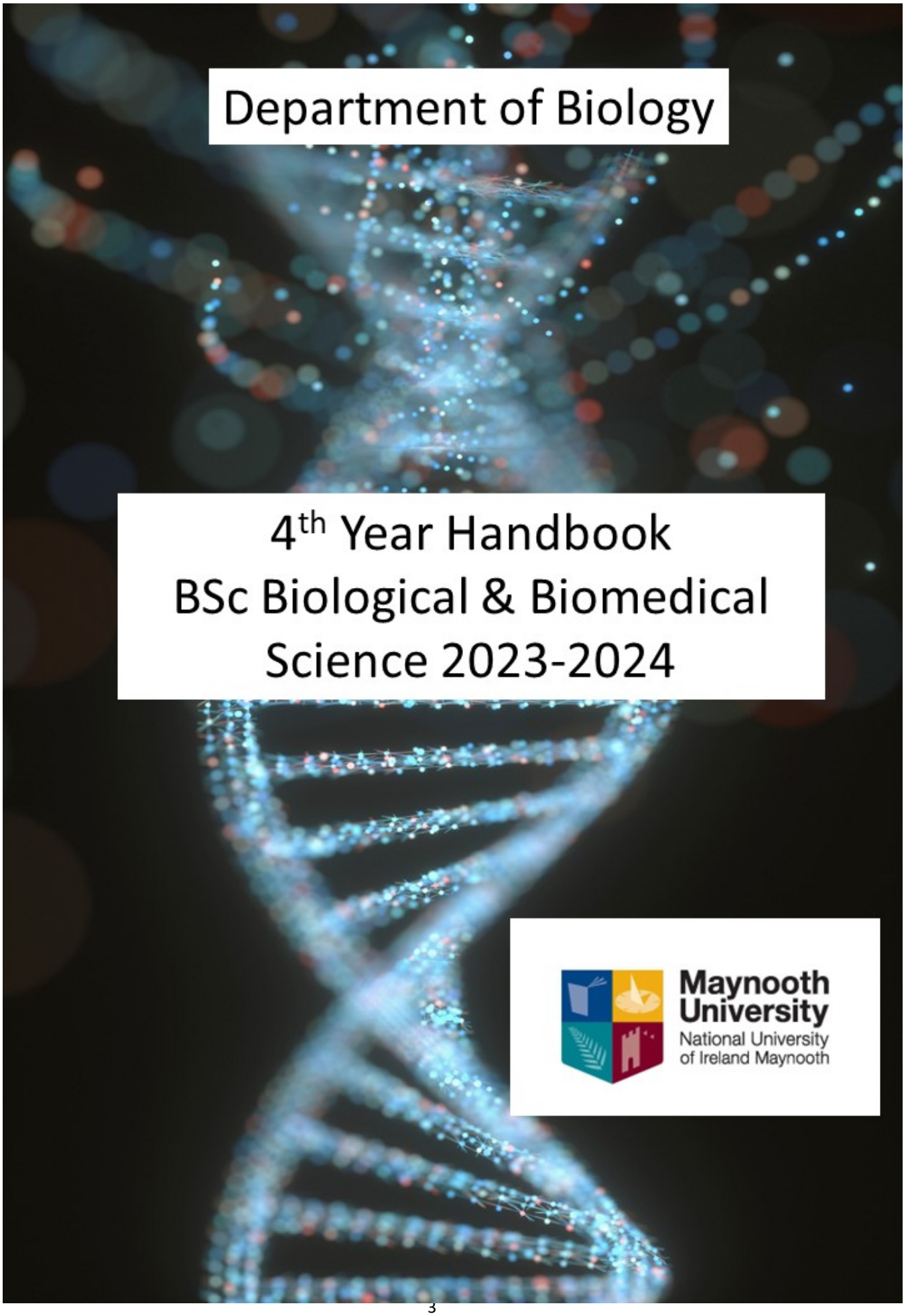
Department of Biology
4th Year Handbook
BSc Biological & Biomedical Science 2023-2024
Maynooth University
National University of Ireland Maynooth

Table of Contents

Maynooth University Biology Department:

Aims of the department

To enhance students' knowledge and understanding of important concepts in the Biological Sciences and to develop their analytical, practical and communication skills and appreciation of environmental and other bioethical issues.

Our commitment to equality, diversity, and inclusion.

The Maynooth University Biology department is committed to equality, diversity and inclusion. We are proud to have been the first department in the University to receive an externally validated Athena Swan Bronze Department Award for our work toward promoting gender equality, diversity and inclusion within the Department of Biology.

Our goals in this area include supporting and advancing women's careers in Biology, promoting work-life balance in the department and address any gender equity or diversity issues within the department. We look forward to engaging with all members (students and staff) of the department as we implement our Gender Equality Action Plan. As part of this we will continue to seek input from the student population (through surveys and focus groups) and will endeavor to keep you informed of our progress in this area.

For more information on the Department of Biology's Gender Equality Action Plan, please see https://www.maynoothuniversity.ie/biology/athena-swan or contact:

Mark Robinson (Biology Athena SWAN Committee Chair): Mark.Robinson@mu.ie
Gavin Fanning (UG Committee Member)
Louis McCabe (UG Committee Member)
Kirti Achanta (UG Committee Member)

September 2023
Biology Department Athena SWAN Committee

Information for Fourth Year Biological & Biomedical Science Students 2023 – 2024

Please read this manual carefully and keep it safely, so that you can refer to it during the year.
The Biology staff extends a warm welcome back to all Fourth Years; we hope you will enjoy your final year with us and gain valuable skills and knowledge.

Calendar 2023-2024 (see also page 58 for project deadlines)

First Semester	
Monday 25th September	Lectures commence/compulsory induction talks 2pm/ Tea & Coffee with staff (3.30-5pm)
Friday 13th October	Deadline for change of registration
Monday 30th October to Friday 3rd November	Study week
Monday 6th November	Lectures resume
Friday 22nd December	Conclusion of First Semester Lectures
Monday 25th December to Friday 5th January	Christmas Vacation
Monday 8th January to Thursday 11th January	Study Period
12th-27th January	Examination period
Second Semester	
Tuesday 6th February	Lectures commence
Monday 25th March to Friday 29th March	Study week
Monday 1st April to Friday 5th April	Easter Vacation
Monday 8th April	Lectures resume
Friday 10th May	Conclusion of Second Semester Lectures
Monday 13th to Thursday 16th May	Study Period
17th May-June	Examination period

Important notes about registration and your responsibilities.
Most final year students will have to amend their registration to reflect the allocation of projects etc after the first week of semester 1. You must make these changes to your registration within **the first THREE weeks of semester 1**. Other changes to lecture-based modules in semester two can be made in the first two weeks of semester 2.

Changes **cannot be made after these deadlines**, and if you do not amend your registration appropriately you may face allocation to modules you do not wish, or more seriously not being able to sit exams in modules you have taken.

Biology Department Staff

Teaching Staff	Phone ext*	Room	E-mail	Consultation Time
Prof. Paul Moynagh *Head of Department*	6105	B3.15	paul.moynagh@mu.ie	Monday 14.00-16.00
Dr. Özgür Bayram	6879	2.31	ozgur.bayram@mu.ie	Tuesday 11.00-13.00
Dr. Marion Butler	3856	B3.18	marion.butler@mu.ie	Monday 11.30-13.30
Dr. Jim Carolan	6367	2.29	james.carolan@mu.ie	Monday 11.00-14.00
Dr. Noreen Curran	3834	1.18	noreen.curran@mu.ie	Friday after lecture
Dr. John Devaney	7496	2.27	john.devaney@mu.ie	Wednesday 11.00 - 13.00
Dr. Tara Dirilgen	Teams	F2	tara.dirilgen@mu.ie	Thursday 14:00-16:00
Dr. Paul Dowling	6368	2.35	paul.dowling@mu.ie	Tuesday 11.00-13.00
Prof. Sean Doyle	3858	1.24**	sean.doyle@mu.ie	Tuesday 10.00-11.30
Prof. Karen English	6290	B3.17	karen.english@mu.ie	Monday 14.00-16.00
Dr. David Fitzpatrick	6844	1.26**	david.fitzpatrick@mu.ie	Monday 10.00-11.00
Dr. Emmanuelle Graciet	6255	B1.25	emmanuelle.graciet@mu.ie	Tuesday 10.00-12.00
Dr. Andy Hogan	6118	B2.16	andrew.e.hogan@mu.ie	Monday 11.00-12.00
Dr. Grace Hoysted	Teams	2.25	grace.hoysted@mu.ie	Tuesday 10.00-12.00
Prof. Kevin Kavanagh	3859	2.39	kevin.kavanagh@mu.ie	Mon & Wed 14.00–16.00
Dr. Lorna Lopez	Teams	2.36	lorna.lopez@mu.ie	Monday 10.00-11.30
Dr. Abigail Maher	6117	F6	abigail.maher@mu.ie	Tuesday 11.00-12.00
Prof. Bernard Mahon	3835	B2.15	bernard.mahon@mu.ie	Monday 09.00-11.00
Dr. Joanne Masterson	6369	B2.17	joanne.masterson@mu.ie	Monday 14.00-16.00
Dr. Eoin McNamee	6148	B2.19	eoin.n.mcnamee@mu.ie	Monday 10.00-11.30
Dr. Conor Meade	6386	2.34	conor.meade@mu.ie	Monday 12.00-13.00
Dr. Sinead Miggin	3855	B3.14	sinead.miggin@mu.ie	Tuesday 12.00-13.00
Dr. Dania Movia	Teams	F1	dania.movia@mu.ie	Friday 12.00-13.00
Dr. Jackie Nugent	3857	B1.23	jackie.nugent@mu.ie	Tuesday 10.00-12.00
Dr. Shirley O'Dea	6480	F7	shirley.odea@mu.ie	Monday 10.00-11.30
Dr. Diarmuid O'Maoileidigh	Teams	B3.08	diarmuid.s.omaoileidigh@mu.ie	Monday 10:00-12:00
Prof. Kay Ohlendieck	3842	2.33	kay.ohlendieck@mu.ie	Monday 12.00-13.00
Dr. Rebecca Owens	3839	2.30	rebecca.owens@mu.ie	Wednesday 10.00-12.00 (Sem 1)
Dr. Mark Robinson	3860	B1.21	mark.robinson@mu.ie	Wednesday 14.00-16.00
Dr. Martina Schroeder	6853	B2.18	martina.schroeder@mu.ie	Monday 10.00-11.00

