



**DN200 SCIENCE**  
4 New Pathways to  
Teaching Mathematics  
and Science

Discover. Experience. Choose.

# UCD SCIENCE

## 2013



[www.ucd.ie/science](http://www.ucd.ie/science)

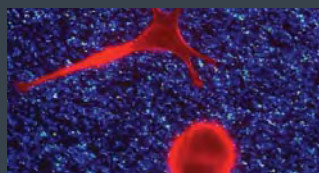
## Biological, Biomedical & Biomolecular Sciences



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Biochemistry & Molecular Biology

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DN200

Cell & Molecular Biology

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DN200

Environmental Biology

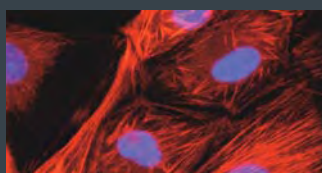
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Neuroscience

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Pharmacology

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Physiology

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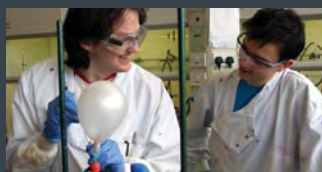


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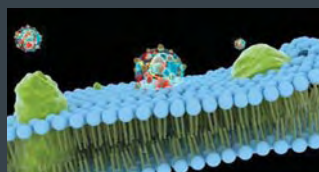
## Chemistry & Chemical Sciences



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Chemistry

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Chemistry with Biophysical Chemistry

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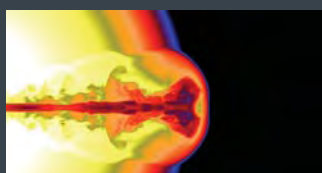


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Chemistry with Environmental & Sustainable Chemistry

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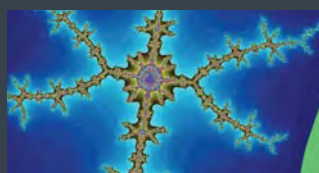
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Applied & Computational Mathematics

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Mathematics

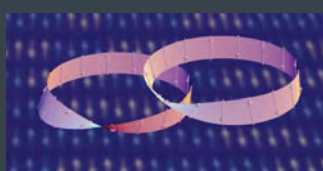
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Archaeology & Geology

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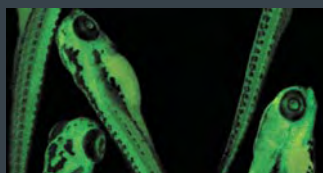
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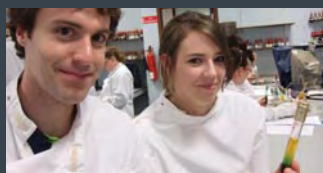
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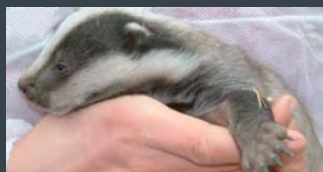
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Zoology

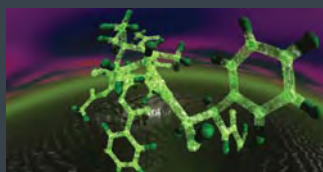
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Biology and Mathematics Education

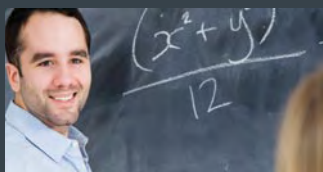
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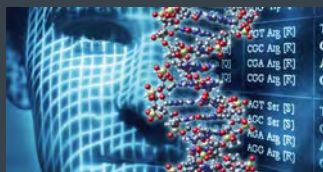
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Physics

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Physics with Astronomy & Space Science

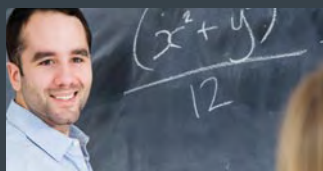
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# Welcome

Our dynamic and modern university is renowned, nationally and internationally, both for its quality of education and pioneering research. Since 1854, our graduates have played a central role in the shaping of modern Ireland and in the conduct of international affairs. Today, University College Dublin is a vibrant and exciting centre of learning where you can enhance your learning experience by broadening your learning or driving deeper into the subjects that interest you. Either way, you will receive a first-class education and a great opportunity for personal development. UCD has the largest Science programme in the country, providing degree courses in biological, chemical, geological, mathematical, physical and computer sciences delivered by lecturers at the forefront of both teaching and research. UCD Science graduates are in great demand in Science-based employment both at home and abroad, and are equally sought after in areas other than Science where there are requirements for rigorously trained, numerically competent and analytically proficient graduates. Many UCD Science graduates continue their studies at graduate level in UCD or through postgraduate training in leading institutions all over the world.

We look forward to welcoming you to UCD.

Professor Joe Carthy  
Dean of Science

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# UCD Science Degrees

The UCD Science DN200 programme offers 22 subjects categorised into three areas. You can specify which area to study on your CAO form or you can wait until you start at UCD to decide on an area. You are guaranteed one degree from within your chosen area of study.

UCD Science also offers the Bachelor of Actuarial and Financial Studies (BAFS) DN230 and two BSc direct entry routes for students who wish to specialise in Computer Science DN201 or Archaeology and Geology DN210.

Honours DN200, DN201 BSc and DN230 BAFS degrees are generally four-year programmes. The Honours DN210 BSc degree is a three-year programme. First year of the DN200 Science programme is designed to enable you to sample a number of subjects in your chosen area but also includes some core subjects required for all degrees. The choices you make in first year will have a bearing on your final degree subject(s). Students have a mix of lectures and practical classes every day depending on the subjects they choose. Typically, lectures take place in the mornings and practicals in the afternoons.

## Applying to UCD

UCD welcomes applications from EU and non-EU students. EU applicants apply through the Central Applications Office (CAO). Application information is available at [www.cao.ie](http://www.cao.ie). Non-EU applicants apply either via a UCD agent in their own country

or online at [www.ucd.ie/apply](http://www.ucd.ie/apply). Table 1 lists the CAO codes for all the UCD Science degrees.

*If you are searching online, it is recommended to use both the code and degree name.*

Table 1. CAO Codes and Points for UCD Science Degrees

CAO Code & Degree Title	Degree	CAO Points Range 2011	Example of equivalent A-Level Grades 2011
DN200 Science	BSc (Hons)	455 – 600	AAB (A-Level) & a (AS) or equivalent
DN201 Computer Science	BSc (Hons)	410 – 580	ABB (A-Level) & d (AS) or equivalent
DN210 Archaeology and Geology	BSc (Hons)	360 – 460	BBB (A-Level) or equivalent
DN230 Actuarial and Financial Studies	BAFS (Hons)	530 – 600	AAAA (A-Level) or equivalent

## Useful Web Addresses and Email Addresses

Description	Web Address	Email Address
UCD Entry Requirements	<a href="http://www.ucd.ie/myucd/entryrequirements">www.ucd.ie/myucd/entryrequirements</a>	<a href="mailto:admissions@ucd.ie">admissions@ucd.ie</a>
UCD Science	<a href="http://www.ucd.ie/science">www.ucd.ie/science</a>	<a href="mailto:science@ucd.ie">science@ucd.ie</a>
International Students	<a href="http://www.ucd.ie/international">www.ucd.ie/international</a>	<a href="mailto:international@ucd.ie">international@ucd.ie</a>
UCD Access Centre	<a href="http://www.ucd.ie/openingworlds">www.ucd.ie/openingworlds</a>	<a href="mailto:accesscentre@ucd.ie">accesscentre@ucd.ie</a>
HEAR and DARE	<a href="http://www.accesscollege.ie">www.accesscollege.ie</a>	For the HEAR scheme: <a href="mailto:hear@ucd.ie">hear@ucd.ie</a> For the DARE scheme: <a href="mailto:dare@ucd.ie">dare@ucd.ie</a>
A-Level Students	<a href="http://www.ucd.ie/myucd/alevel">www.ucd.ie/myucd/alevel</a>	<a href="mailto:admissions@ucd.ie">admissions@ucd.ie</a>
FETAC Students	<a href="http://www.ucd.ie/myucd/fetac">www.ucd.ie/myucd/fetac</a>	<a href="mailto:admissions@ucd.ie">admissions@ucd.ie</a>
Mature Students	<a href="http://www.ucd.ie/myucd/mature">www.ucd.ie/myucd/mature</a>	<a href="mailto:mature.students@ucd.ie">mature.students@ucd.ie</a>
Transfer Applicants	<a href="http://www.ucd.ie/myucd/transfer">www.ucd.ie/myucd/transfer</a>	<a href="mailto:admissions@ucd.ie">admissions@ucd.ie</a>
Fees and Grants Office	<a href="http://www.ucd.ie/fees">www.ucd.ie/fees</a>	<a href="mailto:studentdesk@ucd.ie">studentdesk@ucd.ie</a>

# Your First Year Explained

## Support for Students

The Science Programme Office will be your first point of contact and we encourage you to visit the office for information, support and advice on any issue. Staff in the office will be able to give you advice on module selection for the courses you intend to follow and the subject areas you can progress into in later years or direct you to the appropriate school or staff member for appropriate advice. The Programme Office is open from 8:30am to 5:00pm during term and operates a drop-in policy.

## Peer Mentoring

All incoming First Year Students will be linked with a Peer Mentor who is a Second or Third Year Science Student. They are available to help you to get to know the ropes, answer all of your questions and offer good advice on things such as where to go, how to fit it all in, and how and when to join clubs and societies. You will meet your Mentor during Orientation and you will exchange details so that you can contact them during the year and they can let you know of group meetings.

## Advisory Sessions

Advisory sessions are held for all First Year Science Students before term is due to start. The advisory sessions commence with an address by the Dean of Science. During these sessions you will have the opportunity to attend short talks from science lecturers and meet and talk to individual staff members for consultation on the selection of modules. Science lecturers in each of the Science Schools will be available for the first two weeks of Semester 1 to meet with First Year Science Students to answer questions about module selection.

## Choosing your Modules

The modules you choose in your first year will determine the subjects that you may specialise in, and ultimately what degree you can achieve. You need to study at least 10 Science modules in your first year so after you select the compulsory modules for your degree course, you can then make up your remaining module requirements from optional Science modules.

## Sample pathway for DN200 students

Year  
1

### Explore your options

- In first year, to explore all degree options within the Biological, Biomedical and Biomolecular Sciences, Chemistry and Chemical Sciences and Mathematical, Physical and Geological Sciences areas, students can sample a range of subjects but must decide on an area of study for second year.
- There are additional Mathematics requirements for some subjects, for example, Applied and Computational Mathematics.
- Introductory Biology, Chemistry, Geology, Mathematics and Physics modules are available for students with little or no prior knowledge.
- Students take 12 modules in first year and each module is 5 credits.
- 2 of the 12 modules can be chosen from outside of Science.

Years  
2, 3 & 4

### – Choose your subjects (Year 2)

### – Focus on your chosen subject (Years 3 and 4)

- In second year, students cover the requirements for a minimum of two subjects. All students take 12 modules in second year and may cover the requirements for more than two subjects in those 12 modules.
- In third and fourth year, students will focus on that one subject, for example, Neuroscience or Chemistry or Physics or Geology.
- In most subjects students complete a research project in their fourth year.
- Students must complete 180 credits over the three years.
- Elective modules are on offer in Years 2 and 3.

### BSc (Honours)

MSc (Taught)	PhD	Industry	Conversion courses
A range of Taught MSc programmes is available depending on the subject you specialise in. Examples include:	Students can pursue a PhD in universities in Ireland or abroad. UCD Science graduates have completed PhDs at MIT, Oxford University, Stanford University and Cornell University.	Pharmaceuticals, Biotechnology & Hospitals Environmental Consultancies Conservation & Wildlife Water Utility, Mining & Energy Business & Finance	Postgraduate Diploma in Education (PGDE) Graduate Veterinary Medicine Graduate Medicine Master of Business Administration
MSc (Biotechnology and Business)			
MSc (NanoBio Science)			
MSc (Mathematical Science)		Agriculture, Forestry & Fishing	
MSc Applied Science (Environmental Science)		State Agencies – Forensic Science Laboratory and Met Éireann	

**Biochemistry & Molecular Biology:** Develop practical skills in protein and DNA isolation and analysis; molecular biology techniques used in the pharmaceutical and biotechnology industries; and clinical tests such as immunoassays used in hospital laboratories.

## DN200 BBB



Undergraduate practical in the UCD Conway Institute.

\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Biochemistry & Molecular Biology.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Biochemistry & Molecular Biology. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample pathway for a degree in Biochemistry & Molecular Biology DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### BIOLOGY

Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### BIOCHEMISTRY & MOLECULAR BIOLOGY

Topics include:

- Principles of Biochemistry
- Molecular Genetics and Biotechnology
- Biomolecular Laboratory Skills
- Metabolic and Immune Systems
- Chemistry for Biologists

#### MICROBIOLOGY

Topics include:

- Principles of Microbiology

#### PHARMACOLOGY

Topics include:

- Biomedical Science of Drugs

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### BIOCHEMISTRY & MOLECULAR BIOLOGY – Topics include:

- Metabolism and Disease
- Biochemist's Toolkit
- Advanced Cell Biology
- Cell Signalling

- Regulation of Gene Expression
- Molecular Basis of Disease
- Proteins and Enzymes
- Genomics and Proteomics

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### BIOCHEMISTRY & MOLECULAR BIOLOGY – Topics include:

- Biological NMR
- Advanced Neurochemistry
- Advanced Cell Signalling

- Biochemical Research Strategies
- Biochemistry Research Project
- Protein Structure & Analysis

- Three optional modules on topics such as cancer, genetics, microbiology and pharmacology

## BSc (Honours) Biochemistry & Molecular Biology

#### MSc (Taught)

- MSc Biotechnology
- MSc Biotechnology and Business
- MSc Imaging and Microscopy
- MSc Molecular Medicine

#### Phd

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as medical research, drug development and biomedical science

#### Industry

- Pharmaceutical Companies
- Food sector
- Biotechnology sector
- Chemical Industries

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

# Cell & Molecular Biology: Learn why healthy cells become cancerous, what happens at a cellular level in diseases and the basic concept of genetics. Develop practical skills in microscopy, cellular assays and diagnostic techniques used in industry, hospitals and research labs.

## Sample pathway for a degree in Cell & Molecular Biology DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### BIOLOGY

Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

#### CHEMISTRY

Topics include:

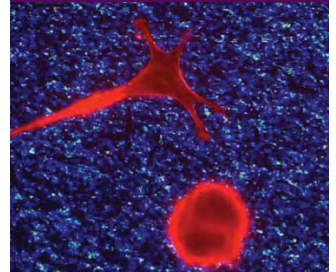
- The Basis of Organic and Biological Chemistry

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project



Advanced biological approaches now allow us to look at how human cells interact with novel biomaterial surfaces at a molecular level. This is an integrated view of cell-biomaterial interaction. Image by Professor William Gallagher © UCD

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### CELL & MOLECULAR BIOLOGY

Topics include:

- Biological Systems
- Principles of Cell Biology
- Techniques in Cell Biology
- Chemistry for Biologists

#### MICROBIOLOGY

Topics include:

- Metabolic and Immune Systems
- Molecular Genetics and Biotechnology
- Biomolecular Laboratory Skills
- Principles of Microbiology

#### GENETICS

Topics include:

- Biological Systems
- Plant & Animal Genetics
- Molecular Genetics and Biotechnology
- Biomolecular Lab Skills

- Two Elective modules

\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Cell & Molecular Biology.

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### CELL & MOLECULAR BIOLOGY – Topics include:

- Advanced Cell Biology
- Research Methods in Cell Biology
- Genetics

- Regulation of Gene Expression
- Animal Development
- Plant Cell Growth and Signalling

- Molecular Basis of Disease
- Scientific Writing & Review

- Two Elective modules

The workload is equal to 60 credits for all subject combinations.

