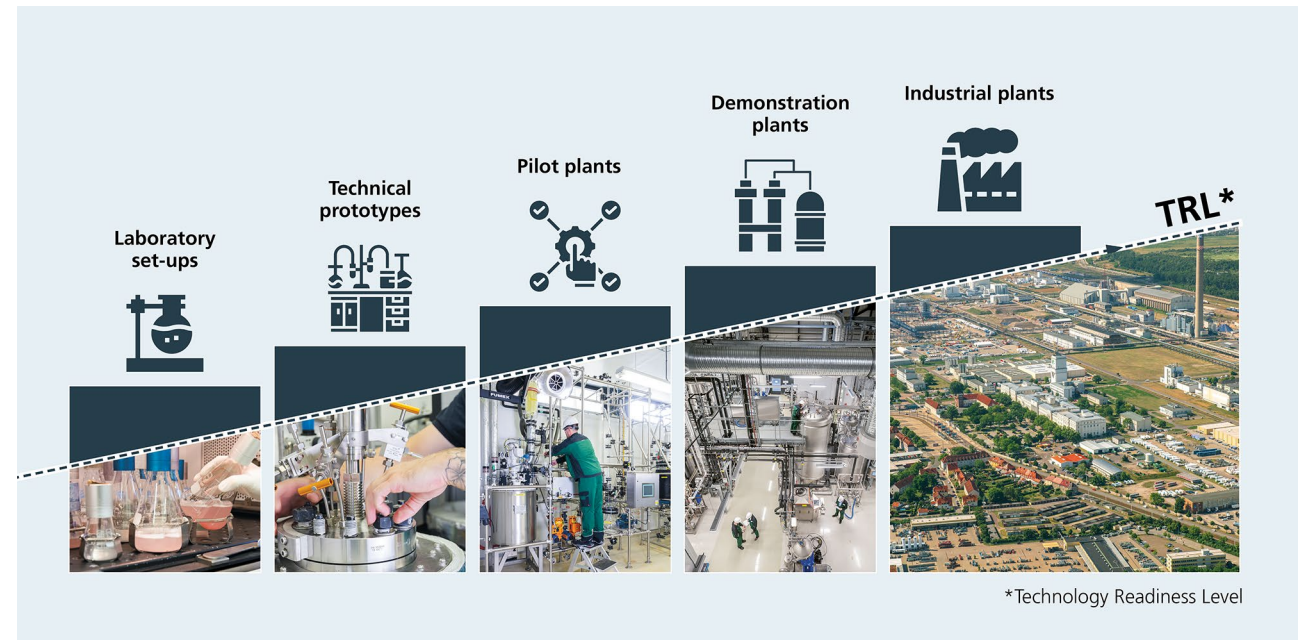
# What is Chem Eng?



more about pumps  
& pipes



Less Chemistry...



more about scaling up chemical processes  
& large-scale manufacturing

# My UCD Chem Eng Experience

## Modules:

- Lab Modules
- Transport phenomena
- Design Modules
- Bioprocessing
- Chemistry modules
  
- Thermodynamics
- Computing



## The community

- Great friends!!!!!!
- Small & close-knit group
- Terrific faculty
- Camaraderie!



Frank Morton Sports Day

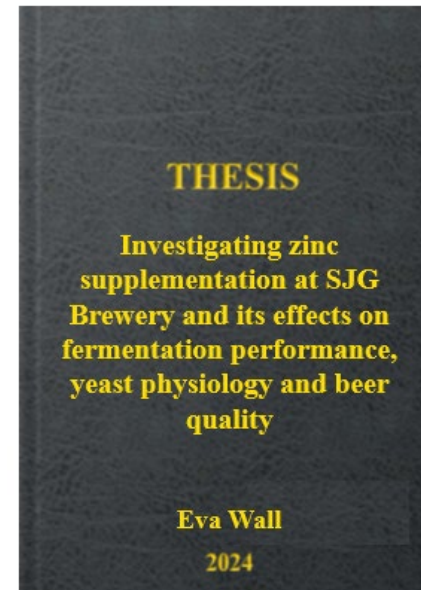
## Great Opportunities:

- Study Abroad: America, Canada, Australia, UK...
- Research bursaries & travel awards!



# Getting to work as a Beer Engineer!

- 1 Year at Saint James's Gate brewery
- Brewing intern on the operations team
- Loved it!
- Hands-on experience!
- Led waste & efficiency meetings
- Led projects, lab & industrial trials
- Thesis!
- Diageo = Global company!



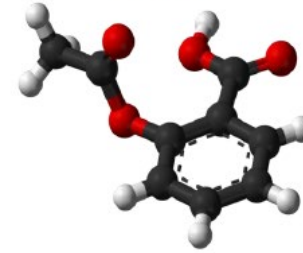
# Pathway Flexibility

## Biochemical Engineering Minor

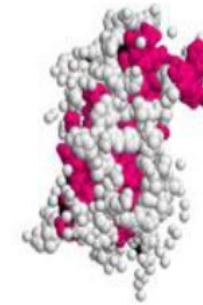
- Addition to base degree
- Instead of electives, do specific sets of modules with focus on biotechnology
- Captures future direction of pharma

- Can leave after 3,4 or 5 Years
- 6-8 month / Year long work experience with masters

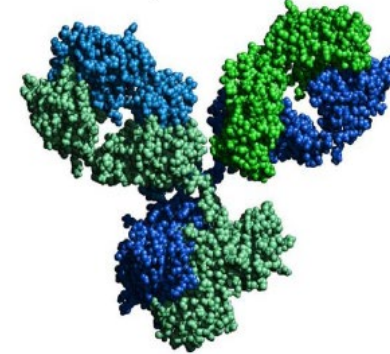
Small Molecule Drug /  
Pharmaceutical  
Aspirin  
21 atoms



Large Molecule Drug  
Human Growth Hormone  
~3,000 atoms



Large Biologic  
Herceptin  
~25,000 atoms



*“ The Biochemical Engineering Minor helped apply my chemical engineering knowledge to the pharmaceutical sector, & developed my analytical skills for biopharmaceutical process design”*



# Opportunities Galore!



What should I  
do after  
college?



**Bio/Pharmaceuticals**



GUINNESS

**Food & Beverage**



**Energy**



**Water treatment**



**Design**



**Further Research**

# Parting Thoughts

No matter which stream you choose, they all have so much to offer, with so many avenues and career options!!

Try EVERYTHING in college!

Don't let getting good grades affect your learning!!

Make sure to get out and have a life!!!

Ask for help!



# Any Questions at all!

cazaliwalleva@gmail.com