*Phone prefix: **(01) 708 *except*** numbers in **red which are prefixed by (01) 474…**
**=Located on ground floor Callan Building; F=Located in Foyer, 1st floor Callan Building; B=Biosciences & Electronic Engineering Building

The times when staff are normally available for consultation are given above. Appointments for other times must be arranged with individual lecturers. Staff with Teams listed under Phone No. can be contacted via Microsoft Teams.
Administrative Offices 2.40, 2.41 open daily: 9.30am-12.30pm; 2.30-4.30pm e-mail: biology.department@mu.ie

Programme Coordinators:

OMNIBUS SCIENCE:	Dr. Jackie Nugent
BIOTECHNOLOGY:	Dr. Shirley O'Dea
SCIENCE EDUCATION:	Dr. Jackie Nugent
BIOLOGICAL & BIOMEDICAL SCIENCES:	Prof. Kevin Kavanagh
BIOLOGICAL & GEOGRAPHICAL SCIENCES:	Dr. Conor Meade
INTERNATIONAL COORDINATOR	Dr. Paul Dowling
MAP (MATURE AND ACCESS STUDENTS) ACADEMIC ADVISOR:	Dr. Joanne Masterson
POSTGRADUATE COORDINATOR:	Dr. Martina Schroeder
MSC IN IMMUNOLOGY & GLOBAL HEALTH:	Dr. Sinead Miggin

For urgent matters the Programme Coordinators and/or Head of Department may be contacted in their rooms at any time. Please contact biology.department@mu.ie to make an appointment.

4th Year Committee: The members will be Profs Bernard Mahon, Kevin Kavanagh & Jackie Nugent and 5 fourth year students elected by the MSU (1 Single Honours, 1 Double Honours student and 2 Biological & Biomedical Science Students, 1 Biology/Geography student). The committee will discuss problems and matters of interest. If you have issues which you would like to be considered, you should tell your representative.

MODULE COORDINATORS:

CODE	NAME	Coordinator	e-mail address
BI403	Plant Biotechnology	Noreen Curran	Noreen.curran@mu.ie
BI405	Advanced Immunology	Martina Schroeder	martina.schroeder@mu.ie
BI406	Behavioural Ecology	Abigail Maher	abigail.maher@mu.ie
BI407	Tumour Biology	Marion Butler	marion.butler@mu.ie
BI410	Plant Developmental Biology	Jackie Nugent	jackie.nugent@mu.ie
BI411	Bioethics & Biotechnology	Sean Doyle	sean.doyle@mu.ie
BI420	Seminar Series	Ozgur Bayram	ozgur.bayram@mu.ie
BI421	Research Methodology 1	Jim Carolan	james.carolan@mu.ie
BI423	Literature Project 1	Bernard Mahon	bernard.mahon@mu.ie
BI425	Advanced Practicals/Professional Modules1	Jim Carolan	james.carolan@mu.ie
BI433	Translational Clinical Research	Paul Dowling	paul.dowling@mu.ie
BI435	Molecular Ecology and Biogeography	Conor Meade	conor.meade@mu.ie
BI436	Medical Mycology	Kevin Kavanagh	kevin.kavanagh@mu.ie
BI437	Neuromuscular Biology	Kay Ohlendieck	kay.ohlendieck@mu.ie
BI439	Antibiotics: Discovery, Modes of Action & Resistance	Ailbhe Brazel	ailbhe.brazel@mu.ie
BI440	Control of Protein Activity	Emmanuelle Graciet	emmanuelle.graciet@mu.ie
BI441	Fungal & Bacterial Secondary Metabolism	Ozgur Bayram	ozgur.bayram@mu.ie
BI443	Clinical Proteomics: Discovery, Validation & Medical Utility	Paul Dowling	paul.dowling@mu.ie
BI444	Human Nutrition & Metabolic Disease	Andrew Hogan	andrew.e.hogan@mu.ie
BI445	Laboratory Project	Bernard Mahon	bernard.mahon@mu.ie
BI447	Sandbox research & Development Project	Bernard Mahon	bernard.mahon@mu.ie
BI448	Prior Research Project	Bernard Mahon	bernard.mahon@mu.ie

The delivery of all fourth-year modules is in-person. It is expected that all students will have access to a laptop and on occasion you will be required to have your own laptop for practical assignments and quizzes.

For information on a number of schemes to provide you with a laptop or financial assistance towards the purchase of one, please contact the Maynooth University Access Office access.office@mu.ie

You must attend the 4th year Introduction talk on **Monday 25th September 2-3pm Teaching Lab 1** where you will learn about your choices. The information below will be discussed in detail.

To obtain a degree you have to obtain 60 credits for the year. To achieve this you must take a combination of
2 Compulsory Modules (BI420 Seminar Series (5 credits)+ BI421 General methodology 1 (5 credits) +
Capstone Project (see figure 1) +
6 or 7 Lecture based modules.

Figure 1: Your year at-a-glance.

<table>
<tr><th colspan="4">Options in your 4th year (BSc Hons; Biological/Biomedical Sciences)</th></tr>
<tr><td colspan="4">BI420 Seminar series (5 credits). Compulsory</td></tr>
<tr><td colspan="4">BI421 General methodology (5 credits). Compulsory</td></tr>
<tr><th>Capstone Group 1</th><th>Capstone Group 2</th><th>Capstone Group 3</th><th>Capstone Group 4</th></tr>
<tr><td>BI423 Lit project (10 credits)
BI425 Adv Practicals & Professional modules (5)</td><td>BI445 Biomedical/ Biological Science Res. Project (15 credits)</td><td>BI448 Approved Prior Research Project (15 credits)*</td><td rowspan="2">BI447 Sandbox project (20 credits)*</td></tr>
<tr><td>Select 7 lecture modules (35 credits)</td><td>Select 7 lecture modules (35 credits)</td><td>Select 7 lecture modules (35 credits)</td><td>Select 6 lecture modules (30 credits)</td></tr>
<tr><td colspan="4">=60 credits</td></tr>
</table>

* Eligible students have been pre-approved and notified.

THE ABOVE IS DELIVERED OVER THE TWO SEMESTERS:

YOUR FIRST CHOICE: THE MH208 STREAMS IN FOURTH YEAR

DO YOU WISH TO GRADUATE WITH BSC BIOLOGICAL SCIENCES OR A BSC BIOMEDICAL SCIENCES DEGREE?.

The MH208 students coming into fourth year are required to make a further choice: whether you graduate with a BSc (Hons) in Biomedical science or with a BSc (Hons) in Biological science.

To graduate with a specific degree (either BSc Biomedical Science or BSc Biological Science) you must choose at least 35/60 credits in your final year in that area. Credits can be from lecture modules, and your capstone project (Groups 1-4, see below).

BSc (Hons) BIOMEDICAL SCIENCE

In order to graduate with a BSc (Hons) Biomedical Science degree, you must pick a minimum of five "core" lecture modules (as part of your 6 or 7 needed) from the following list in your final year:

CORE *BIOMEDICAL* LECTURE MODULES: BI405, BI407, BI411, BI418, BI433, BI436, BI437, BI439, BI443, BI444
Once you have achieved this, any remaining modules you take are an open choice subject to availability. You must select a sufficient number of modules from this list to reach 60 credits for the year.