YEAR 4

### REFINE YOUR KNOWLEDGE

#### CELL & MOLECULAR BIOLOGY – Topics include:

- Membrane Trafficking
- Programmed Cell Death
- Cell Signalling

- Epithelial Transport
- Epigenetics
- Advanced Biological Imaging

- Cellular Architecture
- Core Skills for Research
- Research Project

### BSc (Honours) Cell & Molecular Biology

#### MSc (Taught)

- MSc Imaging and Microscopy
- MSc Molecular Medicine
- MSc Biotechnology
- MSc Biotechnology with Business
- MSc Plant Biology – Future Crops

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as cell & molecular biology, biochemistry, genetics, systems biology and biomolecular science

#### Industry

- Pharmaceutical and Biotechnology companies
- Semi-state bodies such as BIM, Teagasc
- Hospital laboratories
- Genetic Counselling
- Forensic Science

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

■ This is a sample pathway for a student interested in Cell & Molecular Biology. It represents some of the topics available for students to study.

■ In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.

■ In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

Potential combinations shown here are examples only and are not guaranteed by UCD.

**Environmental Biology:** Learn how environmental biology is central to our ability to understand and manage the world's environmental problems. Develop practical skills in field-based sampling of plants and animals in their natural environments in Ireland and Spain.

## DN200 BBB



Studying reptiles on a field trip to southern Spain. Image by Dr Tasman Crowe © UCD

\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Environmental Biology.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Environmental Biology. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits).

## Sample pathway for a degree in Environmental Biology DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### BIOLOGY

Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### ENVIRONMENTAL BIOLOGY

Topics include:

- Chemistry for Biologists
- Biological Systems
- Ecology: Populations
- Microbial Interactions
- Soil Science Basics
- Microbes and Man
- Animal Behaviour
- Plant and Animal Genetics
- Plant and Algal Biology

#### ZOOLOGY

Topics include:

- Animal Form and Function

#### PLANT BIOLOGY

Topics include:

- Plant Biotechnology

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### ENVIRONMENTAL BIOLOGY – Topics include:

- Systems Ecology
- Scientific Writing & Review
- Diversity of Plant Form & Function
- Diversity of Invertebrates

- Ecology & Environmental Microbiology
- Wildlife and Fisheries

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### ENVIRONMENTAL BIOLOGY – Topics include:

- Core Skills for Research
- Research Project
- Marine Community Ecology
- Bioassessment of Freshwaters

- Marine Population Biology
- Agri-Environmental Issues and Policy
- Plant Atmosphere

- Climate Interactions
- Biodiversity
- Foodborne Pathogens
- Environmental Impact Assessment

### BSc (Honours) Environmental Biology

#### MSc (Taught)

- MSc Applied Science (Environmental Science)
- MSc Evolutionary Biology
- MSc Imaging and Microscopy
- MSc World Heritage Management

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas such as ecology, microbiology, fisheries, conservation biology, environmental management and global change

#### Industry

- National Parks and Wildlife Services
- Environmental Management with state agencies, companies or consultancies
- Semi-state bodies such as the EPA and BIM and NGOs such as An Taisce
- Conservation Organisations
- Agriculture and Aquaculture

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

Potential combinations shown here are examples only and are not guaranteed by UCD.



**Genetics:** Explore molecular genetics and molecular biology, which are core components of modern biology and medicine, and form the basis of biotechnology.

### Sample pathway for a degree in Genetics

#### DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR 1

#### ENGAGE WITH THE PRINCIPLES

##### BIOLOGY

Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

##### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry

##### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR 2

#### CHOOSE YOUR SUBJECTS \*

##### GENETICS

Topics include:

- Chemistry for Biologists
- Molecular Genetics and Biotechnology
- Plant and Animal Genetics
- Metabolic and Immune Systems
- Biomolecular Laboratory Skills

##### MICROBIOLOGY

Topics include:

- Principles of Microbiology: Medicine, Environment and Biotechnology

##### ZOOLOGY

Topics include:

- Biological Systems
- Animal Form and Function

- Two Elective modules

YEAR 3

#### FOCUS ON YOUR CHOSEN SUBJECT

**GENETICS** – Topics include:

- Regulation of Gene Expression
- Bioinformatics
- Genome Structure
- Genetics

- Animal Development
- Genomics & Proteomics
- Genetic Basis of Disease
- Evolutionary Biology

- Two Elective modules

YEAR 4

#### REFINE YOUR KNOWLEDGE

**GENETICS** – Topics include:

- Epigenetics
- Genetics Disease & Behaviour

- Gene Regulation
- Systems Microbiology

- Model Organism Genetics
- Genetics Research Project

#### BSc (Honours) Genetics

##### MSc (Taught)

- MSc Biotechnology
- MSc Biotechnology and Business
- MSc Evolutionary Biology

##### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as biotechnology, cell biology, biomedical and health science and bioinformatics

##### Industry

- Biotechnology, pharmaceutical, and genomics companies
- Hospital labs
- Forensic Science labs
- Agribiotech and horticulture

##### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

## DN200 BBB



These are transgenic zebrafish larvae (5 days old, 3mm long) that express green fluorescent protein in all their blood vessels. The zebrafish is our animal model to study retinal development and disease. Image by Dr Yolanda Alvarez © UCD

\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Genetics.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Genetics. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits).

**Microbiology:** Learn about microbes that cause diseases, clean up environmental spills and produce antibiotics. Understand how we engineer fungi and bacteria to produce a vast array of compounds, ranging from antibiotics and hormones to washing powder.

## DN200 BBB



Conor Brennan and Fay Dalton in an undergraduate Microbiology lab investigating the IMViC test used in water and food analysis. Image by Ms Ciara O'Hanlon © UCD

\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Microbiology.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Microbiology. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample pathway for a degree in Microbiology DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### BIOLOGY

Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### MICROBIOLOGY

Topics include:

- Chemistry for Biologists
- Molecular Genetics and Biotechnology
- Biomolecular Laboratory Skills
- Metabolic and Immune Systems
- Principles of Microbiology: Medicine, Environment and Biotechnology

#### CELL & MOLECULAR BIOLOGY

Topics include:

- Biological Systems
- Cell and Molecular Biology - Principles

#### GENETICS

Topics include:

- Plant & Animal Genetics

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### MICROBIOLOGY – Topics include:

- Regulation of Gene Expression
- Microbial Cell Factory
- Applied Microbiology
- Microbial Diversity & Growth
- Microbial Physiology

- Medical Microbiology
- Skills in Microbiology
- Ecology & Environmental Microbiology

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### MICROBIOLOGY – Topics include:

- Ecological & Environmental Microbiology
- Systems Microbiology
- Foodborne Pathogens

- Microbial Pathogenicity
- Enzyme Technology & Protein Engineering
- Microbiology Research Project

- Bioprocessing
- Natural Product Synthesis
- Host Defense Mech. In Health

### BSc (Honours) Microbiology

#### MSc (Taught)

- MSc Biotechnology
- MSc Biotechnology and Business
- MSc Environmental Management
- MSc Toxicology

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as Biotechnology, Environmental Biology, Medical and Veterinary Sciences

#### Industry

- Pharmaceutical Companies
- Food and food-related companies
- (Veterinary) Hospital and related laboratories
- Government agencies including EPA and county councils

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Medical Scientist
- Master of Business Administration

Potential combinations shown here are examples only and are not guaranteed by UCD.

**Neuroscience:** Learn how to employ state-of-the-art techniques to study the nervous system at the molecular, cellular and behavioural levels.

## Sample pathway for a degree in Neuroscience DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR  
1

### ENGAGE WITH THE PRINCIPLES

#### BIOLOGY

Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR  
2

### CHOOSE YOUR SUBJECTS \*

#### NEUROSCIENCE

Topics include:

- Chemistry for Biologists
- Molecular Genetics and Biotechnology
- Biomolecular Laboratory Skills
- Metabolic and Immune Systems
- Principles of Neuroscience

#### PHYSIOLOGY

Topics include:

- Introduction to Physiology
- Physiology of the Internal Environment

#### PHARMACOLOGY

Topics include:

- Biomedical Science of Drugs

#### GENETICS

Topics include:

- Plant Biotechnology

- Two Elective modules

YEAR  
3

### FOCUS ON YOUR CHOSEN SUBJECT

#### NEUROSCIENCE – Topics include:

- Cell Signalling
- Drugs used in CNS diseases
- Nervous System Development
- Membrane Biology

- Biostatistics
- Sensory Neuroscience
- Genetic Basis of Disease
- Higher Cortical Function

- Two Elective modules

YEAR  
4

### REFINE YOUR KNOWLEDGE

#### NEUROSCIENCE – Topics include:

- Synaptic Plasticity
- Advanced Topics in Neural Development
- Neuroscience Research Project

- Advanced Neuropharmacology
- Advanced Neurochemistry
- Molecular Neuroimmunology

- Genetics of Disease & Behaviour
- Synaptic Signalling
- Emerging Therapies

### BSc (Honours) Neuroscience

#### MSc (Taught)

- MSc Biotechnology
- MSc Biotechnology and Business
- MSc Imaging and Microscopy

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in Neuroscience or in areas as diverse as biotechnology, cell biology, biomedical and health science.

#### Industry

- Biotechnology companies
- Hospital laboratories
- Forensic Science laboratories
- Pharmaceutical companies

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

## DN200 BBB



This is a 3D reconstruction of a brain, illustrating the position of the key structure involved in the formation of memories. Image by Dr Darren Scully © UCD

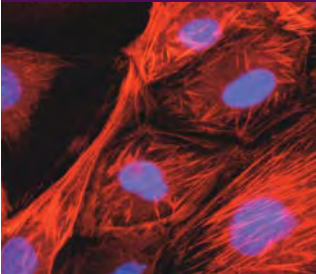
\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Neuroscience.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Neuroscience. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Biology, Chemistry, Physics and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

**Pharmacology:** Study how drugs work at a molecular level, what the body does to drugs and the effects of drugs on the different body systems. Understand the actions of drugs used in the cardiovascular, respiratory, renal endocrine and central nervous systems.

## DN200 BBB



The process of cell changes called EMT (epithelial mesenchymal transdifferentiation) that occur when kidney epithelial cells are treated with drugs. Image by Tara McMorow and Eric Campbell © UCD

\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Pharmacology.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Pharmacology. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample pathway for a degree in Pharmacology DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### BIOLOGY

Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### PHARMACOLOGY

Topics include:

- Chemistry for Biologists
- Molecular Genetics and Biotechnology
- Metabolic and Immune Systems
- Biomolecular Laboratory Skills
- Pharmacology: Biomedical Science of Drugs

#### PHYSIOLOGY

Topics include:

- Introduction to Physiology
- Physiology of the Internal Environment

#### MICROBIOLOGY

Topics include:

- Principles of Microbiology: Medicine, Environment and Biotechnology

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### PHARMACOLOGY – Topics include:

- Cell Signalling
- Biostatistics
- Drug action in body systems
- Chemotherapeutic agents

- Drugs used in CNS diseases
- Advanced CNS Pharmacology
- Toxicology
- Molecular Pharmacology

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### PHARMACOLOGY – Topics include:

- Advanced Neuropharmacology
- Adv. Cardiovascular Pharmacology
- Finding new Pharmaceuticals

- Adv. Pharmacology of Cancer
- Emerging Therapies
- Advanced Renal Pharmacology

- Gene Regulation
- Drug Discovery & Development
- Pharmacology Research Project

### BSc (Honours) Pharmacology

#### MSc (Taught)

- MSc Biotechnology
- MSc Biotechnology and Business
- MSc Imaging and Microscopy

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as drug development and biomedical science

#### Industry

- Pharmaceutical Companies
- Drug regulatory bodies such as Irish Medicines Board
- Biotechnology sector
- Chemical safety and toxicology

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

**Physiology:** Understand normal and abnormal processes within the body in health and disease. Explore various body tissues and their functions as well as an understanding of the structure and function of key biomolecules.

**Sample pathway for a degree in Physiology  
DN200 Biological, Biomedical and Biomolecular Science (BBB)**

**YEAR 1**

**ENGAGE WITH THE PRINCIPLES**

**BIOLOGY**  
*Topics include:*

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

**CHEMISTRY**  
*Topics include:*

- The Basis of Organic and Biological Chemistry

**MATHEMATICS**  
*Topics include:*

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

**YEAR 2**

**CHOOSE YOUR SUBJECTS \***

**PHYSIOLOGY**  
*Topics include:*

- Chemistry for Biologists
- Molecular Genetics and Biotechnology
- Biomolecular Laboratory Skills
- Introduction to Physiology
- Physiology of the Internal Environment
- Metabolic and Immune systems

**NEUROSCIENCE**  
*Topics include:*

- Biomolecular Laboratory Skills
- Principles of Neuroscience

**MICROBIOLOGY**  
*Topics include:*

- Principles of Microbiology: Medicine, Environment and Biotechnology

- Two Elective modules

**YEAR 3**

**FOCUS ON YOUR CHOSEN SUBJECT**

**PHYSIOLOGY – Topics include:**

- Cardiovascular System
- Biostatistics
- Experimental Physiology
- Endocrine/Reproductive Physiology

- Digestion, Absorption and Excretion
- Membrane Biology
- Higher Cortical Function
- Respiratory Physiology

- Two Elective modules

**YEAR 4**

**REFINE YOUR KNOWLEDGE**

**PHYSIOLOGY – Topics include:**

- Physiology at the Extremes
- Control of Vascular Resistance
- Physiology Research Project

- Gastrointestinal Physiology
- Biology of Oxygen
- Synaptic Signalling

- Adaptation to hypoxia
- Integrated Animal Physiology
- Synaptic Plasticity

**BSc (Honours) Physiology**

**MSc (Taught)**

- Students can pursue a Taught Masters or Research Masters in universities in Ireland or abroad in any physiological discipline or a diverse range of medical or other biological areas

**PhD**

- Students can pursue a PhD in universities in Ireland or abroad in any physiological discipline or a diverse range of medical or other biological areas

**Industry**

- Pharmaceutical Research (Laboratory)
- Clinical Research Associate
- Pharmaceutical Industry Sales

**Conversion Courses**

- Postgraduate Diploma in Education (PGDE)
- Graduate Entry Veterinary Medicine
- Graduate Entry Medicine
- Graduate Entry Physiotherapy

**DN200 BBB**



Final Year Physiology students Shona Rankin and Lyndsey Killian analysing rates of glycogen depletion as part of their research project. Image by Ms Ciara O'Hanlon © UCD.

- \* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Physiology.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Physiology. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Biology, Chemistry, Physics and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

Potential combinations shown here are examples only and are not guaranteed by UCD.

**Plant Biology:** Understand how plants are a vital component of the biosphere and are responsible for the environmental conditions essential for all life on Earth. Develop skills to study how plants and plant cells grow and develop.

## DN200 BBB



Undergraduate student Padraic Flood undertaking an experiment on maize for his final year dissertation thesis in the Programme for Experimental Atmospheres and Climate (PÉAC) lab at UCD. Photo by Peter Lang.

\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Plant Biology.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Plant Biology. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample pathway for a degree in Plant Biology DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### BIOLOGY

Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### PLANT BIOLOGY

Topics include:

- Chemistry for Biologists
- Biological Systems
- Plant Biotechnology
- Plant and Algal Biology
- Cell and Molecular Biology

#### ENVIRONMENTAL BIOLOGY

Topics include:

- Ecology: Populations
- Microbial Interactions

#### ZOOLOGY

Topics include:

- Animal Form and Function
- Animal Behaviour

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### PLANT BIOLOGY – Topics include:

- Marine Botany
- Plant Form & Function
- Plant Biotechnology
- Plant Growth & Nutrients

- Plant Cell Growth & Signalling
- Scientific Writing & Review
- Genetics
- Systems Ecology

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### PLANT BIOLOGY – Topics include:

- Core Skills
- Plant Atmosphere Climate Interactions
- Peatlands and Env. Changes

- Research Project
- Environmental Impact Assessments
- Developmental Plant Genetics

- Cell Signalling in Plants
- Plants and Stress
- Different Photosynthetic Pathways

### BSc (Honours) Plant Biology

#### MSc (Taught)

- MSc Applied Science (Environmental Science)
- MSc Evolutionary Biology
- MSc Imaging and Microscopy
- MSc World Heritage Management
- MSc in Plant Biology – Future Crops

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as climate change, marine biology or cell and molecular biology.