Note some modules have limited spaces due to space etc.

BI407 is capped at 150 students.
BI437 is capped at 150 students.
BI439 is capped at 100 students.
BI440 (cap of 50) is timetabled against BI436 (cap of 150).
BI441 is timetabled against BI405 and is capped at 150 students.
BI443 is timetabled against BI406.

BSc (Hons) BIOLOGICAL SCIENCE

In order to graduate with a BSc (Hons) Biological Science degree you must pick a minimum of five "core" lecture modules (as part of your 6 or 7 needed) from the following list in your final year:
CORE *BIOLOGICAL* LECTURE MODULES: BI403, BI406, BI410, BI411, BI435, BI440, BI441

Once you have achieved this, any remaining modules you take are an open choice subject to availability. You must select enough modules from this list to reach 60 credits for the year.

Note some modules have limited places due to space etc.

BI440 (cap of 50) is timetabled against BI436 (cap of 150).
BI441 is timetabled against BI405 and is capped at 150 students.

Biological/Biomedical Sciences Courses Outline

BSc in Biological Science Or BSc in Biomedical Science: Semester 1 Outline:

Compulsory Modules

BI420 Seminar Series (5 credits)
BI421 General methodology 1 (5 credits)

Capstone Projects

Option 1. BI423 (10 credits) &BI425 (5 Credits)
Option 2. BI 445 Lab based research Project (15 credits) scheduled in either semester 1 OR 2. (note: If you select BI445, your lab project may be assigned to either Semester 1 (S1) or Semester 2 (S2). You may also need to update registration early in Semester 1. We recommend taking 3 lecture modules in the semester of your lab project) and 3 or 4 in the other semester.
Option 3. BI448 Prior research Project (15 credits)
Option 4. BI447 Sandbox project (20 credits) across both semester 1 &2.

LECTURE MODULES (5 credits each)
Select Three or Four* lecture modules from:

Module code	Module Name	Restrictions	Lecturer Initials
BI403	Plant Biotechnology	None	NC
BI444	Human Nutrition & Metabolic Disease	None	AH
BI433	Translational Clinical Research		PD
Either BI405	Advanced Immunology	Cannot be taken with BI441	MR/MS
Or BI441	Fungal & Bacterial Secondary Metabolism	Capped at 150 students cannot be taken with BI405	OB
Either BI407	Tumour Biology	Limited to 150 students, cannot be taken with BI411	MB
Or BI411	Bioethics & Biotechnology	Cannot be taken with BI407	SOD/SD

BSc in Biological Science/Biomedical Science Semester 2 Outline:

Compulsory Modules

BI420 Seminar Series (5 credits)
BI421 General methodology 1 (5 credits)

Capstone Projects

Option 1. BI423 (10 credits) &BI425 (5 Credits)
Option 2. BI 445 Lab based research Project (15 credits) scheduled in either semester 1 OR 2. (note: If you select BI445, your lab project may be assigned to either Semester 1 (S1) or Semester 2 (S2). You may need to update registration early in Semester 1. We recommend taking 3 lecture modules in the semester of your lab project) and 3 or 4 in the other semester.

Option 3 BI448 Prior research Project (15 credits)
Option 4. BI447 Sandbox project (20 credits) across both semester 1 &2.

LECTURE MODULES (5 credits each)
Select Three or Four* lecture modules from:

Module code	Module Name	Restrictions	Lecturer Initials
Either BI406	Behavioural Ecology	Cannot be taken with BI443	AM
Or BI443	Clinical Proteomics: Discovery, Validation & Medical Utility	Cannot be taken with BI406	PD
Either BI436	Medical Mycology	Limited to 150 students, cannot be taken with BI440	KK
Or BI440	Control of protein activity	Limited to 50 students, cannot be taken with BI436	EG
BI410	Plant Development	None	JN
BI418	Applied Immunology	None	JM/SM/AH/KE
BI435	Molecular Ecology & Biogeography	None	CM
BI437	Neuromuscular Biology	Limited to 150 students	KO
BI439	Antibiotics: Discovery, Modes of Action & Resistance	Limited to 100 students	AB

The selection of three or four modules depends on your requirement to achieve 60 credits overall and whether you are assigned Option 1 (BI423 Lit project with BI425 Adv practicals/Prof modules) or Option 2 BI445 Lab project (15 credits)

There are some limits (caps) on the numbers of students per module, and some modules cannot be taken together for timetable reasons and available space reasons.

Almost all 4th year students will need to amend their registration after capstone projects are assigned, and early in semester 1. You should try to achieve a balanced workload between semesters.

BIOLOGICAL/BIOMEDICAL Science-The Course in Detail

INTRODUCTORY LECTURE (compulsory):

MONDAY 25TH SEPT 2.00-3.00pm: Teaching Lab 1, followed by an opportunity to meet peers and chat with lecturers 1 to 1 about capstone projects and the courses in general, in the foyer of the Biosciences building from 3.30pm. This is a very important introduction to the year where the choices you have to make are explained to you.

Compulsory Modules BI420 and BI421

Note: There is no "resit" option for compulsory modules in the autumn exams, as these modules require full year attendance and/or demonstrating basic lab competences. Failure or incomplete performance in these modules will require you to retake the year.

BI420 Biology Research Seminar Series

The seminar series is a 5-credit module split over 2 semesters and is compulsory.

The module is composed of twelve compulsory 1-hour advanced research seminars presented in person by active researchers working in diverse areas of biology, including fungal biology, evolution/bioinformatics, immunology/cellular biology, plant biology and ecology. Speakers will be mostly from external institutions based in Ireland or abroad. Specific module content will change each year depending on the research areas of invited seminar speakers. The seminar series consists of twelve invited seminar speakers. Students taking BI420 are required to attend all twelve seminars. At the beginning of each semester, students will have the option to select a seminar on which they will be required to write a 500-word summary on the work presented at this particular seminar in each of the semesters (i.e. 2 abstracts/student will be marked for the module). In addition, the students will be required to outline three questions they would have liked to ask the speaker on the content of the seminar. The reports will be marked by the host staff member and returned to the students with comments. The final mark will be an average of the 2 assessments. Attendance/listening is compulsory for each seminar unless a medical certificate is submitted on Moodle. Final grades calculated will be proportional to the attendance of the student (minimum 10 attendance).

All seminars are planned to be in person, an attendance sheet will be signed by each student. The aim of the module is for you to develop note-taking skills during a scientific seminar. You will compose an abstract for two seminars, which will help you to reflect on, and engage with, the content of the seminar. Two mandatory tutorials (October and February) will also be organized to provide guidance and feedback on note taking, writing a summary, and common mistakes to be avoided. The abstract should be typed and submitted through Moodle by 5pm on Thursday following the seminar. The word count should not exceed 500 words. Please use the template provided at end of manual, filling out your ***name*, *student number*, *staff name*** who will grade your work and ***degree course**** at the top of your write up. Also, state the ***speaker*, *title of talk*, and *date*.** These are NOT included in your 500-word limit. The template is also available to download on the BI420 Moodle page. The first seminar is scheduled under BI421 (see table below).
There are **different arrangements for students taking their capstone project as the BI447 Sandbox project** (Option 4). As these students may be off-campus during the regular seminars, these students are exempt from the routine seminars, but will take bespoke seminars related to food biology and psychology in weeks 1 and 2 of semester 1. These seminars will prepare BI447 students for their project work and each involves a short assignment for submission and assessment. Material, information and a portal for assignments will be on the BI420 Moodle page under the topic “Sandbox students only” with a sperate cover sheet template. **BI420**

Ozgur Bayram

BI421 Research Methodology. Schedule: (10 x 1hr lectures; 11 x 120 – 180 minute practicals as below). Including first seminar of BI420

INTRODUCTORY LECTURE: MONDAY 25th SEPT 2.00-3.00pm: Teaching Lab 1
Meet the staff Tea & Coffee: **MONDAY 25th SEPT 3.30-5.00pm: Biosciences building foyer.**

DATE	TIME	PLACE	TITLE	GIVEN BY
Tues 26 Sept	1pm	TSILT2	Laboratory Safety Lecture 1*	A. Power
Tues 26 Sept	3-4 pm	JHL7	Accessing Information- Library	A. Carey
Wed 27 Sept	9am	ARTSALT	Laboratory Safety Lecture 2*	A. Power
Wed 27 Sept	2-4pm	Lab 3	Introduction to Lab Techniques	J. Nugent
Wed 27 Sept	4-6pm	Lab 3	Basic Microbiological Techniques	K. Kavanagh
Thurs 28 Sept	2-4pm	Lab 1	Basic Biochemical Techniques 1	O. Bayram
Fri 29 Sept	9am	TH1	Options with your degree (incl. introduction to career planning, postgrad study & employment)	E. Strain
Fri 29 Sept	10am	TH1	Plagiarism/Turnitin	C. Meade
Fri 29 Sept	12N-3pm	Lab 3	Microscopy & Cell Techniques	S. Miggin
Mon 2 Oct	11am-1pm	TSI239	Introduction to Excel	A. Maher
Mon 2 Oct	2-4pm	Lab 1	Molecular Biology Techniques 1	A. Brazel
Tues 3 Oct	2-5pm	Lab 1	Basic Biochemical Techniques 2	O. Bayram
Wed 4 Oct	9am	ARTSALT	GM Induction	A. Power
Wed 4 Oct	2-4pm	Lab 1	Molecular Biology Techniques 2	A. Brazel
Wed 4 Oct	4-5pm	Lab 1&3	Basic Microbiological Techs/ Intro to Lab Techniques MCQ	K. Kavanagh/ J. Nugent
Fri 6 Oct	9am	TH1	Postgraduate Studies	M.Schroeder
Fri 6 Oct	10am	TH1	How to write a Science CV**	E. Strain
Fri 6 Oct	1pm	Callan Hall	Thesis Writing	P. Moynagh
Mon 9 Oct	11am-1pm	TSI239	MINITAB 1	A. Maher
Tues 10 Oct	11am-12N	Lab 1&3	Basic Biochemical Techniques 1&2 MCQ	O. Bayram
Fri 13 Oct	*1pm*	*JHL3*	*BI420 Seminar Series Lecture 1*	*O. Bayram*
Mon 16 Oct	11am-1pm	TSI239	MINITAB 2	A. Maher
Mon 23 Oct	11am-1pm	TSI239	MINITAB 3	A. Maher
Mon 6 Nov	11am-1pm	TSI239	MINITAB MCQ	A. Maher

***Students must pass a LABORATORY SAFETY EXAM** before they can begin BI425, BI445 or BI447. This will be a Moodle based exam; arrangements for this exam will be discussed at one of the Laboratory Safety lectures above.

**There will be a CV assignment at the end of the Career Module which the department will keep on file. Academic staff may refer to this document when preparing any references you may request during the year.

Capstone research project-options

Your fourth year is a defining moment in your studies. You build on the work of your previous years. Greater emphasis is put on using knowledge and understanding, rather than a simple accumulation of information. Consequently, poor academic practices and plagiarism are treated more strictly (see below). For more advice on how to approach 4th year study and to do better in exams please watch the video posted in BI420 "How to improve your marks in 4th year" Course: BI420[A] — Seminar Series (2023-23:Year-long) (maynoothuniversity.ie)

As fourth year students you are ready to undertake a capstone research project under supervision of an active scientist from academia or industry. This forms a major part of your final year experience and mark. We describe these

in detail at the introductory lecture and how to make your choice. In addition to your choice for Biological or Biomedical Science, you have options for the type of Capstone project you will follow:
Your Capstone Project offers a choice between a literature-based research project (Group 1 BI423 with BIBI425; or a lab-based project (Group 2 BI445); an opportunity to gain credit for a significant prior research project you have performed in the last 12 months (Group 3 BI448); or a small group project (Sandbox) with scientists based in industry (Group 4 BI447).

Each option is designed to give every student a combination of research skills, and a grounding in professional development to establish a future career.
Remember: There is no "resit" option for capstone modules in the autumn exams as these modules require full year attendance and/or demonstrating basic lab competences. Failure or incomplete performance in these modules may require you to retake the year.

Capstone Group 1: BI423 Literature Project and BI425 Advanced Practicals

An independent literature-based research project covering both semesters (BI423) combined with a series of short courses in specific skills (BI425). The literature topics will be set by the academic staff of the Department (see below). Topics will collectively cover a wide range of biological disciplines, and where possible the student will have an element of choice on the subject area and need to refine the topic to a specific more focused question. Projects will be assessed based on thesis write-up (70%), planning & development (10%) and a compulsory oral presentation (20%) of the research topic. Deadlines for submission are given in the table on page 58.

Provisional titles of BI423 literature projects offered in 2023/2024

Supervisor	**Indicative Title** (Students & Supervisors agree a refined, final title early in module)
Bayram, Özgür (Fungal Genetics and Secondary Metabolism Laboratory)	Strategies to reduce mycotoxin contaminations in food and feed sources
	Degradation of man-made biopolymers by microorganisms
	The mycotoxins: growing health hazard
	Use of fungi for novel future foods
	Use of fungal enzymes in food industry
Butler, Marion (Cell Signalling Lab.)	Immune Checkpoint Inhibitors
	Sex differences in immune Responses.
	The HER family of kinases and Cancer.
	Sex differences in diseases
	The Impact of Ageing on the Immune Response.
Carolan, Jim (Applied Proteomics Lab.)	The molecular basis of pesticide resistance in insects
	eDNA and biodiversity assessment
	The functional diversity of mitochondria
Dirilgen, Tara (Terrestrial Ecology Lab.)	Linking aboveground and belowground diversity
Dowling, Paul (Clinical Proteomics Lab.)	CAR T-cell therapy in multiple myeloma
	Minimal residual disease in multiple myeloma: state of the art and future perspectives
	Advances in the treatment of extramedullary disease in multiple myeloma
	Daratumumab: a game changer in myeloma therapy
	The role of bispecific antibodies in the treatment multiple myeloma.
	Biotechnological applications of siderophores.

Doyle, Sean (Molecular Biotechnology Lab.)	Fungal infections in ICU are the real cause of COVID-19 associated mortality. Discuss.
	Diagnosis and treatment of neonatal sepsis.
	Nutritional immunity strategies to overcome bacterial antimicrobial resistance.
English, Karen (Cellular Immunology Lab)	Trained Immunity in Duchenne Muscular Dystrophy
	The immune response to gene therapy viral vectors
	CRISPR/Cas9 in gene therapy applications
	Gene therapies for Muscular Dystrophies
	Sepsis Induced Immunosuppression
Fitzpatrick, David (Genome Evolution Lab.)	Aneuploidy and its implications for microbial pathogens.
	Genetic Copy Number Variation and pathogenesis.
	Rates and implications of lateral gene transfers into the Fungal Kingdom.
	Multigrug resistance mechanisms in filamentous fungi.
Graciet, Emmanuelle (Plant Biochemistry Lab.)	PROTACs in agriculture
	Susceptibility genes in plants
	Epigenetics and stress memory in plants
Hoysted, Grace (Microbial Ecology Lab.)	Common mycelial networks: can fungi help plants talk to each other?
Kavanagh, Kevin. (Medical Mycology Lab.)	Azole resistance in filamentous fungi
	Fusarium solani: A pathogen of humans and plants ?
	Ocular immune responses
	The potential of using endosymbiotic bacteria of insects as biocontrol agents
	Pathogen recognition receptors in invertebrates and vertebrates, variations on a theme ?
Lopez, Lorna (Human Genomics Lab.)	The impact of genome sequencing on understanding human disease
Mahon, Bernard (Immunology & Cell Biology Lab.)	Extracellular vesicles in Immunology
	Magnesium and the immune response
	Vitamin D and the immune response
	Sex differences in mammalian immune responses
	B cell memory
Masterson, Joanne (Allergy, Inflammation Remodelling research Lab.)	Keratin intermediate filaments in skin diseases
	Extracellular matrix-epithelial interactions in inflammation
	Hypoxia inducible factors and chromatin remodelling
	Molecular mechanisms of epithelial barrier dysfunction in Eosinophilic Esophagitis
	Cellular and molecular mechanisms of skin fibrosis
Meade, Conor (Molecular Ecology Lab.)	The impact of agriculture on the soil microbiome
	How effective are biodiversity conservation policies in Europe?
	Sustainable agriculture in Europe
McNamee, Eoin (Mucosal Immunology Lab.)	JAK/STAT inhibitors for Inflammatory Bowel diseases
	Mucosal Vaccines
	Next generation therapies for autoimmune diseases
	The mucosal immunoglobulin A (IgA) response
	How have infectious diseases shaped the evolution of the human immune system?
	Toll-like receptors and reproduction

Miggin, Sinead (Immune Signalling Lab.)	Inflammation and bovine seminal plasma
	Functional analysis of bovine seminal plasma
	Role of inflammation in reproduction
	Zoonotic diseases-implications for human health
Movia, Dania	The role of microbiome in lung cancer - What do we know and what we still need to understand?
	The importance of moving towards animal-free biomedical research
Nugent, Jackie (Plant Molecular Biology Lab.)	Mitochondrial genomes and human disease
	Plant mitochondrial genomes and genes
	Mitochondria and cytoplasmic male sterility in plants
	Plant chloroplast genes and genomes
	Chloroplast genomes in parasitic plants
O'Dea Shirley (Cell Engineering Lab.)	The tumour microenvironment and its challenges for therapies
	Lung cancer stem cells
	Liver cancer - Causes and treatments
	Immune checkpoint inhibitors in cancer therapies
	Therapeutic applications of hematopoietic stem cells
O'Maoileidigh Diarmuid (Plant Evolution & Genetics Lab.)	The importance of non-foliar photosynthesis in plants
	Genetic control of floral organ differentiation
Ohlendieck, Kay (Muscle Biology Lab.)	Diagnosis of amyotrophic lateral sclerosis
	Cellular mechanisms of skeletal muscle aging
	Physiological mechanisms of skeletal muscle fatigue
	Muscle insulin resistance and type 2 diabetes
	Genetics of cardiomyopathy
Robinson, Mark (Chronic Disease Immunology)	Mechanisms of granzyme-mediated cell death
	Immune cell recognition of glycans
	Interferon auto-antibodies
	Inflammation and endogenous retroviruses
	NK cell killing of senescent cells
Schroeder, Martina (Host-Pathogen Interaction Lab.)	Regulation of alternative splicing during infection and immunity
	Endogenous retroviruses and human health and disease
	Transposable elements in the human genome
	Liquid-liquid phase separation in the regulation of cellular processes
	Regulation of mRNA translation

BI425 Advanced Practicals/Professional Modules

Attendance at all Advanced Practical/Professional module sessions is COMPULSORY without a valid reason for absence. Missing scheduled sessions may result in failure of the module.