#### Industry

- National Parks and Wildlife Services
- State and Semi-state bodies
- Conservation Bodies
- Agriculture and Aquaculture
- Environmental Management

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science
- Graduate Veterinary Medicine

Potential combinations shown here are examples only and are not guaranteed by UCD.

**Zoology:** Learn about animals from the level of individual molecules to how animals interact with one another and their environment. Develop key practical skills in field work, behavioural observation, species identification, genetic analysis, physiology and anatomy.

## Sample pathway for a degree in Zoology DN200 Biological, Biomedical and Biomolecular Science (BBB)

YEAR  
1

### ENGAGE WITH THE PRINCIPLES

#### BIOLOGY Topics include:

- Organisms & Environment
- Diversity of Life
- Cell Biology & Genetics
- Biomedical Sciences

#### CHEMISTRY Topics include:

- The Basis of Organic and Biological Chemistry

#### MATHEMATICS Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR  
2

### CHOOSE YOUR SUBJECTS \*

#### ZOOLOGY Topics include:

- Biological Systems
- Animal Form and Function
- Chemistry for Biologists
- Animal Behaviour and Ecology
- Animal Genetics and Evolution

#### ENVIRONMENTAL BIOLOGY Topics include:

- Ecology: Populations
- Animal Behaviour

#### CELL & MOLECULAR BIOLOGY Topics include:

- Cell & Molecular Biology - Principles
- Plant and Animal Genetics

- Two Elective modules

YEAR  
3

### FOCUS ON YOUR CHOSEN SUBJECT

#### ZOOLOGY – Topics include:

- Systems Ecology
- Scientific Writing & Review
- Diversity of Vertebrates
- Evolutionary Biology

- Functional Morphology
- Arthropoda
- Diversity of Invertebrates
- Field courses in Ireland and Spain

- Two Elective modules

YEAR  
4

### REFINE YOUR KNOWLEDGE

#### ZOOLOGY – Topics include:

- Core Skills for Research
- Biological Invasions
- Epigenetics
- Research Project

- Marine Community Ecology
- Bioassessment of Freshwaters
- Biodiversity

- Molecular Phylogenetics and Evolution
- Physiology of epithelial transport

### BSc (Honours) Zoology

#### MSc (Taught)

- MSc Applied Science (Environmental Science)
- MSc Evolutionary Biology
- MSc Imaging and Microscopy
- MSc World Heritage Management

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as evolution and population biology and cell and molecular biology

#### Industry

- National Parks and Wildlife Services
- Semi-state bodies such as the ESB, BIM and Salmon Research Trust
- Conservation Bodies
- Agriculture and Aquaculture
- Environmental Management

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

## DN200 BBB



Image by Dr Eamonn Gormley © UCD 2008.

\* In Year 2, students must select a minimum of 2 subjects. If those 2 subjects are within the Biological, Biomedical, and Biomolecular group, students must then select a minimum of 3 subjects. If the 3 subjects are Neuroscience, Pharmacology and Physiology, a student must then select 4 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Zoology.

The workload is equal to 60 credits for all subject combinations.

■ This is a sample pathway for a student interested in Zoology. It represents some of the topics available for students to study.

■ In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.

■ In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

# Biology and Mathematics Education

## DN200 (BBB)



\* To teach Junior Certificate Science, students must also take modules in Chemistry and Physics. These modules can be taken in Years 1, 2 or 3.

§ At the end of Year 2, students who decide not to follow a career in teaching can pursue a degree in one of the following:

- Biochemistry and Molecular Biology
- Cell and Molecular Biology
- Environmental Biology
- Microbiology
- Plant Biology
- Zoology

The choice of degree to pursue will depend on the Biology modules students complete in Year 2.

- Students are guaranteed their subjects of choice in both Years 1 and 2.
- Elective modules are available in Year 3.
- Year 3 places are assigned on the basis of Year 2 results.
- The existing Professional Diploma in Education (PDE), formerly the HDip, will be a two-year programme from 2014.



The Teaching Council  
An Chomhairle Mhúinteoiríochta

**APPROVED  
DEGREE**

## Sample pathway to become a Biology and Mathematics teacher DN200 Biological, Biomolecular and Biomedical Sciences (BBB)

YEAR  
1

### ENGAGE WITH THE PRINCIPLES

#### EDUCATION Topics include:

- ▶ Teaching and Learning Calculus

#### BIOLOGY Topics include:

- ▶ Organisms and Environment
- ▶ Diversity of Life
- ▶ Cell Biology and Genetics

#### MATHEMATICS Topics include:

- ▶ Linear Algebra
- ▶ Calculus
- ▶ Statistical Modelling

#### \* SCIENCE

- ▶ Chemistry
- ▶ Physics
- ▶ One Small-Group Project
- ▶ Elective Module

YEAR  
2

### CHOOSE YOUR SUBJECTS §

#### EDUCATION Topics include:

- ▶ Education Issues and Ideas
- ▶ Mathematics, Science and Contemporary Education

#### BIOLOGY Topics include:

- ▶ Plant and Animal Genetics
- ▶ Ecology: Populations
- ▶ Laboratory Skills
- ▶ Molecular Genetics and Biotechnology

#### MATHEMATICS Topics include:

- ▶ Calculus of Several Variables
- ▶ Mathematical Modelling
- ▶ History of Mathematics
- ▶ Analysis

- ▶ Elective Modules

YEAR  
3

### REFINE YOUR KNOWLEDGE

#### EDUCATION Topics include:

- ▶ Mathematics Education
- ▶ Science Education

#### SCHOOL PLACEMENT

- ▶ Secondary School – Undergraduate Ambassadors Scheme
- ▶ University – Peer-Assisted Tutoring

#### BIOLOGY Topics include:

- ▶ Systems Ecology
- ▶ Functional Morphology
- ▶ Regulation of Gene Expression
- ▶ Microbiology

#### MATHEMATICS Topics include:

- ▶ Algebraic Structures
- ▶ Probability Theory
- ▶ Geometry

## BSc Mathematics and Science

YEAR  
4

### PREPARE FOR PROFESSIONAL PRACTICE

#### EDUCATION Topics include:

- ▶ Pedagogical Approaches for Effective Student Learning
- ▶ Students, Schools and Society
- ▶ Structures, Policies and Practices of Post-Primary Education in Ireland

#### SCHOOL PLACEMENT

- ▶ Year-Long Placement in Second-Level School
- ▶ Classroom Teaching
- ▶ Broad Experience of Wider School Context
- ▶ Develop a Professional Practice Portfolio

#### BIOLOGY AND MATHEMATICS Topics include:

- ▶ Biochemistry
- ▶ Proteins and Enzymes
- ▶ Differential Equations with Computer Algebra

YEAR  
5

### PREPARE FOR PROFESSIONAL PRACTICE

#### EDUCATION Topics include:

- ▶ Research Methods
- ▶ Professional Dissertation

#### SCHOOL PLACEMENT

- ▶ Year-Long Placement in Second-Level School
- ▶ To Include a Range of Both Teaching and Non-Teaching Activities
- ▶ Further Development of Professional Practice Portfolio

#### BIOLOGY AND MATHEMATICS Topics include:

- ▶ Ecological and Environmental Microbiology
- ▶ Biochemist's Toolkit
- ▶ Complex Analysis

## MSc Mathematics and Science Education

### QUALIFIED TO TEACH

Post-Primary  
School  
Teacher

Biology  
Leaving Certificate

Mathematics  
Leaving Certificate

Science  
Junior Certificate

Potential combinations shown here are examples only and are not guaranteed by UCD.



**Chemistry:** Understand the important role chemistry plays in controlling the conversion of matter into useful substances such as new materials, sensors and medicines. Develop skills in modern synthesis and analysis techniques used in the pharmaceutical and chemistry industries.

## Sample pathway for a degree in Chemistry DN200 Chemistry & Chemical Sciences (CCS)

YEAR  
1

### ENGAGE WITH THE PRINCIPLES

#### CHEMISTRY Topics include:

- The Basis of Organic and Biological Chemistry
- The Basis of Physical Chemistry
- The Molecular World

#### MATHEMATICS Topics include:

- Mathematics for the Biological & Chemical Sciences

- One Small-Group Project

- Two Elective modules

YEAR  
2

### CHOOSE YOUR SUBJECTS \*

#### CHEMISTRY Topics include:

- The Basis of Inorganic Chemistry
- Organic Chemistry
- Physical Chemistry
- Inorganic Chemistry

#### MEDICINAL CHEMISTRY & CHEMICAL BIOLOGY Topics include:

- Molecular Genetics and Biotechnology
- Principles of Biochemistry
- Med. Chem. & Chem. Bio
- Pharmacology: Biomedical Science of Drugs
- Biomolecular Laboratory Skills

- Two Elective modules

YEAR  
3

### FOCUS ON YOUR CHOSEN SUBJECT

#### CHEMISTRY – Topics include:

- Quantum Mechanics
- Carbonyl Chemistry & Synthesis
- Chemical Kinetics
- Mechanism & Stereochemistry

- Instrumental Analysis
- Organometallic & Solid State Chemistry
- Main Group Chemistry & Bonding
- Symmetry & Computational Chemistry

- Two Elective modules

YEAR  
4

### REFINE YOUR KNOWLEDGE

#### CHEMISTRY – Topics include:

- Methods in Organic Synthesis
- Chemical Thermodynamics
- Research Project

- Electrochemistry
- Reactivity & Change
- Nanochemistry

- Advanced Inorganic Chemistry
- Methods in Organic Synthesis 2
- Modern Methods of Catalysis

### BSc (Honours) Chemistry

#### PhD

Students can pursue a PhD in Ireland or abroad in areas as diverse as:

- Pharmaceutical design
- Atmospheric kinetics
- Biological aspects of nanoscience
- Energy generation
- Pollution control
- Novel material synthesis
- Polymer chemistry
- Materials analysis bio-inorganic chemistry
- Computational studies

#### Industry

Most graduates work in the pharmaceutical or chemical industries. Positions range from manufacturing chemists to quality control/analysis/assurance, research and development and raw materials/product analysis in manufacturing.

- 2nd level or 3rd level Teaching
- State Labs such as the Forensic laboratory
- ESB and Bord Gáis
- Environmental Protection Agency
- Medical device industry
- Patent law
- Healthcare industry

## DN200 CCS



Chemistry students Rory Herron and Craig Connolly during a practical involving the formation and use of cyclopentadiene. Image by Ms Ciara O'Hanlon © UCD

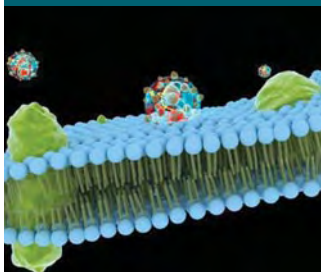
\* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Chemistry.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Chemistry. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

# Chemistry with Biophysical Chemistry: Develop theoretical and practical skills in exploiting the physical and chemical principles of the biomolecular world in modern industrial and biomedical applications.

## DN200 CCS



A nanoparticle with encapsulated active ingredient is penetrating a cell membrane. Image and copyright of Nanobotmodels Company (info@nanobotmodels.com).

\* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Chemistry with Biophysical Chemistry.

The workload is equal to 60 credits for all subject combinations.

■ This is a sample pathway for a student interested in Chemistry with Biophysical Chemistry. It represents some of the topics available for students to study.

■ In first year, students may have to take introductory modules in Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.

■ In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits).

## Sample pathway for a degree in Chemistry with Biophysical Chemistry DN200 Chemistry & Chemical Sciences (CCS)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry
- The Basis of Physical Chemistry
- The Molecular World

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

#### BIOLOGY

Topics include:

- Cell Biology & Genetics

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### CHEMISTRY WITH BIOPHYSICAL CHEMISTRY

Topics include:

- Biophysical Chemistry
- Physical Chemistry
- Inorganic Chemistry
- Organic Chemistry

#### CHEMISTRY

Topics include:

- Students who choose Chemistry with Biophysical Chemistry as their main subject for second year also cover the requirements for Chemistry.

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### CHEMISTRY WITH BIOPHYSICAL CHEMISTRY – Topics include:

- Instrumental Analysis
- Carbonyl Chemistry & Synthesis
- Quantum Mechanics
- Mechanism & Stereochemistry

- Nano-Assemblies and Interfaces
- Organometallic & Solid State Chemistry
- Main Group Chemistry & Bonding
- Symmetry & Computational Chemistry
- Optional modules in Biomolecular, Organic and Inorganic Chemistry

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### CHEMISTRY WITH BIOPHYSICAL CHEMISTRY – Topics include:

- Research Project in Bioph. Chemistry
- Metals in Biology
- Electrochemistry

- Biophysical Chemistry
- Advanced Kinetics and Thermodynamics
- Nanochemistry

- Optional modules in Biomolecular, Organic and Inorganic Chemistry

## BSc (Honours) Chemistry with Biophysical Chemistry

### PhD

- Students can pursue a PhD in Ireland or abroad in areas as diverse as:
- Pharmaceutical and biomedical biomolecular formulations design
  - Bio-processing and bio-engineering
  - Bio-nanotechnology
  - Forensic science
  - Food and agro technologies
  - Energy generation
  - Novel materials and materials analysis
  - Polymer chemistry

### Industry

- Pharmaceuticals, Biomedicals, Medical Device Industry
- Biotechnology, Food Technology, Agrochemistry
- Fine Chemical, Chemical Development
- Personal Care, Cosmetics, Environmental Protection, Paints and Coatings/ Petrochemistry
- Patenting
- Science-based Sales, Marketing, Finance

### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

Potential combinations shown here are examples only and are not guaranteed by UCD.

# Chemistry with Environmental & Sustainable Chemistry: Learn the basis of 'Green Chemistry' and what happens, at a molecular level, when chemicals interact with the environment. Discover techniques to produce energy and commodity chemicals sustainably.

## Sample pathway for a degree in Chemistry with Environmental & Sustainable Chemistry DN200 Chemistry & Chemical Sciences (CCS)

## DN200 CCS



PhD students Linda Sherry and Elaine Neville studying materials which promote the synthesis of sustainable fuels. Image by Ms Ciara O'Hanlon © UCD.

\* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Chemistry with Environmental & Sustainable Chemistry.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Chemistry with Environmental & Sustainable Chemistry. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry
- The Basis of Physical Chemistry
- The Molecular World

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- One Small-Group Project

- Two Elective modules

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### CHEMISTRY WITH ENVIRONMENTAL & SUSTAINABLE CHEMISTRY

Topics include:

- Sustainable Chemistry
- Inorganic Chemistry
- Physical Chemistry
- Organic Chemistry

#### CHEMISTRY

Topics include:

- The Basis of Inorganic Chemistry
- Organic Chemistry
- Ecology II

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### CHEMISTRY WITH ENVIRONMENTAL & SUSTAINABLE CHEMISTRY – Topics include:

- Quantum Mechanics
- Carbonyl Chemistry & Synthesis
- Self-Assembly of Biomolecules
- Environmental Chemistry
- Mechanism & Stereochemistry

- Instrumental Analysis
- Organometallic & Solid State Chemistry
- Main Group Chemistry & Bonding
- Ecology III
- Symmetry & Computational Chemistry

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### CHEMISTRY WITH ENVIRONMENTAL & SUSTAINABLE CHEMISTRY – Topics include:

- Research Project in Sus / Env Chem
- Methods in Organic Synthesis
- Chemical Thermodynamics

- Nanochemistry
- Electrochemistry
- Reactivity & Change
- Modern Methods of Catalysis

- Special topics in Env / Sus Chem
- Advanced Inorganic Chemistry
- Methods in Organic Synthesis 2

## BSc (Honours) Chemistry with Environmental & Sustainable Chemistry

Apart from the positions that a chemistry degree would qualify a student for (see below), graduates in this degree would be uniquely qualified to work in fields related to Environmental Protection (e.g., the Environmental Protection Agency), Green chemistry and Sustainable Energy generation

#### PhD

Students can pursue a PhD in Ireland or abroad in areas as diverse as:

- Pharmaceutical design
- Atmospheric kinetics
- Biological aspects of nanoscience
- Energy generation
- Pollution control
- Novel material synthesis
- Polymer chemistry
- Materials analysis bio-inorganic chemistry
- Computational studies

#### Industry

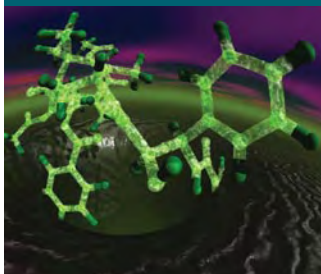
Most graduates work in the pharmaceutical or chemical industries. Positions range from manufacturing chemists to quality control/analysis/assurance, research and development and raw materials/product analysis in manufacturing.