NOTE WELL: Continuous Assessment components are not carried over, if you fail BI425 you will have to repeat all components!

*You will be allocated **3 advanced practicals and 3 professional module**s designed to give you sufficient technical skill to commence work in a scientific industry, in a research lab, or more broadly.*

Students indicate preferences for Advanced practicals from the following list and will be allocated three:

SEMESTER 1:

- **Applied Medical Mycology** (K.Kavanagh): week 4, 16-19 Oct, Mon 3-5.30pm, Lab 1; Tues 3-5pm, Lab 1; Wed 3-4.30pm, Lab 2
- **Protein Bioinformatics** (K.Ohlendieck): week 5, 23-25 Oct, Mon 3-6pm, Lab 1; Tues 2-5pm, Lab 1; Wed 3-6pm, Lab 3
- **BioPharma: producing human therapeutics in plants** (J.Nugent/E.Graciet): week 8, Tues 14 Nov Prelab 2-3pm, Lab 1; week 9, 20-23 Nov, Mon 3-6pm, Wed 2-5pm, Thurs 2-5pm; Lab 1
- **Biomarker Discovery** (E.McNamee): week 11, 4-7 Dec, Mon 3-6pm, Wed 2-5pm, Thurs 2-5pm; Lab 1
- **Bacterial Sequencing** (A.Brazel)*:* week 12, 11-14 Dec Mon 3-5pm, Tues 3-5pm, Wed 4-6pm, Thurs 2-5pm; Lab 1

SEMESTER 2:

- **Behavioural Observation** (G.Hoysted): week 1, 6-8 Feb, Tues 2-5pm; Wed 2-5pm, Thurs 2-5pm; Lab 2
- **Abnormal Phosphorylation in Cancer Development** (P.Dowling): week 2, 12-14 Feb, Mon 2-5pm; Tues 2-5, Wed 2-5pm; Lab 5
- **Clinical Applications**(E.McNamee): week 3, 19-21 Feb, Mon 2-5pm, Lab 1; Tues 2-5pm, Lab 1; Wed 2-5pm, Lab 2
- **Immunology: assessment of antibody response by ELISA** (M.Schroeder): week 4, 26-28 Feb, Mon 2-5pm, Lab 1; Tues 2-5pm, Lab 1; Wed 2-5pm, Lab 2
- **Mammalian Cell Culture** (A.Hogan): week 5, 4-5 Mar, Mon 2-5pm & Tues 2-5pm, Lab 1; week 6, Tues 12 Mar 2-5pm; Lab 1
- **Comparative Genomics of Pathogenic Bacteria** (D.Fitzpatrick): week 7, 19-21 Mar, Tues 3-6pm LC, Wed 2-5pm, TSI239; Thurs 2-5pm, TSI239
- **Cleanroom Technology** (S.O'Dea/K.Kavanagh): week 9, 8-10 Apr, Mon 2-5pm; Tues 2-5pm, Wed 2-5pm; Lab 4 or 5 TBC

Students select their preferences and are allocated 3 professional modules from the following:

SEMESTER 1:

- **Business Risk Management** (S.O'Dea)**:** weeks 4 &5, 16-19 Oct & 23-26 Oct, Mondays 3-4pm CB2; Wednesdays 3-5pm CB2; Thursdays 3-4pm CB1
- **End User computing** (D.Rathna Kumar): weeks 7 & 8, 6-9 & 13-16 Nov, Mondays 3-4pm CB2; Wednesdays 3-5pm Eolas-002 Lab; Thursdays 3-4pm CB1
- **Public Health & Emergency Planning** (B. Mahon): weeks 9 & 10, 20-23 & 27-30 Nov, Mondays 3-4pm CB2; Wednesdays 3-5pm CB2; Thursdays 3-4pm CB1

SEMESTER 2:

- **Data Visualisation and Interpretation** (E.McNamee): weeks 1 & 2, 7-8 & 12-15 Feb, Wednesdays 3-5pm CB1; Thursdays 3-4pm SLT; Monday (week 2 only) 3-4pm SLT;
- **Peer-review and Scientific Communication** (O.Bayram): weeks 3 & 4, 19-22 & 26-29 Feb, Mondays 3-4pm SLT, Wednesdays 3-5pm CB1, Thursdays 3-4pm SLT
- **Patenting and Licensing of Biological Products** (S.Doyle/A.Hogan): weeks 9-10, 8-11 & 15-18 Apr, Mondays 3-4pm SLT, Wednesdays 3-5pm CB1, Thursdays 3-4pm SLT; week 11, Monday 22 April Questionnaire 3-3.30pm Lab 1

BI425 Advanced Practicals Detailed Descriptions:

SEMESTER 1

Applied Medical Mycology *(Prof. Kevin Kavanagh)*

A number of yeasts have been implicated in superficial and systemic diseases in humans. In general, the superficial diseases (oral candidosis, 'Thrush', cutaneous infection) can be effectively treated with either azole or polyene drugs and under most circumstances are not life threatening. However, systemic diseases occur in severely debilitated individuals and are potentially fatal. Treatment may be protracted and often fails to arrest the dissemination of the yeast. The ability to differentiate yeasts is critically important since it facilitates treatment and allows the tracking of yeasts implicated in recurring bouts of superficial disease. In this practical we shall examine means of morphologically distinguishing between pathogenic yeast species and of discriminating between them on the basis of their altered susceptibilities to antifungal agents. Restriction Fragment Length Polymorphisms may be used to differentiate between the main fungal pathogens and this technique will be used in conjunction with the variations evident in the whole cell protein banding pattern to identify and distinguish yeast strains. At the end of this practical the student will be familiar with the main techniques used to rapidly identify the most common yeast pathogens of humans and the reasons why identification is important for patient recovery.

Protein Bioinformatics *(Prof. Kay Ohlendieck)*

This practical introduces students to the basics of protein bioinformatics. Many proteins consist of more than one polypeptide chain and these individual subunits may be identical or different in primary structure. Importantly, oligomeric proteins can assemble to become even larger supramolecular structures. A crucial biochemical method for determining the subunit composition and spatial configuration of large protein complexes is the XL/MS (chemical crosslinking mass spectrometry) technique. The main bioanalytical objective of this practical is the demonstration of how mass spectrometry-based proteomics can be combined with protein bioinformatics to determine patterns of protein oligomerisation. In addition, an introduction to gel electrophoretic separation approaches and related biochemical methodology is given in order for students to understand how one can unequivocally identify specific subunits in a complex mixture of proteins. Individual sessions will focus on (i) protein identification by gel- and mass spectrometry-based proteomics (principles of peptide mass spectrometry; comparative gel-based proteomics; fluorescence two-dimensional difference gel electrophoresis), (ii) protein oligomerisation analysis using chemical crosslinking/mass spectrometry (principles of interaction proteomics; chemical crosslinking of proteins; XL/MS analysis), and (iii) bioinformatic protein complexome analysis (proteomic establishment of protein families, bioinformatics of protein network analysis, protein pathway analysis).

BioPharma – producing human therapeutics in plants *(Dr. Jackie Nugent, Dr. Emmanuelle Graciet)* Plants are emerging as a major platform for industrial-scale production of a range of recombinant products including many human therapeutics. The purpose of this advanced practical is to provide familiarity with some of the methods involved in producing human therapeutic proteins in plants. Students will: carry out plant transformation with a gene of interest for therapeutic applications; assess gene expression in planta; purify the human therapeutic protein from total plant protein and assess the purity of the isolated protein by polyacrylamide gel electrophoresis (PAGE). This practical will allow students to gain competence in a range of highly transferable molecular laboratory techniques including reporter gene assays, protein isolation, protein purification and PAGE.