- 2nd level or 3rd level Teaching
- State Labs such as the Forensic laboratory
- ESB and Bord Gáis
- Medical device industry
- Patent law
- Healthcare industry

Potential combinations shown here are examples only and are not guaranteed by UCD.

**Medicinal Chemistry & Chemical Biology:** Learn how to apply the tools of Chemistry to study biological systems. Develop experience in techniques and instrumentation used in the pharmaceutical industry, e.g. the synthesis, identification and analysis of chemicals.

## DN200 CCS



A model of Paclitaxel, a semi-synthetic drug which is used in cancer chemotherapy. Image by Dr Lukasz Komsta, Medical University of Lublin ©.

\* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Medicinal Chemistry & Chemical Biology.

The workload is equal to 60 credits for all subject combinations.

■ This is a sample pathway for a student interested in Medicinal Chemistry & Chemical Biology. It represents some of the topics available for students to study.

■ In first year, students may have to take introductory modules in Biology, Chemistry and Mathematics, depending on their Leaving Certificate or A Levels.

■ In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits).

## Sample Pathway for a degree in Medicinal Chemistry & Chemical Biology DN200 Chemistry & Chemical Sciences (CCS)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### CHEMISTRY

Topics include:

- The Basis of Organic and Biological Chemistry
- The Basis of Physical Chemistry
- The Basis of Inorganic Chemistry
- The Molecular World

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

#### BIOLOGY

Topics include:

- Cell Biology & Genetics

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### MEDICINAL CHEMISTRY & CHEMICAL BIOLOGY

Topics include:

- Molecular Genetics and Biotechnology
- Principals of Biochemistry
- Medicinal Chemistry & Chemical Biology
- Pharmacology: Biomedical Science of Drugs
- Biomolecular Laboratory Skills

- Organic Chemistry
- Physical Chemistry
- Inorganic Chemistry

#### CHEMISTRY

Topics include:

- Students who choose Medicinal Chemistry & Chemical Biology as their main subject for second year also cover the requirements for Chemistry.

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### MEDICINAL CHEMISTRY & CHEMICAL BIOLOGY – Topics include:

- Chemical Biology of Natural Products
- Chemical Biology of Macromolecules
- Carbonyl Chemistry & Synthesis
- Medicinal Chemistry

- Structure Determination & Heterocyclic Chemistry
- Microbial Cell Factory/Chemists
- Mechanism & Stereochemistry
- Biochemist's Toolkit

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### MEDICINAL CHEMISTRY & CHEMICAL BIOLOGY – Topics include:

- Metals in Biology
- Methods in Organic Synthesis

- Modern Methods of Catalysis
- Research Project

- Special topics in Medicinal Chemistry and Chemical Biology

## BSc (Honours) Medicinal Chemistry & Chemical Biology

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as Chemistry, Chemical Biology, Medicinal Chemistry, and Biochemistry

#### Industry

- Pharmaceuticals and Biopharmaceuticals
- Cosmetics Food Technology
- Fine Chemicals
- Chemical Development
- Patenting
- Science-based Sales, Marketing, Finance

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Veterinary Medicine
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

Potential combinations shown here are examples only and are not guaranteed by UCD.

# Chemistry and Mathematics Education

## Sample pathway to become a Chemistry and Mathematics teacher DN200 Chemistry and Chemical Sciences (CCS)

YEAR  
1

### ENGAGE WITH THE PRINCIPLES

#### EDUCATION Topics include:

- ▶ Teaching and Learning Calculus

#### CHEMISTRY Topics include:

- ▶ Introductory Chemistry
- ▶ Organic Chemistry and Chemical Biology

#### MATHEMATICS Topics include:

- ▶ Linear Algebra
- ▶ Calculus
- ▶ Statistical Modelling

#### \* SCIENCE

- ▶ Biology
- ▶ Physics
- ▶ One Small-Group Project
- ▶ Elective Module

YEAR  
2

### CHOOSE YOUR SUBJECTS §

#### EDUCATION Topics include:

- ▶ Education Issues and Ideas
- ▶ Mathematics, Science and Contemporary Education

#### CHEMISTRY Topics include:

- ▶ Physical Chemistry
- ▶ Organic Chemistry
- ▶ Inorganic Chemistry

#### MATHEMATICS Topics include:

- ▶ Calculus of Several Variables
- ▶ Mathematical Modelling
- ▶ History of Mathematics
- ▶ Analysis

- ▶ Elective Modules

YEAR  
3

### REFINE YOUR KNOWLEDGE

#### EDUCATION Topics include:

- ▶ Mathematics Education
- ▶ Science Education

#### SCHOOL PLACEMENT

- ▶ Secondary School – Undergraduate Ambassadors Scheme
- ▶ University – Peer-Assisted Tutoring

#### CHEMISTRY Topics include:

- ▶ Instrumental Analysis
- ▶ Mechanism and Stereochemistry
- ▶ Main Group Chemistry and Bonding
- ▶ Chemical Thermodynamics

#### MATHEMATICS Topics include:

- ▶ Algebraic Structures
- ▶ Probability Theory
- ▶ Geometry

## BSc Mathematics and Science

YEAR  
4

### PREPARE FOR PROFESSIONAL PRACTICE

#### EDUCATION Topics include:

- ▶ Pedagogical Approaches for Effective Student Learning
- ▶ Students, Schools and Society
- ▶ Structures, Policies and Practices of Post-Primary Education in Ireland

#### SCHOOL PLACEMENT

- ▶ Year-Long Placement in Second-Level School
- ▶ Classroom Teaching
- ▶ Broad Experience of Wider School Context
- ▶ Develop a Professional Practice Portfolio

#### CHEMISTRY AND MATHEMATICS Topics include:

- ▶ Carbonyl Chemistry and Synthesis
- ▶ Differential Equations with Computer Algebra

YEAR  
5

### PREPARE FOR PROFESSIONAL PRACTICE

#### EDUCATION Topics include:

- ▶ Research Methods
- ▶ Professional Dissertation

#### SCHOOL PLACEMENT

- ▶ Year-Long Placement in Second-Level School
- ▶ To Include a Range of Both Teaching and Non-Teaching Activities
- ▶ Further Development of Professional Practice Portfolio

#### CHEMISTRY AND MATHEMATICS Topics include:

- ▶ Organometallic and Solid State Chemistry
- ▶ Complex Analysis

## MSc Mathematics and Science Education

Post-Primary  
School  
Teacher

### QUALIFIED TO TEACH

Chemistry  
Leaving Certificate

Mathematics  
Leaving Certificate

Science  
Junior Certificate

Potential combinations shown here are examples only and are not guaranteed by UCD.

## DN200 (CCS)



\* To teach Junior Certificate Science, students must also take modules in Biology and Physics. These modules can be taken in Years 1, 2 or 3.

§ At the end of Year 2, students who decide not to follow a career in teaching can pursue a degree in Chemistry.

■ Students are guaranteed their subjects of choice in both Years 1 and 2.

■ Elective modules are available in Year 3.

■ Year 3 places are assigned on the basis of Year 2 results.

■ The existing Professional Diploma in Education (PDE), formerly the HDip, will be a two-year programme from 2014.

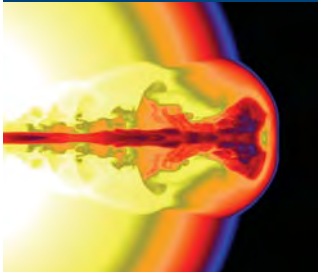


The Teaching Council  
An Chomhairle Mhúinteoireachta

APPROVED  
DEGREE

# Applied & Computational Mathematics: Discover how Applied and Computational Mathematics is fundamental in providing uniquely powerful ways to describe, analyse and advance the physical and life sciences, engineering, technology, business and finance.

## DN200 MPG



Fluid mechanics was developed in the 19th century but finds applications today in everything from astrophysics and Formula One to traffic control on the M50.

\* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Applied & Computational Mathematics.

The workload is equal to 60 credits for all subject combinations.

■ This is a sample pathway for a student interested in Applied & Computational Mathematics. It represents some of the topics available for students to study.

■ **Important Advice:** We recommend that all students in Applied and Computational Mathematics should have a minimum Grade HB3 in Leaving Certificate Higher Level Mathematics (A-Level Grade B).  
 ■ In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample Pathway for a degree in Applied & Computational Mathematics DN200 Mathematical, Physical & Geological Sciences (MPG)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### APPLIED & COMPUTATIONAL MATHEMATICS

Topics include:

- Mathematical Modelling in the Sciences
- Introduction to Applied and Computational Mathematics

#### MATHEMATICS

Topics include:

- Calculus in the Mathematical Sciences
- Mathematical Analysis
- Linear Algebra in the Mathematical Sciences

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### APPLIED & COMPUTATIONAL MATHEMATICS

Topics include:

- Computational Science
- Vector Integral and Differential Calculus
- Oscillations and Waves
- Classical Mechanics and Special Relativity

#### MATHEMATICS

Topics include:

- Linear Algebra 2
- Groups, Rings & Fields
- Calculus of Several Variables

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### APPLIED & COMPUTATIONAL MATHEMATICS – Topics include:

- Analytic Mechanics
- Dynamical Systems
- Functions of One Complex Variable
- Partial Differential Equations

- Advanced Mathematical Methods
- Foundations of Fluid Mechanics
- Foundations of Quantum Mechanics
- Advanced Computational Science

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### APPLIED & COMPUTATIONAL MATHEMATICS – Topics include:

- Differential Geometry
- General Relativity and Cosmology
- Relativistic Quantum Mechanics

- Electrodynamics and Gauge Theory
- Environmental Fluid Mechanics
- Research Project

- Stochastic Methods
- Functional Analysis

## BSc (Honours) Applied & Computational Mathematics

#### MSc (Taught)

- MSc Simulation Science
- MSc Mathematical Sciences
- MSc Meteorology and Climate

#### PhD

Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as:

- Meteorology and Climate
- Mathematical Biology
- Fluid Mechanics
- Integrable Systems
- General Relativity
- Simulation Science

#### Industry

A wide variety of career opportunities are open with new application areas discovered constantly.

- Technology areas include:
- Biology
  - Finance
  - Pharmaceuticals
  - Environment
  - Communication
  - Computing
  - Physics

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Graduate Engineering
- Masters in Management
- Masters in Computer Science

Potential combinations shown here are examples only and are not guaranteed by UCD.

# Mathematics: Master the language and concepts of modern mathematical thinking. Develop a high level of competence in its applications.

## Sample Pathway for a degree in Mathematics DN200 Mathematical, Physical & Geological Sciences (MPG)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### MATHEMATICS Topics include:

- Calculus in the Mathematical Sciences
- Numbers & Functions
- Linear Algebra in the Mathematical Sciences
- Mathematical Analysis

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### MATHEMATICS Topics include:

- Linear Algebra 2
- Calculus of Several Variables
- Groups, Rings & Fields

#### APPLIED & COMPUTATIONAL MATHEMATICS (OPTIONAL) Topics include:

- Computational Science
- Vector Integral and Differential Calculus
- Oscillations and Waves
- Classical Mechanics and Special Relativity

#### STATISTICS (OPTIONAL) Topics include:

- Probability Theory
- Stochastic Models

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### MATHEMATICS – Topics include:

- Field and Galois Theory
- Functions of One Complex Variable
- Cryptography
- Number Theory

- Metric Spaces
- Algorithms
- Set Theory
- Mathematical Logic

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### MATHEMATICS – Topics include:

- Differential Geometry
- Combinatorics

- Numerical Analysis
- Measure Theory

- Ring Theory
- Functional Analysis

### BSc (Honours) Mathematics

#### MSc (Taught)

- MSc Mathematics
- MSc in Mathematical Sciences

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad

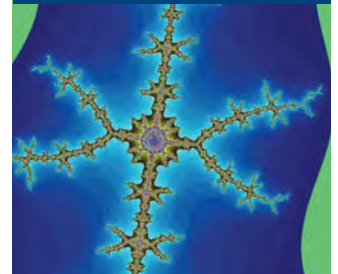
#### Industry

- Banking & Finance
- Mathematical Modelling
- Information and Communications Technology
- Actuarial Science

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Masters in Actuarial Science
- MSc in Business Analytics
- MSc in Quantitative Finance
- Masters in Computer Science

## DN200 MPG



This is an image of a fractal, a beautiful and very complex object described by a very simple equation. While often seen in art, applications are now found in medicine and seismology.

- \* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Mathematics.

The workload is equal to 60 credits for all subject combinations.

- Below is a sample pathway for a student interested in Mathematics. It represents some of the topics available for students to study.

- Important Advice:** We recommend that all students in Mathematics should have a minimum Grade HB3 in Leaving Certificate Higher Level Mathematics (A-Level Grade B).
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

**Mathematical Science:** Develop strong mathematical, problem-solving and analytical skills that are used in areas such as banking and finance, meteorology and climate research, pharmaceutical research, software design and coding and cryptography.

## DN200 MPG



Distribution of micro-organisms in a fluid flow. Aggregation of chemotactic particles (e.g., representing bacteria) that swim in the direction of increasing nutrient concentration in a chaotically moving fluid medium. (Numerical simulation.) Image by Dr Zoltan Neufeld © UCD

\* In Year 2, students must select a minimum of 2 subjects. The modules required for Applied and Computational Mathematics and Mathematics are included in the second year Mathematical Science modules.

The workload is equal to 60 credits for all subject combinations.

■ This is a sample pathway for a student interested in Mathematical Science. It represents some of the topics available for students to study.

■ **Important Advice:** We recommend that all students in Mathematical Science should have a minimum Grade HB3 in Leaving Certificate Higher Level Mathematics (A-Level Grade B).

## Sample Pathway for a degree in Mathematical Science DN200 Mathematical, Physical & Geological Sciences (MPG)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### MATHEMATICS

Topics include:

- Calculus in the Mathematical Sciences
- Linear Algebra in the Mathematical Sciences
- Mathematical Analysis
- Numbers & Functions

#### APPLIED & COMPUTATIONAL MATHEMATICS

Topics include:

- Introduction to Applied & Computational Mathematics

#### STATISTICS

Topics include:

- Introduction to Statistical Modelling
- Statistical Modelling

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### MATHEMATICAL SCIENCE

Topics include:

- Linear Algebra 2
- Calculus of Several Variables
- Groups, Rings & Fields
- Probability Theory
- Linear Models

- Vector Integral and Differential Calculus
- Computational Science
- Classical Mechanics and Special Relativity
- Inferential Statistics

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### MATHEMATICAL SCIENCE – Topics include:

- Metric Spaces
- Number Theory
- Functions of one Complex Variable
- Time Series Analysis

- Foundations of Quantum Mechanics
- Foundations of Fluid Mechanics
- Advanced Computational Science
- Dynamical Systems

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### MATHEMATICAL SCIENCE – Topics include:

- Measure and Integration
- Field and Galois Theory
- Functional Analysis

- Relativistic Quantum Mechanics
- General Relativity and Cosmology
- Environmental Fluid Mechanics

- Monte Carlo Inference
- Bayesian Analysis
- Applied Statistical Modelling

### BSc (Honours) Mathematical Science

#### MSc (Taught)

- MSc Mathematics
- MSc in Mathematical Sciences

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad

#### Industry

- Banking & Finance
- Mathematical Modelling
- Information and Communications Technology
- Actuarial Science

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Masters in Actuarial Science
- MSc in Business Analytics
- MSc in Quantitative Finance
- Masters in Computer Science



**Statistics:** Learn how statistics is used in areas as diverse as biotechnology, finance, marketing, science, medicine and even psychology.

## Sample Pathway for a degree in Statistics DN200 Mathematical, Physical & Geological Sciences (MPG)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### STATISTICS

*Topics include:*

- Introduction to Statistical Modelling
- Statistical Modelling

#### MATHEMATICS

*Topics include:*

- Calculus in the Mathematical Sciences
- Linear Algebra in the Mathematical Sciences

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### STATISTICS

*Topics include:*

- Probability Theory
- Inferential Statistics
- Linear Models

#### MATHEMATICS

*Topics include:*

- Calculus of Several Variables
- Linear Algebra 2
- Vector Integral and Differential Calculus

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### STATISTICS – *Topics include:*

- Statistical Data Mining
- Survey Sampling

- Data Structures & Algorithms
- Linear Models

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### STATISTICS – *Topics include:*

- Stochastic Models
- Design of Experiments
- Multivariate Analysis

- Time Series Analysis
- Survival Analysis
- Monte Carlo Inference

- Actuarial Statistics
- Applied Statistical Modelling
- Bayesian Analysis

### BSc (Honours) Statistics

#### MSc (Taught)

- MSc in Statistics
- MSc in Actuarial Science
- MSc Meteorology

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as Bayesian Statistics, Pharmaceutical, Medical and Educational Statistics, Epidemiology, Econometrics, Environmental and ecological modelling

#### Industry

- Pharmaceutical
- Actuarial Science
- Banking & Finance
- Insurance
- CSO

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- Higher Diploma in Actuarial Studies
- MSc in Quantitative Finance
- Masters in Computer Science

## DN200 MPG



Statistics deals with the collection, analysis and interpretation of numerical data.

- \* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Statistics.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Statistics. It represents some of the topics available for students to study.
- **Important Advice:** We recommend that all students in Statistics should have a minimum Grade HB3 in Leaving Certificate Higher Level Mathematics (A-Level Grade B).
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

**Physics:** Learn how to investigate the physical world from the outermost reaches of the universe to the innermost parts of the atom. Develop skills in how to interpret the physical world, carry out experiments and compare results critically with predictions from theory.

## DN200 MPG



Cathy Keenan, Fiona Nolan and Riona Tully measure the resistivity of metal alloy in an undergraduate Physics lab. Image by Ms Ciara O'Hanlon © UCD

\* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Physics.

The workload is equal to 60 credits for all subject combinations.

■ This is a sample pathway for a student interested in Physics. It represents some of the topics available for students to study.

■ In first year, students may have to take introductory modules in Physics, Mathematics and Applied & Computational Mathematics, depending on their Leaving Certificate or A Levels.

■ In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample pathway for a degree in Physics DN200 Mathematical, Physical & Geological Sciences (MPG)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### PHYSICS

Topics include:

- Foundations of Physics
- Frontiers of Physics
- Thermal Physics and Materials

#### MATHEMATICS

Topics include:

- Calculus in the Physical Sciences
- Linear Algebra in the Physical Sciences

#### APPLIED & COMPUTATIONAL MATHEMATICS

Topics include:

- Introduction to Applied & Computational Mathematics

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### PHYSICS

Topics include:

- Electromagnetism and Optics
- Introductory Quantum Mechanics
- Fields, Waves and Light
- Methods for Physicists

Physics students also study the following topics in Mathematics:

- Calculus of Several Variables
- Vector Integral & Differential Calculus
- Computational Science

#### PHYSICS WITH ASTRONOMY & SPACE SCIENCE

Topics include:

- Astronomy & Space Science
- Exploring the Solar System

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

PHYSICS – Topics include:

- Classical Mechanics & Relativity
- Optics & Lasers
- Electromagnetism
- Advanced Laboratory

- Thermodynamics & Statistical Physics
- Nuclear Physics
- Quantum Mechanics
- Stellar Astrophysics & Astronomical Techniques

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

PHYSICS – Topics include:

- Applied Quantum Mechanics
- Advanced Quantum Mechanics
- Applied Optics
- General Relativity & Cosmology

- High Energy Particle Physics
- Advanced Laboratory
- Computational Biophysics
- Theoretical Astrophysics

- Condensed Matter Physics
- Medical Physics
- Galaxies & Observational Cosmology

## BSc (Honours) Physics

#### MSc (Taught)

- MSc Nanobio Science
- MSc Meteorology
- MSc Research
- MSc Physics by Negotiated Learning

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as atomic physics, computational nanobio physics, particle physics, biophysics, nuclear physics, medical physics, theoretical physics and astrophysics

#### Industry

- Energy Technology Sector
- Medical Physics & Biotechnology
- Material Science & Nanotechnology
- Geoscience & Exploration
- ICT Industry
- Financial Sector
- Meteorology

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- MA in Economics
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

Potential combinations shown here are examples only and are not guaranteed by UCD.

# Physics with Astronomy & Space Science: Develop practical skills by learning how to design a satellite or make astronomical observations using a variety of telescopes.

## Sample pathway for a degree in Physics with Astronomy & Space Science DN200 Mathematical, Physical & Geological Sciences (MPG)

YEAR  
1

### ENGAGE WITH THE PRINCIPLES

#### PHYSICS

Topics include:

- Foundations of Physics
- Frontiers of Physics
- Astronomy & Space Science
- Thermal Physics and Materials

#### MATHEMATICS

Topics include:

- Calculus in the Physical Sciences
- Linear Algebra in the Physical Sciences

#### APPLIED & COMPUTATIONAL MATHEMATICS

Topics include:

- Introduction to Applied & Computational Mathematics

- Two Elective modules
- One Small-Group Project

YEAR  
2

### CHOOSE YOUR SUBJECTS \*

#### PHYSICS WITH ASTRONOMY & SPACE SCIENCE

Topics include:

- Electromagnetism and Optics
- Introductory Quantum Mechanics
- Fields, Waves and Light
- Exploring the Solar System
- Methods for Physicists

Students also study the following topics in Mathematics:

- Calculus of Several Variables
- Vector Integral & Differential Calculus
- Computational Science

#### PHYSICS

Topics include:

- Students who choose Physics with Astronomy & Space Science as their main subject for second year also cover the requirements for Physics.

- Two Elective modules

YEAR  
3

### FOCUS ON YOUR CHOSEN SUBJECT

#### PHYSICS WITH ASTRONOMY & SPACE SCIENCE – Topics include:

- Classical Mechanics & Relativity
- Stellar Astrophysics & Astronomical Techniques
- Nuclear Physics

- Astronomy & Astrophysics Lab
- Quantum Mechanics
- Thermodynamics & Statistical Physics
- Electromagnetism

- Two Elective modules

YEAR  
4

### REFINE YOUR KNOWLEDGE

#### PHYSICS WITH ASTRONOMY & SPACE SCIENCE – Topics include:

- Galaxies & Obs. Astronomy
- Space Mission Design or Astronomy Field Trip to Tenerife
- Theoretical Astrophysics
- Astronomy & Astrophysics Lab

- General Relativity & Cosmology
- Applied Quantum Mechanics
- Condensed Matter Physics
- Optics & Lasers
- Computational Biophysics

- High Energy Particle Physics
- Advanced Quantum Mechanics
- Medical Physics

## BSc (Honours) Physics with Astronomy & Space Science

#### MSc (Taught)

- MSc Nanobio Science
- MSc Meteorology
- MSc Research
- MSc Physics by Negotiated Learning

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as space science, astrophysics, atomic physics, computational nanobio physics, particle physics, biophysics, nuclear physics, medical physics and theoretical physics

#### Industry

- Space Industry
- Medical Physics & Biotechnology
- Energy Technology Sector
- Meteorology
- ICT Industry
- Financial Sector
- Geoscience & Exploration
- Material Science & Nanotechnology

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- MA in Economics
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

## DN200 MPG



Professor David Southwood, Director of the European Space Agency Science Programme, meeting some of the Physics with Astronomy & Space Science students on the School of Physics roof, in front of the student radio telescope.

- \* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Physics with Astronomy & Space Science.

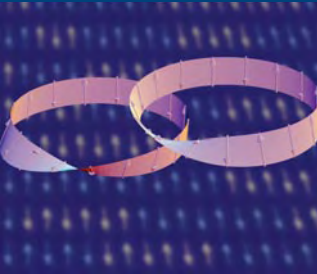
The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Physics with Astronomy & Space Science. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Physics, Mathematics and Applied & Computational Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

Potential combinations shown here are examples only and are not guaranteed by UCD.

# Theoretical Physics: Learn to understand and predict the behaviour of physical systems ranging from subatomic to astronomical scales using advanced mathematics.

## DN200 MPG



Chiral objects such as seashells, DNA and even elementary particles such as neutrinos are ubiquitous in nature, yet the origin of such chirality continues to puzzle scientists. Now physicists have revealed a mechanism that explains the origin of chirality in magnets. Image by Prof. Hans-Benjamin Braun © UCd

\* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subject students choose to combine with Theoretical Physics.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Theoretical Physics. It represents some of the topics available for students to study.
- In first year, students may have to take introductory modules in Physics, Mathematics and Applied & Computational Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample pathway for a degree in Theoretical Physics DN200 Mathematical, Physical & Geological Sciences (MPG)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### PHYSICS

Topics include:

- Foundations of Physics
- Frontiers of Physics
- Thermal Physics and Materials

#### MATHEMATICS

Topics include:

- Calculus in the Physical Sciences
- Linear Algebra in the Physical Sciences

#### APPLIED & COMPUTATIONAL MATHEMATICS

Topics include:

- Introduction to Applied & Computational Mathematics

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### THEORETICAL PHYSICS – Topics include:

- Electromagnetism and Optics
- Introductory Quantum Mechanics
- Fields, Waves and Light
- Methods for Physicists
- Calculus of Several Variables

- Oscillations and Waves
- Classical Mechanics and Special Relativity
- Vector Integral and Differential Calculus
- Computational Science

#### PHYSICS

Topics include:

- Students who choose Theoretical Physics as their main subject for second year also cover the requirements for Physics.

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### THEORETICAL PHYSICS – Topics include:

- Analytical Mechanics
- Partial Differential Equations
- Electromagnetism
- Foundations of Fluid Mechanics

- Thermodynamics & Statistical Physics
- Quantum Mechanics
- Functions of One Complex Variable
- Advanced Laboratory

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### THEORETICAL PHYSICS – Topics include:

- Applied Quantum Mechanics
- Advanced Mathematical Methods
- High Energy Particle Physics
- Environmental Fluids

- Nuclear Physics
- General Relativity & Cosmology
- Quantum Theory of Condensed Matter

- Projects in Theoretical Physics
- Computational Biophysics
- Relativistic Quantum Mechanics
- Theoretical Astrophysics

## BSc (Honours) Theoretical Physics

#### MSc (Taught)

- MSc Nanobio Science
- MSc Simulation Science
- MSc Meteorology
- MSc Research
- MSc Physics by Negotiated Learning

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as theoretical physics, atomic physics, computational nanobio physics, particle physics, biophysics, nuclear physics, medical physics and astrophysics

#### Industry

- Financial Sector
- ICT industry
- Material Science & Nanotechnology
- Medical Physics and Biotechnology
- Geoscience & Exploration
- Energy Technology Sector
- Meteorology

#### Conversion Courses

- Postgraduate Diploma in Education (PGDE)
- MA Economics
- Graduate Medicine
- Master of Business Administration
- Master in Management
- Masters in Computer Science

Potential combinations shown here are examples only and are not guaranteed by UCd.

**Geology:** Learn about the Earth, its composition, resources and the processes that shape its surface and interior, such as climate change, earthquakes and volcanoes. Develop the skills to become a geologist through field courses and projects in Ireland and abroad.

## Sample pathway for a degree in Geology DN200 Mathematical, Physical & Geological Sciences (MPG)

YEAR  
1

### ENGAGE WITH THE PRINCIPLES

#### GEOLOGY

Topics include:

- How the Earth works
- Earth science and materials
- Geological field work
- Interactions between people, the environment and geology

#### MATHEMATICS

Topics include:

- Mathematics for the Biological & Chemical Sciences

- Two Elective modules
- One Small-Group Project

YEAR  
2

### CHOOSE YOUR SUBJECTS \*

#### GEOLOGY

Topics include:

- Sedimentology & Palaeobiology
- Mineralogy & Geochemistry
- Structural Geology & Tectonics
- Field Geology
- Geophysical Methods
- Global Environmental Change

#### ENVIRONMENTAL BIOLOGY

Topics include:

- Chemistry for Biologists
- Biological Systems
- Ecology: Populations

OR

#### CHEMISTRY

Topics include:

- The Basis of Inorganic Chemistry
- Organic Chemistry
- Physical Chemistry

- Two Elective modules

YEAR  
3

### FOCUS ON YOUR CHOSEN SUBJECT

#### GEOLOGY – Topics include:

- Palaeobiology
- Geochemistry
- Earth Resources & Applied Geology
- Environmental Geochemistry
- Structural & Petroleum Geology

- Phanerozoic Stratigraphy
- Sedimentology & Volcanology
- Precambrian Geology & Geotectonics
- Igneous & Metamorphic Petrology
- Field Geology

- Two Elective modules

YEAR  
4

### REFINE YOUR KNOWLEDGE

#### GEOLOGY – Topics include:

- Basin Analysis
- Mapwork & Orogenic Belts
- Petrology & Ore Geology

- Palaeontology & Stratigraphy
- Field Work
- Field Mapping Research Project

- Palaeobiology
- Geosynthesis

### BSc (Honours) Geology

#### MSc (Taught)

- MSc in Petroleum Geoscience
- MSc in Hydrogeology\*
- MSc in Engineering Geology\*
- MSc in Environmental Geology\*
- MSc in Oceanography\*

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in areas as diverse as hydrocarbon and mineral exploration, volcanic and earthquake hazards, palaeobiology, environmental geochemistry, geophysics and climate change

#### Industry

- Resources (oil and mineral exploration and development)
- Environmental consultancy companies
- Hydrogeology and water resources
- Geological Surveys, Environmental Protection Agencies
- Engineering Geology
- Oceanography and Marine Geology

#### Conversion Courses

- Master of Business Administration
- Master in Management
- Masters in Computer Science

\*Currently offered by several UK universities

Potential combinations shown here are examples only and are not guaranteed by UCD.

## DN200 MPG



Geology students on a field class on the Isle of Portland, southern England.

\* In Year 2, students must select a minimum of 2 subjects. The Year 2 subject combinations illustrate the most popular subjects students choose to combine with Geology.

The workload is equal to 60 credits for all subject combinations.

- This is a sample pathway for a student interested in Geology. It represents some of the topics available for students to study.
- In first year, students may have to take an introductory module in Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

# Archaeology & Geology: Learn about past life, dating and interpreting past events. Investigate natural materials of interest to people. Explore the relationships between culture and the natural world.

## DN210



Undergraduate students drawing a medieval church wall. Credit: UCD School of Archaeology

- This is a sample pathway for a student interested in Archaeology & Geology. It represents some of the topics available for students to study.
- In first year, students may have to take an introductory module in Mathematics, depending on their Leaving Certificate or A Levels.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample pathway for a degree in Archaeology & Geology DN210

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### ARCHAEOLOGY

Topics include:

- How archaeologists work
- Prehistoric world archaeology
- Archaeology of the last 2,000 years
- Irish archaeology

#### GEOLOGY

Topics include:

- How the Earth works
- Earth science and materials
- Geology in the field
- Interactions between people, the environment and geology

- Two Elective modules
- One Small-Group Project

YEAR 2

### CHOOSE YOUR SUBJECTS

#### ARCHAEOLOGY & GEOLOGY – Topics include:

- Environmental archaeology
- Studying material culture
- Interpreting archaeology
- Interpreting sites and landscapes
- Archaeological fieldwork

- Geophysical methods
- Field geology
- Structural geology and tectonics
- Sedimentology and palaeobiology
- Mineralogy and geochemistry

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### ARCHAEOLOGY & GEOLOGY – Topics include:

- Irish archaeological practice today
- Key issues in world archaeology
- Geoarchaeology
- Geoarchaeology fieldwork
- Experimental archaeology

- Sedimentology and volcanology
- Environmental geochemistry
- Earth resources and applied geology
- Palaeobiology
- Structural and petroleum geology

- Two Elective modules

## BSc (Honours) Archaeology & Geology

#### MSc (Taught)

- MA in Archaeology
- MSc in World Heritage Management
- Masters courses in overseas universities in Geoarchaeology, Archaeological Science, Environmental Archaeology, Conservation Studies, Heritage and Archaeology

#### PhD

- Students can pursue a PhD in universities in Ireland or abroad in aspects of Archaeology and Geoarchaeology.