Biomarker Discovery *(Dr. Eoin McNamee)*

Central to the diagnosis and subsequent treatment of disease is biomarker discovery, involving the identification of molecules (usually proteins) that are more or less abundant in samples taken from patients with and without a disease. The most commonly used biomarkers are those that are found in the fluid fractions of our body such as saliva, urine or blood as their identification generally involves non-invasive and rapid procedures. Samples are screened for the

presence or quantity of the biomarker protein and thus give the clinician an idea of whether the patient is suffering from a disease and the stage of disease progression. Although biomarker screening involves focusing on one or two individual proteins, their initial discovery require high throughput analysis of thousands of proteins (e.g. the blood serum proteome) to find those that are consistently different or diagnostic for a disease.

One of the most commonly used methods for high throughput proteome characterisation is 2 Dimensional Electrophoresis (2DE). During these practicals you will conduct 2DE and LC-MS/MS on samples representing serum obtained from patient's that have been diagnosed with ovarian cancer. By comparing the 2D profiles of sufferers and non sufferers it is anticipated that differentially expressed proteins will be identified; proteins which could represent novel biomarkers for ovarian cancer. Differentially expressed protein spots will be excised and identified using mass spectrometry. The techniques and experience you obtain during these practicals will be valuable to those interested in immunology, clinical research, drug discovery, proteomics and mass spectrometry.

Bacterial sequencing *(Dr. Ailbhe Brazel)*

This practical will incorporate some of the molecular techniques and bioinformatics analysis used to determine the complete DNA sequence of bacteria using Oxford Nanopore technology (ONT). This course will cover the wet lab preparation of libraries from genomic DNA, with a focus on the critical steps and potential pitfalls and understanding what constitutes a 'good' sample for purpose of best results using the technology. Advances in sequencing now allow scientists to sequence a bacterial genome in a week using a small machine and a laptop known as ONT. The practical experiment will involve extracting the DNA from bacteria and checking the quality and quantity is sufficient for sequencing. The samples will be prepared for sequencing by generating a library prep. The flow cell will be loaded with the prepared samples. The sequencing run will be performed by the machine. The sequencing data will be analysed for quality and filtered. The resulting data will be mapped to known bacterial genomes and assembled using software tools such as Minimap2 and Canu. The bacterial genome will be visualised and investigated for mutations or inserted genes of interest.

Learning Outcomes

After this course you should be able to:

1. Prepare libraries from genomic DNA for whole genome approaches to nanopore sequencing
2. Run Oxford Nanopore Technology (ONT) device and assess sequencing performance during a run
3. Understand the basics of ONT data handling and analysis
4. Analyse and interpret ONT whole genomic data from bacterial samples

SEMESTER 2

Behavioural Observation *(Dr. Grace Hoysted)*

This course introduces students to methods for sampling and recording animal behaviour. You will learn how to categorize behavioural events and record them objectively. Using these skills, you will then devise, carry out and analyse the results of an experiment testing a hypothesis about how certain animals behave. Usually, the subjects of the experiments are insects. The course material includes video recordings (birds, chimpanzees etc), and observations of live animals (such as insects) in the lab.

Abnormal Phosphorylation in Cancer Development *(Dr. Paul Dowling)*

The aim of this practical is to identify increased levels of phosphorylation on NF-κB (nuclear factor kappa-light-chain-enhancer of activated B cells) using a combination of immunoprecipitation and mass spectrometry. Phosphorylation plays critical roles in the regulation of many cellular processes including cell cycle, growth, apoptosis and signal transduction pathways, with abnormal phosphorylation a cause or consequence of many diseases. Tumor necrosis factor (TNF) stimulated cells (which will increase phosphorylation levels on NF-κB) will be analysed using immunoprecipitation, a technique of precipitating a protein antigen out of solution using an antibody that specifically binds to that particular protein (in this case NF-κB). This precipitated protein will then be digested with trypsin prior to

mass spectrometry, an analytical chemistry technique that helps identify the amount and type of chemicals present in a sample.

Clinical Applications *(Dr. Eoin McNamee)*

The successful treatment of disease depends on early detection which in many cases involves screening patient samples for specific diagnostic biomarkers. These biomarkers are usually proteins that vary significantly in quantity during the disease. Mor *et al.,* (2005) identified a number of biomarkers associated with ovarian cancer (OVCA). One of these proteins, prolactin, was shown to be consistently higher in abundance in patients with OVCA. Subsequently prolactin has been used in clinical situations as a pre-screen for OVCA and to monitor the success treatment in patients with OVCA. In the following set of Advanced Practicals the presence and progression of ovarian cancer will be investigated using antibodies for prolactin. Students will initially assess patient serum samples for the presence of elevated prolactin (compared to a negative control) and then evaluate the success of different cancer treatments. Over the course of these practicals, you will be introduced to many of the core methods used to study proteins, including protein extraction and quantification, SDS PAGE, Western Blotting and ELISA. These techniques and the experience you obtain during these practicals will be valuable to those interested in immunology, clinical research, drug discovery and proteomics.

Immunology: Assessment of Antibody response by ELISA and detection of Proteins by Western Blotting *(Dr. Martina Schroeder)*

The immune system responds to proteins on infectious organisms and in vaccines, by mounting cellular and humoral immune responses to foreign *antigens*. Antigens are simply short amino acid sequences that are recognized as foreign, or non-self, in the host organism. B cells produce antibodies that can bind to almost any antigen and these can be detected in serum or mucosal secretions of immune individuals. The immunoglobulin molecules (antibodies) in the serum can be detected by a variety of techniques, including enzyme-linked immunoassay (ELISA). The ELISA is based on the principle that the protein antigen binds to plastic on the wells of an assay plate and when the serum is added the antibodies specific for that antigen will selectively bind to the antigen (other antibodies in the serum specific for other antigens will not bind and can be washed away). The bound antibody can be detected by using a second antibody raised against the immunoglobulin of the species from which the serum was obtained (e.g. anti-mouse IgG) coupled to an enzyme, which converts a colourless substrate to a coloured product, which can be detected by measurement of absorbance.

The ability of antibodies to bind to other proteins, coupled with the ability of the immune system to generate endless antibody variants all with their own antigenic specificity, make antibodies the perfect tools with which to identify almost any protein. These characteristics are taken advantage of in Western blotting where antibodies raised against a specific protein (e.g. a HIV protein) can be used to detect the presence of this protein in a complex protein mixture that may contain thousands of other proteins. Western blotting is a technique where complex mixtures of proteins that have been separated by electrophoresis and blotted onto a solid support (e.g. PVDF, nitrocellulose) are probed for the presence of the protein of interest using an antibody raised against that protein. The bound antibody is subsequently detected by a method similar to that described for the ELISA procedure above.

Mammalian Cell Culture *(Dr. Andrew Hogan)*

Cells that previously grew in humans or animals (*in vivo*) can be modified to grow (culture) in glass or plastic vessels in the laboratory (*in vitro*). Cultured mammalian cells are used widely and extensively as an alternative to using animals in research. Whole animals are highly complex and contain many different cell types with diverse and interacting activities. Cell cultures (for example lung epithelial cells, skin cells, bone cells etc.) reduce this complexity and enable more specific questions to be addressed in a simplified context. In addition, cell culture reduces the numbers of animals required to address scientific questions.

Specific growth conditions must be maintained to keep the cells alive outside the body and a number of special skills are required to preserve the structure, function, behavior and biology of the cells. The conditions and skills include using specialised growth media, storing the cells at 37□C and importantly, using ‘aseptic’ technique to prevent microbial

contamination and death of the cultures which lack the immune defense system present in the full organism. This course describes the basic skills required to maintain and preserve cell cultures: aseptic technique, medium characteristics, passaging, freezing and storage, recovering frozen stocks, and counting viable cells. Students will then use these skills to carry out experiments to study factors that affect the growth and structure of lung cells.

Comparative Genomics of Pathogenic Bacteria *(Dr. David Fitzpatrick)*
Genomics is defined as the study of an organism's complete genome sequence. The first complete genome to be sequenced was the bacterium *Haemophilus influenzae* in 1995 at a cost of millions of dollars. Today more than 1,300 bacterial genomes have been sequenced. With the advent of next generation sequencing technologies the costs of sequencing a bacterial genome are decreasing rapidly and it is now possible to sequence a complete bacterial genome for approximately two thousand dollars. This practical will examine next generation sequence techniques and use computational approaches to assemble a bacterial genome from the raw sequence reads. Once we have an assembly, we will computationally locate genes and perform a partial annotation by comparing them to a database of genes with known functions. When annotated we can determine if our bacterial genome contains any genes normally associated with disease. Finally, we will use comparative genomics to compare the genomic sequence of a pathogenic bacterium to a non-pathogenic bacterium in an attempt to determine putative virulence factors.