#### Industry

- Heritage sector – museums, OPW, tourism, county councils
- Archaeological consultancy companies
- Civil engineering sector – National Roads Authority, consulting companies
- Environmental sector – EPA, county councils

#### Conversion Courses

- Master of Business Administration
- Master in Management
- Postgraduate Diploma in Education (PGDE)
- Graduate Diploma in Arts or Humanities

Potential combinations shown here are examples only and are not guaranteed by UCD.

**Computer Science:** Develop skills in object-oriented programming languages such as C++ and Java, the latest Internet technologies, software engineering, mobile application development, database technology and operating systems such as Windows and Unix and Linux.

## Sample pathway for a degree in Computer Science DN201

DN201



UCD Computer Science Active Learning Lab.

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### COMPUTER SCIENCE

Topics include:

- Algorithmic Problem Solving
- Computer Programming
- Introduction to Computer Architecture

- Formal Foundations
- Computer Science in Practice
- Software Engineering Project

#### MATHEMATICS

Topics include:

- Matrix Algebra
- Foundations of Mathematics for Computer Science

- Two Elective modules

YEAR 2

### CHOOSE YOUR SUBJECTS

#### COMPUTER SCIENCE – Topics include:

- Data Structures & Algorithms
- Discrete Mathematics for Computer Science
- Software Engineering Project
- Linear Algebra
- Introductory Statistics

- Databases and Information Systems
- Digital Systems
- Introduction to Operating Systems
- Introduction to Functional Programming

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### COMPUTER SCIENCE – Topics include:

- Foundations of Computing
- Networks and Internet Systems
- Object-Oriented Programming
- Software Engineering Project

- Introduction to AI
- Program Construction
- Computer Graphics
- Processor Design

- Operating Systems

- Two Elective modules

YEAR 4

### REFINE YOUR KNOWLEDGE

#### COMPUTER SCIENCE – Topics include:

- Computer Science Project
- AI for Games and Puzzles
- Information Systems

- Machine Learning
- Data Mining
- Multimed Security & Data Hiding

- Distributed Systems
- Advances in Wireless Networking
- Compiler Construction

### BSc (Honours) Computer Science

#### MSc (Taught)

- All postgraduate courses requiring numeracy skills including (but not limited to the following):
- MSc in Computer Science (by negotiated learning)
- MSc in Advanced Software Engineering
- MSc in Digital Investigation
- MSc in Cognitive Science
- MSc in Simulation Science

#### PhD

- Many graduates pursue PhD studies in Ireland and abroad in diverse areas such as:
- Artificial Intelligence
- Software and Systems Engineering
- Networks and Distributed Systems

#### Industry

- High Tech sector
- Financial Sector
- Consultancies
- R&D
- UCD Tech Startups
- Education (Third Level)
- Postdoctoral researcher

#### Conversion Courses

- Smurfit Business School postgraduate degrees, e.g., Masters in Business Administration; Masters in Business Analytics

Potential combinations shown here are examples only and are not guaranteed by UCD.

# Actuarial & Financial Studies: Learn how actuaries understand the nature of risk and find ways to manage it. Develop the analytical skills and business knowledge necessary to design and manage programmes that control risk for the insurance and pension sectors.

## DN230



Actuaries are typically employed in the financial services sector where their role is to understand the nature of risk and find ways to manage it.

- This is a sample pathway for a student interested in Actuarial & Financial Studies. It represents some of the topics available for students to study.
- In Years 1-3, students take 10 Science modules and 2 elective modules (60 credits per year).

## Sample pathway for a degree in Actuarial & Financial Studies DN230

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### MATHEMATICS

Topics include:

- Linear Algebra & Geometry
- Numbers & Functions
- Introduction to Statistical Modelling
- Calculus for the Mathematical Sciences
- Statistical Modelling

#### COMPUTER SCIENCE

Topics include:

- Introduction to Programming

#### BUSINESS

Topics include:

- Principles of Microeconomics
- Principles of Macroeconomics
- Financial Accounting

- Two Elective modules

YEAR 2

### CHOOSE YOUR SUBJECTS

#### ACTUARIAL & FINANCIAL STUDIES

Topics include:

- Principles of Finance
- Linear Models
- Analytics Modelling

- Financial & Actuarial Mathematics
- Probability Theory
- Inferential Statistics

- Two Elective modules

YEAR 3

### FOCUS ON YOUR CHOSEN SUBJECT

#### ACTUARIAL & FINANCIAL STUDIES – Topics include:

- Advanced Corporate Finance
- Models - Stochastic Models
- Time Series Analysis

- Models - Survival
- Information Management for Actuaries
- BAFS Professional Work Placement

- One Elective module

YEAR 4

### REFINE YOUR KNOWLEDGE

#### ACTUARIAL & FINANCIAL STUDIES – Topics include:

- Actuarial Risk Management
- Actuarial Statistics

- Financial Economics
- Actuarial Mathematics

- One Elective Module
- One Option

## BAFS (Honours) Actuarial and Financial Studies

### Industry

- Insurance Actuarial Trainee in the following areas:
  - Life
  - Pensions
  - Health
  - General Insurance
- Banking or Finance
  - Business Analyst
  - Financial Analyst

### PhD

- Students can pursue a PhD in Ireland or abroad in areas as diverse as: Mathematics, Statistics and Actuarial studies

### Conversion Courses

- Master of Science in Computational Science
- Master of Science in Mathematical Sciences
- Master of Science in Mathematics
- Master of Science in Statistics

Potential combinations shown here are examples only and are not guaranteed by UCD.



# Applied Mathematics and Mathematics Education

## Sample pathway to become an Applied Mathematics and Mathematics teacher DN200 Mathematical, Physical and Geological Sciences (MPG)

YEAR 1

### ENGAGE WITH THE PRINCIPLES

#### EDUCATION Topics include:

- ▶ Teaching and Learning Calculus

#### APPLIED MATHEMATICS Topics include:

- ▶ Applied Mathematics, Methods and Applications
- ▶ Applied and Computational Mathematics

#### MATHEMATICS Topics include:

- ▶ Linear Algebra
- ▶ Numbers and Functions
- ▶ Calculus
- ▶ Mathematical Analysis
- ▶ Statistical Modelling

- ▶ One Small-Group Project
- ▶ Elective Module

YEAR 2

### CHOOSE YOUR SUBJECTS \*

#### EDUCATION Topics include:

- ▶ Education Issues and Ideas
- ▶ Mathematics, Science and Contemporary Education

#### APPLIED MATHEMATICS Topics include:

- ▶ Computational Science
- ▶ Vector, Integral and Differential Calculus
- ▶ Oscillations in Mechanical Systems
- ▶ Classical Mechanics and Special Relativity

#### MATHEMATICS Topics include:

- ▶ Calculus of Several Variables
- ▶ Groups, Rings and Fields
- ▶ Linear Algebra

- ▶ Elective Modules

YEAR 3

### REFINE YOUR KNOWLEDGE

#### EDUCATION Topics include:

- ▶ Mathematics Education
- ▶ Science Education

#### SCHOOL PLACEMENT

- ▶ Secondary School – Undergraduate Ambassadors Scheme
- ▶ University – Peer-Assisted Tutoring

#### APPLIED MATHEMATICS Topics include:

- ▶ Analytical Mechanics
- ▶ Fluid Mechanics

#### MATHEMATICS Topics include:

- ▶ Probability Theory
- ▶ Financial Maths
- ▶ Geometry
- ▶ History of Mathematics

## BSc Mathematics and Science

YEAR 4

### PREPARE FOR PROFESSIONAL PRACTICE

#### EDUCATION Topics include:

- ▶ Pedagogical Approaches for Effective Student Learning
- ▶ Students, Schools and Society
- ▶ Structures, Policies and Practices of Post-Primary Education in Ireland

#### SCHOOL PLACEMENT

- ▶ Year-Long Placement in Second-Level School
- ▶ Classroom Teaching
- ▶ Broad Experience of Wider School Context
- ▶ Develop a Professional Practice Portfolio

#### APPLIED MATHEMATICS AND MATHEMATICS Topics include:

- ▶ Mathematical Biology
- ▶ Differential Equations with Computer Algebra

YEAR 5

### PREPARE FOR PROFESSIONAL PRACTICE

#### EDUCATION Topics include:

- ▶ Research Methods
- ▶ Professional Dissertation

#### SCHOOL PLACEMENT

- ▶ Year-Long Placement in Second-Level School
- ▶ To Include a Range of Both Teaching and Non-Teaching Activities
- ▶ Further Development of Professional Practice Portfolio

#### APPLIED MATHEMATICS AND MATHEMATICS Topics include:

- ▶ Cryptography: Theory and Practice
- ▶ Complex Analysis

## MSc Mathematics and Science Education

Post-Primary School Teacher

### QUALIFIED TO TEACH

Applied Mathematics  
Leaving Certificate

Mathematics  
Leaving Certificate

Potential combinations shown here are examples only and are not guaranteed by UCD.

## DN200 (MPG)



\* At the end of Year 2, students who decide not to follow a career in teaching can pursue a degree in Mathematics or Applied and Computational Mathematics.

■ Students are guaranteed their subjects of choice in both Years 1 and 2.

■ Elective modules are available in Year 3.

■ Year 3 places are assigned on the basis of Year 2 results.

■ The existing Professional Diploma in Education (PDE), formerly the HDip, will be a two-year programme from 2014.



The Teaching Council  
An Chomhairle Mhúinteoireachta

APPROVED  
DEGREE

# Physics and Mathematics Education

## DN200 (MPG)



\* To teach Junior Certificate Science, students must also take modules in Biology and Chemistry. These modules can be taken in Years 1, 2 or 3.

§ At the end of Year 2, students who decide not to follow a career in teaching can pursue a degree in Physics or Physics with Astronomy and Space Science, depending on the Physics modules they choose in Years 1 and 2.

■ Students are guaranteed their subjects of choice in both Years 1 and 2.

■ Elective modules are available in Year 3.

■ Year 3 places are assigned on the basis of Year 2 results.

■ The existing Professional Diploma in Education (PDE), formerly the HDip, will be a two-year programme from 2014.



The Teaching Council  
An Chomhairle Mhúinteoirí

**APPROVED  
DEGREE**

## Sample pathway to become a Physics and Mathematics teacher DN200 Mathematical, Physical and Geological Sciences (MPG)

**YEAR 1**

### ENGAGE WITH THE PRINCIPLES

#### EDUCATION Topics include:

- ▶ Teaching and Learning Calculus

#### PHYSICS Topics include:

- ▶ Foundations of Physics
- ▶ Frontiers of Physics

#### MATHEMATICS Topics include:

- ▶ Linear Algebra
- ▶ Calculus
- ▶ Applied and Computational Mathematics

#### \* SCIENCE

- ▶ Biology
- ▶ Chemistry
- ▶ One Small-Group Project
- ▶ Elective Module

**YEAR 2**

### CHOOSE YOUR SUBJECTS §

#### EDUCATION Topics include:

- ▶ Education Issues and Ideas
- ▶ Mathematics, Science and Contemporary Education

#### PHYSICS Topics include:

- ▶ Quantum Mechanics
- ▶ Electromagnetism and Optics
- ▶ Fields, Waves and Light
- ▶ Methods for Physicists
- ▶ Thermal Physics

#### MATHEMATICS Topics include:

- ▶ Vector Integral and Differential Calculus
- ▶ Calculus of Several Variables
- ▶ Analysis

- ▶ Elective Modules

**YEAR 3**

### REFINE YOUR KNOWLEDGE

#### EDUCATION Topics include:

- ▶ Mathematics Education
- ▶ Science Education

#### SCHOOL PLACEMENT

- ▶ Secondary School – Undergraduate Ambassadors Scheme
- ▶ University – Peer-Assisted Tutoring

#### PHYSICS Topics include:

- ▶ Classical Mechanics and Relativity
- ▶ Quantum Mechanics
- ▶ Electromagnetism

#### MATHEMATICS Topics include:

- ▶ Algebraic Structures
- ▶ Geometry
- ▶ Probability Theory
- ▶ History of Mathematics

## BSc Mathematics and Science

**YEAR 4**

### PREPARE FOR PROFESSIONAL PRACTICE

#### EDUCATION Topics include:

- ▶ Pedagogical Approaches for Effective Student Learning
- ▶ Students, Schools and Society
- ▶ Structures, Policies and Practices of Post-Primary Education in Ireland

#### SCHOOL PLACEMENT

- ▶ Year-Long Placement in Second-Level School
- ▶ Classroom Teaching
- ▶ Broad Experience of Wider School Context
- ▶ Develop a Professional Practice Portfolio

#### PHYSICS AND MATHEMATICS Topics include:

- ▶ Particle Physics
- ▶ Differential Equations with Computer Algebra

**YEAR 5**

### PREPARE FOR PROFESSIONAL PRACTICE

#### EDUCATION Topics include:

- ▶ Research Methods
- ▶ Professional Dissertation

#### SCHOOL PLACEMENT

- ▶ Year-Long Placement in Second-Level School
- ▶ To Include a Range of Both Teaching and Non-Teaching Activities
- ▶ Further Development of Professional Practice Portfolio

#### PHYSICS AND MATHEMATICS Topics include:

- ▶ Nuclear Physics
- ▶ Complex Analysis

## MSc Mathematics and Science Education

### QUALIFIED TO TEACH

Post-Primary  
School  
Teacher

Physics  
Leaving Certificate

Mathematics  
Leaving Certificate

Science  
Junior Certificate

Potential combinations shown here are examples only and are not guaranteed by UCD.

# Careers in Science

## Planning your career with the UCD Career Development Centre

The Career Development Centre aims to provide a high quality information, advice and guidance service to University College Dublin students and recent graduates. This includes help in:

- Developing career management skills
- Job search including job vacancies, work experience and internships, job applications and interviews
- Identifying graduate study options, application and entry procedures

## Meet your future employer on campus

The Career Development Centre provides opportunities for students to network with recruiters, and many students meet their future employer at a Careers Fair or at employer presentations.

In 2010, over 100 employers attended our Careers Fairs, while others delivered recruitment presentations or skills workshops on campus and still more advertised vacancies with us. You will find details of employers presenting on campus at our events page [www.ucd.ie/careers](http://www.ucd.ie/careers). Make the most of opportunities to learn about the workplace, discover whether the jobs on offer suit you and get tips on improving your applications and how to impress at interviews and assessment centres.

## Internships

The UCD Career Development Centre organises an internship fair each year and advertises any available internships on its website at [www.ucd.ie/careers/internships](http://www.ucd.ie/careers/internships)

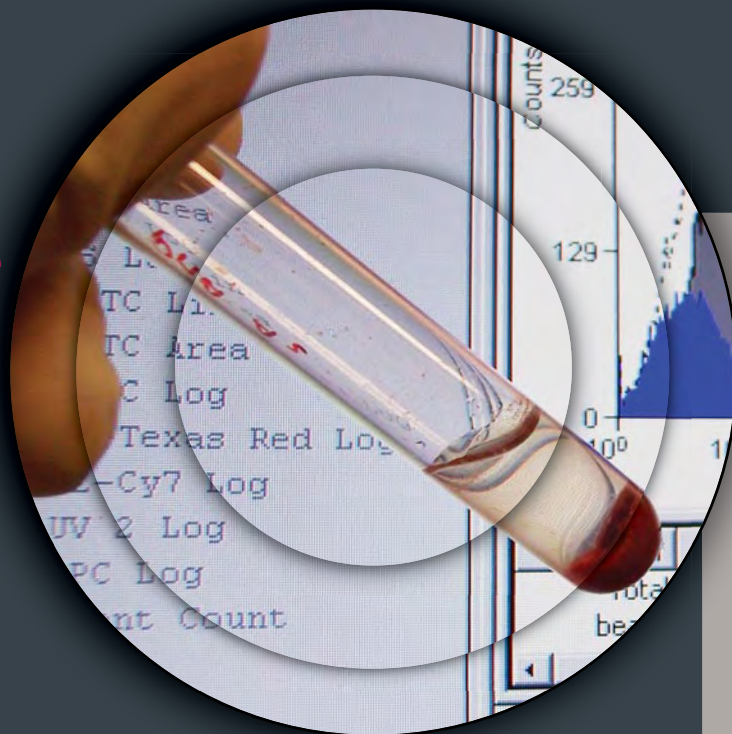
## Study Abroad Opportunities

Whether you are a UCD student thinking of studying abroad or a student thinking of coming to UCD on exchange, spending a semester or year abroad is one of the best opportunities available to you during your time as a student.

You have the chance to:

- Study at some of the best universities worldwide
- Immerse yourself in a new culture and see the world from a different perspective
- Learn a language
- Travel extensively
- Improve your career prospects.

*For more information on our study abroad opportunities, visit [www.ucd.ie/international/exchanges](http://www.ucd.ie/international/exchanges)*



## Graduate Study Opportunities

Many UCD Science graduates continue their studies to masters or doctoral degree level in one of UCD's Science Schools, Institutes and Research Centres or at universities and institutions around the world. In addition, UCD is also home to NovaUCD, the Innovation and Technology Transfer Centre. Notable successes include the development and licensing of a BSE test, which to date has generated €2 million in royalty income for UCD, and the establishment of a range of spin-off companies including Celtic Catalysts and ChangingWorlds.

## Why Graduate Studies?

There are many reasons why people choose to take a graduate degree. Graduate studies can enable you to immerse yourself in a subject you love, will help you to hone your knowledge of your chosen subject area, and allow you to develop new skills and new knowledge. Therefore, it is a tremendously rewarding experience and one which will both enrich your life and enhance your career prospects. These are some reasons people often give for pursuing a graduate programme:

- I have a passion for my subject
- I would like a graduate qualification to pursue my chosen career
- A graduate degree will make me stand out in a competitive work environment
- Salary increase

Taught degrees provide the student with a highly structured learning environment in which to study their chosen subject, whereas research degrees give students the opportunity to conduct their own research under the close supervision of their supervisor. You can also apply for a range of MSc research programmes or for a PhD.

## Putting in a little time throughout your university career can lay the groundwork for an easier time when it comes to job hunting later on.

When?	What?	How?
First/second year	Get involved at university	Join clubs, sports, societies and volunteer – try something new
	Apply for internships, research careers	Use the Career Development Centre for local, national and international opportunities
Pre-final/final year	Explore career options Know where you want to go	Use this Guide and visit our Centre. Do Prospect Planner – <a href="http://www.prospects.ac.uk">www.prospects.ac.uk</a> – or the gradireland Careers Report – <a href="http://gradireland.co.uk/careers-report">gradireland.co.uk/careers-report</a> – and use <a href="http://gradireland.com">gradireland.com</a> for local information
	Fill any gaps in your skills profile that may inhibit the success of job applications	Attend skills workshops
	Check deadlines – many jobs close as early as October	Be active at Careers Fairs: network for your future. Get as much job-related experience as possible.
Final year/graduates	Apply for jobs/submit speculative applications to target firms	Talk with a Careers Adviser; review your job applications or personal statements for graduate study
	Prepare well for recruitment/selection	Get help with CVs, applications, and covering letters
	Apply for further study or graduate training	Get help to be effective when preparing for interview
	Plan time out to travel if you want to take a year out	Continue to use the Career Development Centre online <a href="http://www.ucd.ie/careers">www.ucd.ie/careers</a> or call in Make sure a year out is accepted by your future employer/sector

## Types of Careers and Salaries

There is a diverse range of careers available to UCD Science graduates. Depending on the subject you specialise in you will learn practical skills in laboratory procedures and running equipment or in programming, database management and networking. All our Science graduates are skilled at analysing data, writing reports, solving problems and are trained to use their own initiative – all qualities that companies are looking for in employees. These skills can be transferred to businesses from biotechnology, conservation and wildlife to business, finance and forensics. Many Science graduates take entry level positions in the pharmaceutical, information technology and banking sectors. After building up their skills and work experience graduates can then progress to more senior levels within the same company or move to a different company. Table 2 illustrates the salaries for some of the positions available for Science graduates. It shows how salaries increase with an increase in work experience. For example, a Microbiology Analyst with one to three years' experience could earn €25,000 – €35,000 and with three years' plus experience could earn €35,000 – €45,000. This survey also indicates how a Science graduate can progress through their career within a company. For example, a Chemistry graduate with one to three years of experience could start out as a QA/QC Analyst earning between €28,000 and €40,000 and with experience and promotion could potentially become a Quality Manager on €50,000 – €75,000 or even a Director of Quality on a salary of €90,000 – €120,000.

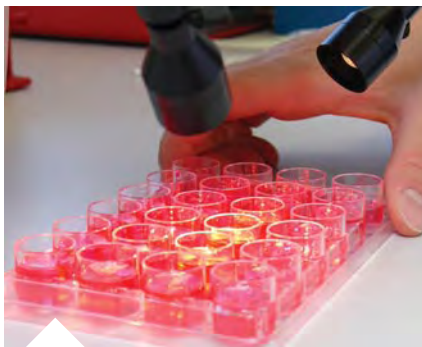
Table 2. Salary Survey 2012

Job Title	Regional €
<b>Science and Pharmaceutical</b>	
QA/QC Analyst (1-3 Years' experience)	28,000 – 40,000
QA/QC Analyst (3+ Years' experience)	40,000 – 50,000
Microbiology Analyst (1-3 years' experience)	25,000 – 35,000
Microbiology Analyst (3+ years' experience)	35,000 – 45,000
Documentation Officer	22,000 – 28,000
QA/QC Supervisor	45,000 – 60,000
Quality Manager	50,000 – 75,000
Director of Quality	90,000 – 120,000
Clinical Research Officer	35,000 – 45,000
Clinical Operations Manager	60,000 – 80,000
<b>Information Technology</b>	
Technical Writer/Editor	20,000 – 40,000
Software Test/QA Engineer	30,000 – 55,000
Database Administrator (Oracle/SQL Server/Sybase)	35,000 – 65,000
Multimedia/Graphical/Web Designer	22,000 – 40,000
Project Manager	55,000 – 65,000
<b>Banking and Insurance</b>	
Business Analyst	35,000 – 50,000
Pensions Actuary (Part-Qualified)	30,000 – 60,000
Pensions Actuary (Qualified)	90,000 – 130,000
Banking (graduate entry)	23,000 – 25,000

This survey was provided by Brightwater and the complete survey is available at [www.brightwater.ie](http://www.brightwater.ie)

# Careers in Science

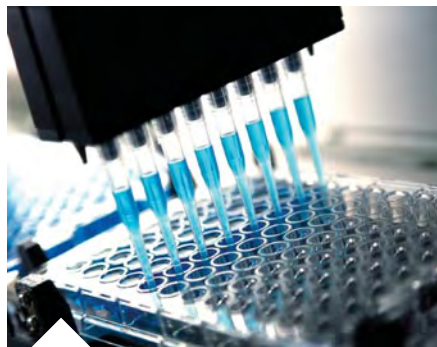
## Hospitals and Clinics



**Dr Claire Moran**  
Clinical Embryologist  
BSc (Hons) Pharmacology,  
PhD Pharmacology

After my degree in Pharmacology I did a PhD in Developmental Biology in Dr Carmel Hensey's lab in the Conway Institute. My first introduction to developmental biology was during my undergraduate fourth-year project. This project, and subsequently my thesis, was based on the development of the embryo from the time of fertilisation. The embryos we studied were from the African clawed frog, *Xenopus laevis*. Studies on these frog embryos have provided us with much of what we know about human embryo development today. After my PhD I was employed by a fertility clinic in Kilkenny and I am currently training as a clinical embryologist in their IVF laboratory. A typical day's work involves egg collections, inseminating eggs, culturing embryos, freezing embryos and embryo transfers. It's a fascinating job as you get to create human embryos every day and make people's dreams come true. It is a highly rewarding career and every day presents a new challenge. As an embryologist you are part of a medical team which includes fertility consultants, doctors and fertility nurse specialists. Embryologists are closely involved in the diagnosis of a patient's fertility problems and at each step of a patient's treatment.

## Biotechnology



**Dr Gavin Byrne**  
Production Lead with Trinity Biotech Plc  
BSc (Hons) Microbiology, PhD

Right from my introduction to Chemistry and Biology at secondary level, I knew that I would like to study Science. UCD was an easy choice to make, with a large array of disciplines to choose a speciality from, as well as its huge student population making it a true eye-opening experience. I found early on that Biology really attracted me, particularly Microbiology. I specialised in Microbiology for my third and fourth years at UCD. The emphasis on good practical demonstrations really drilled into me the core techniques I still use today, while the lectures gave me a varied background in a number of microbiological areas. I continued my study by carrying out postgraduate research on pathogenic microorganisms, which was both hugely rewarding and interesting. Throughout my years there, my lecturers and postgraduate supervisor continuously motivated and supported my studies. I chose a manufacturing route straight after my UCD years, where my solid core background has helped me progress to my current position with one of the leading players in the international diagnostic industry.

## Conservation



**Dr Catherine O'Connell**  
Chief Executive with Irish Peatland  
Conservation Council  
BSc (Hons) Botany & Zoology, PhD

I graduated from UCD with a Science degree specialising in Botany and Zoology. I followed this with a PhD study focusing on peatlands. During my time at college the Irish Peatland Conservation Council (IPCC) was set up due to concern among academics and government agencies about the destruction of peatland habitats without any conservation plan in place. As a postgraduate an opportunity arose for me to join the Committee of Management of this campaigning organisation. For many years with the organisation my initial focus was on education as I had followed my primary degree with the Higher Diploma in Education. I published over 30 educational resources focusing on peatlands, which have become recognised by the Department of Education and Skills and are widely used in primary and post-primary school education programmes. In 2004, I was promoted to Chief Executive with the IPCC and my role has been to establish a centre of excellence in peatland education, research and conservation at the Bog of Allen Nature Centre in County Kildare. I believe that a degree in Science is a wonderful foundation for any further work in nature conservation, management, environmental education and campaigning.

# Careers in Science

## Marine Research



**Dr Kenneth Whelan**  
Director, Marine Institute, Aquaculture and Catchment Management Services  
BSc (Hons) Zoology, PhD

Dr Kenneth Whelan studied Zoology in University College Dublin in the early '70s. He joined the Inland Fisheries Trust (IFT) Incorporated in 1975 and served with the IFT from 1975 to 1980. During this time he completed, through UCD, a PhD study on the biology of Irish ephemeroptera (mayflies). This research included the development of novel techniques for the restocking of these important insects. He also carried out, on behalf of Bord na Móna (the Irish Peat Board), a major environmental impact assessment on the impact of peat bog development on freshwater ecosystems in the midlands and west of Ireland. He worked for the Central Fisheries Board from 1980 to 1989, where he acted as principal adviser to the Board on salmon and sea trout stocks. His work included detailed assessments of a wide range of salmonid habitats and the compilation of policy documents on the management of salmon and sea trout stocks. He was appointed Director and CEO of the Salmon Research Agency in 1989 and served in that capacity until his appointment, in July of 1999, as an Executive Director of the Marine Institute. In this capacity he acts as adviser to the Ministers and Department of Communications, Energy and Natural Resources and Department of Agriculture, Food and the Marine on all matters relating to salmon and eel stocks.

## Pharmaceuticals



**Dr Keith Meany**  
Principal Chemist, GlaxoSmithKline R&D  
BSc (Hons) Chemistry, PhD Chemistry

I enjoyed my time at UCD as an undergraduate and a postgraduate. I chose to study for an honours degree in Chemistry with a minor in Pharmacology. For me the opportunity to focus on two key subjects related to the development of medicines was a crucial factor in choosing Science at UCD. Since obtaining my PhD I have worked for two multinational pharmaceutical companies in Ireland and in the UK, and I have been involved in various roles in production and R&D. These roles not only require a strong organic chemistry knowledge, but also a good understanding of analytical chemistry, separation science, particle science and crystal engineering, all of which were taught at UCD. Chemical biology and biotechnology are becoming very significant for the development of new medicines and UCD has diversified its courses to meet the latest demands in science and technology for industry and academia. The UCD School of Chemistry and Chemical Biology combines excellent teaching, leading researchers and world-class facilities, at the same time maintaining a friendly attitude and personalised support to its students.

## Engineering Consultancy



**Aoife McKenna**  
BSc Geology, MSc

Geology at UCD provided me with both a solid understanding of the subject and excellent practical skills. The skills acquired through the practical coursework and field trips play an important part in my everyday work in the field of contaminated land and geotechnical ground investigation. Following my BSc degree and Masters in Environment Engineering Technology with UCD's Department of Biosystems Engineering, I worked with an environmental planning consultancy in Ireland. I then relocated to the UK to work with a geo-environmental and geotechnical consultancy. I am currently enjoying living in Sydney and working with an international engineering consultancy on large-scale contaminated land remediation projects.

# Careers in Science

## Environmental Monitoring

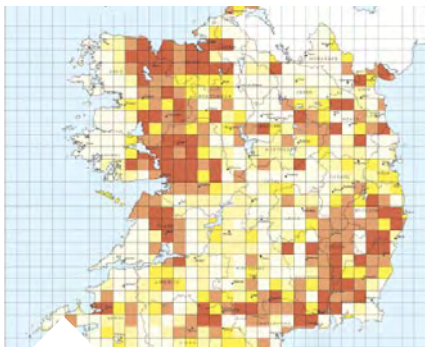


Image by Radiological Protection Institute of Ireland (RPII).

**Ms Stephanie Long**  
Senior Scientist with the Radiological Protection Institute of Ireland  
BSc (Experimental Physics), MSc (Experimental Physics)

I decided to study Physics as I enjoyed learning about how the world around us works, everything from sub-atomic particles to the big bang theory! I particularly enjoyed Environmental Physics and Nuclear Physics and combined these in my MSc research, which measured the uptake by humans of radioactive plutonium released into the environment. Following this I began work with the Radiological Protection Institute of Ireland (RPII), where I studied the impact of radioactive releases on the environment. This work included studies with Ukrainian scientists on the effects of the Chernobyl accident on food products in the Ukraine and studies of the impact of Sellafield discharges on the Irish population and marine environment. I currently work in the Radon Advice Section of the RPII. The aim of our work is to encourage home-owners and workplaces to measure radon and reduce levels of this gas when necessary. Our work includes carrying out research on the behaviour of radon in the environment, keeping up to date with international research and recommendations on radon and giving presentations to the public. We also work closely with county councils and organisations such as the Health Service Executive and the Health and Safety Authority to spread the message that radon is a serious health issue that can be easily dealt with.

## Meteorology



Cumulonimbus incus: massive thunder cloud with spreading anvil.

**Mr Keith Lambkin**  
Chief Scientist at Met Éireann's Valentia Observatory, BSc (Experimental Physics), MSc (TCD in High Performance Computers), MSc (UCD in Meteorology)

With supportive lecturers, that you would easily call friends, I quickly found that Experimental Physics was the field for me. I eagerly looked forward to getting my hands dirty in the well equipped experimental labs. After four years in UCD's explosively social campus and an MSc in High Performance Computers at Trinity College Dublin, I travelled and explored the world for 18 months. Returning to turn down a job as an advanced warhead technician, I instead joined ESB Independent Energy. Here, I learnt both business structure and project management skills before my original interest in Physics led me to Met Éireann in 2006. Following a very pleasant return to UCD for an MSc in Meteorology, I am now Chief Scientist at Met Éireann's Valentia Observatory. Among other responsibilities, I currently manage Ireland's ozone, magnetic and weather balloon programmes. Travelling the world on business is always a great bonus!