Cleanroom Technology *(Dr. Shirley O'Dea, Prof. Kevin Kavanagh)*
'Cleanroom' describes a controlled environment where pollutants like aerosol, airborne bacteria, and dust are present only in very small amounts. A broad range of clinical and industrial sectors such as (bio)pharmaceutical, food, cosmetics, hospitals and research facilities use cleanrooms at certain stages of their processes when their products must be protected from contamination. Cleanrooms require both technological (equipment and infrastructure) and operational (work practices) measures in order to limit the presence of contaminating particles and micro-organisms. In this Advanced Practical, students will be introduced to cleanroom concepts and technologies and will learn processes such as gowning, aseptic cell culture techniques and environmental monitoring. Familiarity with cleanroom processes is highly desirable for a range of graduate positions in industry, research and clinical sectors.

BI425 Professional Modules: Detailed Descriptions:

SEMESTER 1
Business Risk Management *(Dr Shirley O'Dea)*
To ensure the success of a business, or indeed any project, venture or endeavor, proper planning is essential and risk management forms a crucial part of this planning. A risk assessment is fundamental to any organizational risk management program and is a methodology used to identify, assess, and prioritise organizational risk. A risk assessment allows you to get a clear picture of where your strengths lie and what potential threats to your success might exist. You can then assess the likelihood and impact of those threats and so prevent them from actually happening. In this module we will learn how to perform a risk assessment and practice examples that will demonstrate the value in planning for success in any project or business. The skills obtained will be advantageous for any student following a business management or leadership career path.

End User Computing *(Dr Dharani Rathna Kumar, Dept. Computer Science)*
This professional module helps students gain logical thinking skills and use a programming language. Students will learn ways to represent their work over the internet, which would be beneficial in developing e-portfolios to showcase their learning. *Week 1***:** Introduction to python would focus on developing an idea about programming skills and working on a biological dataset for simple analysis and graphical plots.
*Week 2***:** Website development using CSS and HTML coding would enable students to create live webpages and portfolios of their works or research on the internet.

Public Health & Emergency Planning *(Prof Bernard Mahon)*

Despite decades of pandemic preparedness, the Covid-19 pandemic took private businesses of all scales and major public functions (eg schools, social welfare etc) by surprise and revealed a lack of expertise and capacity to respond. Designed for final year biology and biomed students, this course focuses on professional skills to allow a Maynooth graduate to meet future challenges facing business or public sector institution to help crisis and response planning. We will:

- Cover the basics of public health planning and preparedness.
- Work in small groups to prepare simulated "Response plans" for local businesses in response to different threats.
- Present and critique plans in class, before team submission.

Assessment will be "group marked" with an element of peer marking for individuals by their team.

SEMESTER 2

Data Visualisation and Interpretation *(Dr Eoin McNamee)*

Global industries such as the pharmaceutical and biotechnology sectors rely on information to function. Information, in a readable format requires interpreting huge volumes of data and the communication of that material to global networks with diverse fields. The biopharmaceutical industry relies on visualization tools not only for the clear and comprehensive representation of data but also for exploration leading to new insights and drug discovery. From R&D to Venture capital investment, regulatory affairs to competitor analysis and marketing; how information is managed, analyzed and visually presented is a critical skill. Taking examples from the drug development industry, this course will consider how interpretation of early experimental data is processed to generate usable biologic information that can inform decision making. We will discuss these processes in the context of early clinical trials and the progress of new drugs through regulatory procedures and to market.

Peer-review and Scientific Communication *(Dr. Ozgur Bayram)*

Scientists publish the outcomes of their research findings at the end of a certain period. Publication is often a tedious and difficult process that requires writing and submitting a manuscript to a journal for peer-review. Once published, these research papers are also discussed by the public and experts in the field in various forms using social media, newspapers, websites and blogs. This module will focus on peer-review process and scientific communication of the researchers. On peer-review side, preparation of the manuscripts, presentation of the key data, selecting an appropriate journal, submission process, evaluation process of the manuscript and correspondence of the researcher with the journal will be analysed and discussed in the first part of the course. The public rely on mass media, in all its forms, for information and appreciation of science to drive innovation and sustainable development and underpin continuing progress in health and social welfare. In turn, the scientific community, in all its various manifestations, relies on 'public trust' in science, in its integrity, credibility, and expertise, to maintain their enterprise. In the second part of the course, scientific communication will be discussed with examples. An introduction to basic skills necessary for effective science communication and public engagement will be given. At the end of this course, students will be able to distinguish these two interconnected processes and discuss the common and different sides of them and able to communicate in a peer review and scientific communication process.

Patenting Evaluation and Licensing of Biological Products *(Prof. Sean Doyle, Dr. Andrew Hogan)*

Following discovery of a new biological product or process in the laboratory, the first step to commercialization is to establish intellectual property rights by submitting a patent application. This involves a thorough search of existing patents in the area and close scrutiny of submitted material, including supporting experimental data, by national and international patent agencies. Once a patent has been issued the next step is to seek an industrial partner or raise the finance to scale up production and begin the process of evaluation prior to licensure. The transition of a biological product (e.g. vaccine or blood product) from laboratory to the market place requires evaluation in humans in clinical trials and approval by regulatory authorities. Biological products are evaluated in a sequence of clinical trials, which

provide increasingly stringent tests on safety and efficacy. Successful completion of three phases of clinical trials is normally required prior to licensure, after which further observational studies are undertaken to monitor performance in the field. The World Health Organization (WHO) establishes minimal requirement for biological products, which form the basis for assuring acceptability of products globally. In general, they specify the need for appropriate starting materials, including seed pools; strict adherence to established protocols; tests for purity, potency, and safety at specific steps during production; and the keeping of proper records. These requirements provide guidelines for those responsible for production and control procedures and national regulatory Authorities, such as the Food & Drug Administration (FDA) in the US or the Irish Medicines Board usually adopt them. Each product has to be approved by the local regulatory authority prior to marketing in that country.

Capstone Group 2: BI445 Biological/Biomedical Science Research Project

Students undertake an 8-week research project in either semester 1 or 2 under the supervision of a member of staff. During this time students should become proficient in the techniques and equipment relevant to their project. This module is assessed in the following ways**:**

1. Students are required to prepare a mid-semester **2,500** word literature review on the general area of their project to be submitted in the middle of the appropriate semester (see page 58 for deadlines). This review should be an examination of material relating to the general area of the research project and is not meant as the Introduction to the research project thesis. For example, a research project might be entitled: 'Antimicrobial peptide production in *Galleria mellonella* as a means of suppressing fungal infections' while the Literature project might be entitled 'Fungal diseases of Insects' (worth 30%).
2. At completion of their project, students must submit a thesis outlining their findings (40%). This laboratory project should be no more than **5000** words. Appendices can be separate.
3. All students must deliver a 12-minute oral presentation on their research (20%)
4. Your lab work is assessed at 10% of your overall BI445 mark.

Descriptions of BI445 Laboratory Projects 2023/24

Supervisor & laboratory	**Project Title and Description**	**Possible Timing** (blank if flexible)
Bayram, Özgür (Fungal Genetics and Secondary Metabolism Laboratory)	**Investigating molecular functions of PHD finger protein in opportunistic human pathogen *Aspergillus fumigatus.*** Aspergillosis is a life-threatening disease caused by the opportunistic human pathogen *Aspergillus fumigatus*, which is ubiquitious fungus found every environment. Yearly, one billion people experience fungal infections caused by different fungi. Alone the number of individuals infected by A. fumigatus exceeds 2 million in the EU. Recently, our laboratory has dicovered a chromatin binding KERS complex which controls fungal growth, stress response and production of mycotoxins in model fungus *Aspergillus nidulans* and Aspergillus flavus. In this project, we will dissect the functions of SntB subunit of the KERS complex to see how it influences fungal growth and stress responses in *A. fumitagus*. For this aim, sntB gene will be deleted by genetic engineering and knock out strains will be subjected to different kinds of stressors and growth tests. Final aim of the project is also test the pathogenicity of the sntB mutants in insect and murine models. The further details regarding this project can be discussed with Dr. Özgür Bayram.	Semester 2
	Conjugation of human IgG molecules to activated solid surfaces. Covalent attachment of biomolecules to solid surfaces is a common and challenging practice in biotechnology. In this project, human IgG molecules will be chemically linked to chemical groups found on a solid surface. Initially, commercially purchased carboxy-	Semester 1