## Insurance



**Ms Elena Mcllroy De La Rosa**  
Actuary Transamerica International Reinsurance Ireland  
BAFS, FSAI, FIA

It has been a number of years since I graduated from the Bachelor of Actuarial and Financial Studies (BAFS) course at UCD and I still look back on those four years in UCD as the best days of my life. The BAFS classes at UCD are small classes of around 35 people from all over Ireland. The valuable actuarial technical knowledge, as well as some other more practical courses and the six- to eight-month work placement that is an obligatory part of third year ensured that by the time I had graduated I was in a prime position to take on the role of a Trainee Actuary at my current employer. I qualified recently as an actuary after sitting the professional exams that the UK Institute of Actuaries offers. My role is within the pricing and risk management areas and this sometimes feeds through into the valuation area. My job has proved to be extremely interesting. I work as part of a small team so I have had a very varied work experience and some extremely challenging periods whereby I was given a lot of responsibility and simultaneously learnt a lot. Working in a reinsurance company means that something different happens every day and my actuarial colleagues and I are constantly challenged by new and different concepts.

# Careers in Science

## Finance



**Ms Anne-Marie Lam**  
Financial Analyst  
BSc (Hons) Mathematics

I studied Mathematics and Mathematical Physics in UCD. I have very fond memories of my time there and I'd love to go back and relive it. After graduation I worked in technology in a bank and then I switched to working as a financial analyst. Having a Maths degree made changing careers a lot easier. Employers regard maths as a good foundation for both technology and finance. They also have high expectations of a Maths graduate from a top university like UCD. I now work in structured finance in London.

The financial products I deal with are complicated with many variables affecting their value. Staying aware of how these variables are changing can be quite challenging, but it's also my favourite part of my job. Studying Maths involves lots of problem solving and I approach tasks at work in the same way as I approached Maths problems in college – trying to find insights and logical deductions from the information provided. If I can spot a trend or a relationship that others have missed then I can really add value in my job.

## Forensic Science



**Dr Sheila Willis**  
Director of Forensic Laboratory  
BSc (Hons) Chemistry, PhD Chemistry

I can trace my interest in Science to my father's influence and encouragement from particular teachers. UCD was a very positive exciting experience for me and although I flirted with Botany for a while, Chemistry was my main interest. I was fascinated by my first exposure to organometallic chemistry at the Youth Science fortnight in London. I later carried out research in this area with Professor A.R. Manning and left UCD with a PhD in 1977 and a very keen interest in mountaineering!

After two years as Chief Chemist in Clondalkin Paper Mills, I joined the fledgling Forensic Science Laboratory where I have been privileged to progress to the Director post I now hold. Initially the wide range of analytical techniques in the laboratory attracted me but I now realise that the mix of science and real life applications with tangible outcomes suits my skills. I also enjoy the professional company of like-minded people. My career has paralleled significant developments in forensic science, which has resulted in a continuous learning experience for me. This has satisfied the interest in knowledge that first attracted me to a career in science.

## IT



**Mr Dan Lynch**  
Technical Consultant for FINEOS  
BSc (Hons) Computer Science, MSc

Studying in UCD instilled in me a sense of pride in my work. The UCD School of Computer Science and Informatics has transitioned from a small fledgling department to become a major centre for research in its field. With this drive and ambition in the academic staff, I could not help but be inspired in my studies.

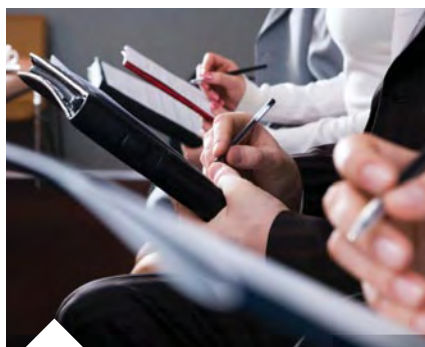
Upon completion of my primary degree I undertook a Masters by research in Computer Science, which allowed me to explore my main area of interest, information retrieval for mobile users. My college experience, both on an academic and social level, has provided me with a wealth of skills.

I now work in the software industry as a Technical Consultant for FINEOS, who are a provider of banking and insurance software. I work mainly using the Java programming language but am also required to be proficient in SQL Server, DB2 and Oracle. In my current role I am required to travel extensively to customer sites, where I represent my company, and the technical and interpersonal skills acquired over the course of my studies have proved invaluable in my career.



# Careers in Science

## Journalism



**Dr Claire O'Connell**  
Freelance Science Journalist  
BSc (Hons) Cell Biology and Molecular Genetics\*, PhD Pharmacology

\*This degree is now called Cell and Molecular Biology

Studying Science at UCD opened plenty of doors for me – and not all of them expected. I chose to study Botany along with Biochemistry and Zoology, which provided me with an excellent grounding in grander schemes like evolution and ecology as well as the more nuts-and-bolts workings of cells and genes. After my primary degree I jumped ship to Pharmacology, where I earned my doctorate looking at genes involved in cell growth, regulation and cancer. The PhD was literally a passport to the world – I went on to carry out postdoctoral research in Scotland and Australia – before returning to Ireland and waving goodbye to lab life. Next I started work as a technical writer for an e-learning company, where I honed writing skills like brevity and clarity – all the while trying to make difficult concepts engaging for readers. From there it was a sideways shimmy into journalism, a work-from-home move that dovetailed neatly with my growing family. Later I formalised the career move with a Masters in Science Communication from DCU. Sometimes people express surprise that I trained for almost a decade in science to become a journalist, but having that specialty has provided a springboard to write about a diverse range of subjects for *The Irish Times* and *The Irish Examiner*, and to research and broadcast radio programmes on RTÉ.

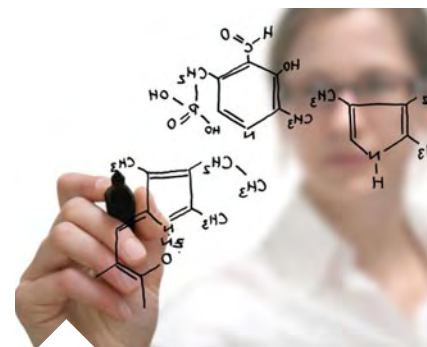
## Communications



**Mr Micéal Whelan**  
Project Manager, Communications  
BSc (Hons) Geology, MSc, MBA

I thoroughly enjoyed studying Geology at UCD. The enthusiasm of the lecturers was contagious and the practicals and field trips were always great fun. On graduating I completed an MSc in Petroleum Geology at Aberdeen University. I then joined Shell as a Petroleum Geologist. During my 10-year career, which included a period working on drilling locations, I was a member of multi-disciplinary and multi-cultural teams charged with the exploration and development of hydrocarbon fields both offshore and onshore. My last role in Shell headquarters was as part of a consultancy group whose objective was to provide global Shell companies with strategic solutions to their complex technical, operational and investment problems. I returned to Ireland in 2000 and completed an MBA in UCD's Michael Smurfit Graduate School of Business. I then joined NovaUCD, the Innovation and Technology Transfer Centre at UCD. At NovaUCD I am responsible for the development, management and execution of NovaUCD's internal and external communication strategies.

## Teaching



**Ms Fiona McKeever**  
Chemistry teacher (St Bede's Catholic Grammar School, Bradford, BD9 4BQ)  
BSc (Hons) Chemistry, PGCE

Studying Chemistry in UCD provided me with a great general understanding of science and an in-depth view of Chemistry. After completing my degree I was unsure of what direction to take, but after consultation with UCD's careers service I was advised to try substitute teaching and I haven't looked back. Through this experience I found I have the ability to engage and enthuse the students using the wonders of science. I applied to Leeds University to complete a PGCE (post graduate certificate in education), the English equivalent of the HDip/PGDE, which is accepted in many countries around the world, through the GTTR (graduate teacher training registry) online. The selection process involved a written exam and an interview with the course leader. The course involved some time based at university improving my academic knowledge of teaching and teaching skills, along with refreshing my subject expertise. When I wasn't at university I was on one of two secondary school placements or the short primary placement. The primary placement is designed to enable you as a teacher to understand the level of attainment of students as they arrive at secondary school. Unlike the traditional view of there being difficulties obtaining a job in education I found it relatively easy as science teachers are always in demand. Teaching as a career choice has changed a lot since I've been in the classroom and there are many different opportunities available both in or out of the classroom.



# UCD Science Events Calendar 2012/2013

Below is a list of UCD Science events for secondary school students during the school year 2012 – 2013. You can also visit us on Facebook at [www.facebook.com/UCDSscience](http://www.facebook.com/UCDSscience) and on Twitter at [www.twitter.com/ucdsience](http://www.twitter.com/ucdsience)



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## OCTOBER 2012

### Studying Science at UCD Talk – DN200, DN201, DN210 & DN230

Date: October 2012 – April 2013  
Venues: UCD and Schools  
Audience: 5th and 6th Year secondary school students and FETAC students.

Contact: *Dr Orla Donoghue*  
T: +353 1 716 2311  
E: [orla.donoghue@ucd.ie](mailto:orla.donoghue@ucd.ie)

The UCD Science talk will include information on degrees as well as the career opportunities for Science graduates and is designed for 5th and 6th year students only. School visits are available for a limited number of local schools from October 2012.

### National Maths Week Talks at UCD

Date: 16 October 2012  
Venue: Astra Hall – UCD Student Centre  
Time: 10:00am – 11:30am  
Audience: TY, 5th and 6th Years secondary school students

Email [science.events@ucd.ie](mailto:science.events@ucd.ie) specifying the number of places you would like to book.  
Admission: Free but pre-booking essential

1. Climate Change and Diagnosing Cancer: How Maths Rules Everything – Dr Andrew Parnell from UCD School of Mathematical Sciences
2. The Maths in Obama's Mobile Phone – Professor Gary McGuire from the UCD School of Mathematical Sciences
3. Randomness and Human Intuition – Professor Pádraig Cunningham from the UCD School of Computer Science and Informatics

### UCD Science Open Night

Date: 23 October 2012  
Venue: Global Irish Institute  
Time: 6:30pm to 8:30pm  
Audience: 6th Year students, A-Level students, FETAC applicants, mature applicants, parents and teachers.

Email [science.events@ucd.ie](mailto:science.events@ucd.ie) specifying the number of seats you would like to book.  
Admission: Free but pre-booking essential

The evening will comprise a series of talks from UCD Science graduates, a chance to meet lecturers and attend a talk by the Dean of Science on the UCD Science degrees.

## NOVEMBER 2012

### UCD Computer Science Open Night

Date: 6 November 2012  
Time: 6:30pm – 8:30pm  
Venue: UCD School of Computer Science & Informatics  
Audience: 5th and 6th Year students, A-Level students, FETAC students, mature applicants, parents and teachers

Contact: *Ms Clare Comerford*  
T: +353 1 716 2483  
E: [csi.secretary@ucd.ie](mailto:csi.secretary@ucd.ie)  
Admission: Free but pre-booking essential

Do you need language to think? How do search engines, Skype, Internet banking and computer games work? If you're interested in finding the answers and are a logical thinker who likes problem solving, a degree in Computer Science could be for you. The evening will include presentations on the UCD Computer Science degree, job opportunities for graduates and a chance to meet staff and students.



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### UCD Physics Open Night

Date: 13 November 2012  
Venue: UCD School of Physics  
Time: 6:30pm – 8:30pm  
Audience: 5th and 6th Year students, A-Level students, FETAC applicants, mature applicants, parents and teachers

Contact: *Ms Bairbre Fox*  
T: +353 1 716 2213  
E: [bairbre.a.fox@ucd.ie](mailto:bairbre.a.fox@ucd.ie)  
Admission: Free but pre-booking essential

Could life exist elsewhere in the universe? Do black holes really exist? Are there planets around stars beyond our sun? Join us at the Physics Open Evening for 5th and 6th year students and find out more about studying Physics at UCD & get careers information.



## UCD Geology Saturday Workshop

**Date:** 24 November 2012  
**Venue:** UCD School of Geological Sciences  
**Time:** 10:00am to 4:00pm  
**Audience:** 5th and 6th Year students and A-Level students

**Contact:** Ms Sarah Procter  
**T:** + 353 1 716 2331  
**E:** sarah.procter@ucd.ie  
**Admission:** By application only.  
**No fee and lunch is included.**

This is a one day workshop for Leaving Cert and A-level students. Students will learn about the wide range of careers open to geologists and geophysicists. The emphasis will be on what geologists do in their day-to-day working lives, and how the Geology BSc degree programme at UCD prepares students for careers in the Geosciences. Send an email to Sarah Procter for an application form.



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## UCD Mathematical Sciences & Actuarial and Financial Studies Open evening

**Date:** 27 November 2012  
**Venue:** Will be advertised on [www.ucd.ie/science](http://www.ucd.ie/science)  
**Time:** 6:00pm to 7:30pm  
**Audience:** 5th and 6th Year students, A-Level students, FETAC students, mature applicants, parents and teachers

**Contact:** Dr Andrew Parnell  
**T:** +353 1 716 7105  
**E:** andrew.parnell@ucd.ie  
**Admission:** Free but pre-booking is essential

The UCD School of Mathematical Sciences welcomes students, teachers and parents to an evening which will include talks in Mathematics, Statistics, Actuarial and Financial Studies and Applied and Computational Mathematics. During the evening you will have the opportunity to speak with lecturers and current students.



## DECEMBER 2012

### UCD Chemistry and Chemical Sciences Open Evening

**Date:** 4 December 2012  
**Venue:** UCD Science Centre South  
**Time:** 6:00pm – 8:00pm  
**Audience:** 5th and 6th Year students, A-Level students, FETAC students, mature applicants, parents and teachers

**Contact:** Ms Deirdre Murphy  
**E:** deirdre.murphy@ucd.ie  
**T:** +353 1 716 2165  
**Admission:** Free but pre-booking essential

Do forensic scientists use analytical chemical testing? How are medicines discovered from nature? Why are enzymes essential to life? Join us for an evening of chemistry at UCD and find out about the career opportunities for graduates in Chemistry, Chemistry with Biophysical Chemistry, Chemistry with Environmental and Sustainable Chemistry and Medicinal Chemistry and Chemical Biology.

### UCD Physics Transition Year Week

**Provisional Dates:** 3–7 December 2012  
**Venue:** UCD School of Physics  
**Time:** TBC

**Contact:** Dr Tom McCormack  
**E:** tom.mccormack@ucd.ie  
**Admission is by application only.**

This week is aimed at students who have a strong interest in pursuing a career in Science in general and Physics in particular. Visit [www.ucd.ie/physics](http://www.ucd.ie/physics) for an application form.

**For further information on the Science at UCD events  
visit [www.ucd.ie/science/events.html](http://www.ucd.ie/science/events.html)**

This calendar of events is not an official publication of the University and does not bind the University in any way. Entries are subject to change so please check the UCD Science website for updates.

## CONTACT DETAILS

UCD Science Programme Office,  
Room S1.10,  
Science Centre South,  
University College Dublin,  
Belfield,  
Dublin 4.

T: (01) 716 2375

F: (01) 716 2439

E: [science@ucd.ie](mailto:science@ucd.ie)



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The information provided in this booklet is correct at the time of going to press but degree programmes are subject to continuing development and the university reserves the right to make changes at any time, before or after a student's admission.

### Image Credits

*Top image: Bumble bee (Bombus sp) feeding on marsh thistle flower (Cirsium palustre). Mr Tim Carnus. © UCD*

*RHS image: The process of cell changes called EMT (epithelial mesenchymal transdifferentiation) that occur when kidney epithelial cells are treated with drugs. Tara McMorrow and Eric Campbell. © UCD*

*LHS image: Illustration of sub 20 femtosecond laser pulse excitation of propagating plasmonic pulses on the surface of a tailor designed periodic nanostructured surface. B. Ashall, J. Lopez-Barbera, D. Zerulla, UCD Plasmonics and Ultrafast Nanooptics Group, Physics. © UCD*