	modified microspheres will be activated in a particular buffer. These activated beads will be mixed with different amounts of human immunoglobulin G (IgG) and incubated under specific conditions. Attachment of IgGs on the microspheres will be validated by using protein separation and staining techniques such as poly acrylamide sodium dodecyl sulfate (SDS) gel electrophoresis followed by Coomassie or silver staining. These beads will be eventually used for construction and protein purification system.	
	Bacterial expression of a viral protease. Heterologous expression of foreign proteins in bacteria is an important method in Biomedicine and Biotechnology. In this project, a specific protease will be heterologously expressed in *Escherichia coli* bacteria. Initially, a plasmid containing the protease gene fused to His tag will be purified from E. coli cells in order to increase the amount of the plasmid, which will be eventually transformed into specialized BL21 (DE3) competent *E. coli* cells. A number of clones will be selected for expression studies.	Semester 2
Butler, Marion (Cell Signalling Lab.)	**Investigating the role of SHP2 in the TLR3/7-interferon pathway.** SHP2 is a cytoplasmic protein tyrosine phosphatase that has been shown to have a negative regulatory role in the TLR3 and RIG-I-interferon-b signalling pathway. More recently, a positive role for SHP2 in the TLR7-NF-kB pathway was reported, with increased SHP2 levels found in immune cells from psoriatic patients contributing to the pro-inflammatory disease state. We have generated research tools for SHP2 including SHP2-deficient macrophage cell lines. This project will examine the type I interferon signalling pathways downstream of the TLR3 or TLR7 pathways focusing on IRF7 activation.	Semester 1
	Targeting proteins of interest in Ovarian cancer. Ovarian cancer (OvCa) is the 4th most common female cancer in Ireland and accounts for 270 women losing their lives from this disease each year. Ireland has the lowest 5-year survival rate (2010-2014) for ovarian cancer (36%), when compared to 7 other high-income countries. High-grade serous ovarian cancer (HGSOC) accounts for approximately 70% of epithelial ovarian cancers. This project will focus on HGSOC and will involve examining the role of a protein of interest in this cancer type. The work will involve cellular assays to assess the impact of inhibitors of this protein of interest on the growth of ovarian cancer cells. This work will involve cell culture work, cell viability assays and colony formation assays.	Semester 1
	Proteomic analysis of the chemoresistant disease state in Ovarian cancer. This project will analyze data that we have on an Ovarian cancer cell lines representing cisplatin sensitive and resistant disease to identify proteins and pathways which become deregulated in the cisplatin resistant state to give understanding to the disease progression in Ovarian cancer. The student will be using this data and input this list of proteins into both KEGG Mapper and STRING pathway analysis tools. The student will then focus on pathways that are identified and carry out an in-depth literature review of published work in the cancer field to link our findings to pathways of interest in Ovarian cancer. Following the data analysis, the student will select one novel pathway to research in depth. This project does not involve lab work (proteomic data analysis only).	Semester 2
Carolan, Jim (Applied Proteomics Lab.	**Investigating the effects of neonicotinoid pesticides on the bumblebee nervous system** Recent research has indicated that neonicotinoid pesticides affect insect pollinators such as bees. These chemicals bind to receptors in the insect brain and impair basic processes necessary for individual and colony survival. Due to the profound economic and environmental consequences that bee decline has, a detailed molecular characterisation of the pesticide effects on the bee brain is necessary to gain insights into these chemical's mode of action. This project will involve a proteomic characterisation of the response to clothianidin exposure in the important European pollinator *Bombus terrestris*. The brain proteome of *B. terrestris* will be investigated by comparing changes in the dissected brains from bees exposed orally to the pesticide against the control group.	
	Investigating pesticide resistance mechanisms in insects.	

	One of the most alarming consequences of chemical insecticide use in agriculture is the emergence of pesticide resistant insects. This resistance may relate to changes in the insecticide target (neuronal receptors/channels) or altered forms or expression of detoxification enzymes. This project will investigate the molecular basis of pyrethroid resistance in the English grain aphid *Sitobion avenae*, a persistent pest of cereal crops worldwide. Susceptible and resistant biotypes will be exposed to field relevant doses of pyrethroid and their total protein extracts subjected to quantitative mass spectrometry.	
	Investigating the effects of entomopathogenic fungi on the immune response of the buff-tailed bumblebee ***Bombus terrestris*****.** As with many pollinators, bumblebees are suffering from detrimental population declines, reducing their genetic variability and increasing their vulnerability to a host of parasites and pathogens. Due to the profound economic and environmental consequences these losses could have, a detailed characterisation and mechanistic analysis of their immune response is necessary to gain valuable insights into mechanisms of disease pathology and resistance in these highly social insects. This project will involve characterising the immune response of the common European pollinator *Bombus terrestris* to infection with blastospores of the entomopathogenic fungi (EPF) *Metarhizium anisopliae. M. anisopliae* is a commercial EPF commonly exploited as a bio-pesticide due to its virulence in insects. The immune response of *B. terrestris* to *M. anisopliae* will be investigated by comparing proteome changes in the fat body and haemolymph, to determine the immune components involved in this response.	
Devaney, John (Forest Ecology & Global Change Lab.)	**Dublin mountains makeover: The influence of light availability and microclimate on the growth of native broadleaf tree seedlings in a managed conifer forest.** Forest policy in Ireland is focused on diversifying tree species in managed woodlands and increasing emphasis on the provision of multiple ecosystem services in forests. For example, Coillte - Ireland's state forestry company - has recently announced ambitious plans to restore and rehabilitate its forests in the Dublin mountains (https://www.coillte.ie/coillte-nature/ourprojects/dublinmountainsmakeover/). Understanding how light availability and microclimate influences the growth of native tree seedlings in forests is central to designing effective forest restoration programmes. Using photosynthetically active radiation meters and hemispherical photography, this project will investigate the relationship between beneath canopy light availability and the growth of broadleaf trees at forest sites in the Dublin mountains. The project will also compare traditional canopy openness measurement techniques with new low-cost smartphone hemispherical photography.	Semester 1
	Dublin mountains makeover: Impact of soil environment on the growth of underplanted tree seedlings in a managed conifer forest canopy. Ireland's forest policy promotes the move to more sustainable forest management practices, including "Continuous Cover Forestry" (CCF). CCF is expected to increase structural diversity in forests and has the potential to enhance forest-related ecosystem services. Underplanting monoculture forest canopies with a diverse mixture of tree species can be used as part of the transformation of conventionally managed commercial forests to CCF. Understanding the conditions that promote the successful establishment and growth of underplanted seedlings is crucial to designing efficient CFF transformation strategies. In this project, the relationship between soil conditions and seedling growth will be quantified. At a series of forest sites in the Dublin mountains, soil parameters such as pH, nutrient status, and soil moisture will be assessed and related to the performance of underplanted seedlings.	Semester 1
	Using camera traps to estimating deer densities and associated browsing damage to vegetation in forests. Deer populations have reached extreme levels throughout Ireland, resulting in serious financial and environmental damage to forests. Understanding deer population size has	Semester 2

	become a key forest management consideration. This project will use camera trap experiments (motion sensor trail cams) to estimate the deer population density and behavior at two forest sites. Additionally, the impact of deer browsing of vegetation communities at experimental sites will be assessed.	
Dowling, Paul (Clinical Proteomics Lab.)	**Proteomic analysis of abnormal phosphorylation patterns in Multiple Myeloma.** This project will focus on using protein abundance data to identify abnormal phosphorylation levels associated with drug sensitivity/resistance in clinical samples from multiple myeloma patients. Since the inception of phosphoproteomics, research has focused on changes to the phosphoproteome during disease progression. Phosphoproteins could be markers useful as diagnostics and also be therapeutic targets. It is predicted that up to 30% of all proteins may be phosphorylated, some multiple times. Phosphoproteins from highly sensitive (Group I), sensitive (Group II), resistant (Group III) or highly resistant (Group IV) patient plasma cell samples will be investigated using proteomics platforms to identify abnormal signalling pathways associated with drug sensitivity.	Semester 1
	Identification of Molecular Mechanisms Responsible for the Development of Extramedullary Disease in Myeloma. Multiple myeloma (MM) is a debilitating malignancy that is part of a spectrum of diseases ranging from monoclonal gammopathy of unknown significance (MGUS) to plasma cell leukaemia. Immunomodulatory drugs (IMiDs) are changing the treatment paradigm in MM and improving overall survival. Extramedullary multiple myeloma (EMM) is an aggressive subentity of multiple myeloma, characterized by the ability of a subclone to thrive and grow independent of the bone marrow microenvironment, resulting in a high-risk state associated with increased proliferation, evasion of apoptosis and treatment resistance. This project will focus on the characterisation of abnormal protein pathways in extramedullary multiple myeloma	Semester 1
	Investigating the role of bone marrow stromal cells from multiple myeloma patients in therapeutic resistance. Multiple myeloma (MM) is a malignant plasma cell (PC) disorder, characterised by a complex interactive network of tumour cells and the bone marrow (BM) stromal microenvironment, contributing to MM cell survival, proliferation and chemoresistance. In MM, the balance between the cellular, extracellular, and liquid compartments within the BM is profoundly disturbed. Stromal cells support MM cell growth, osteoclastogenesis and angiogenesis. The aims of this study are to investigate the constitutive differences between stromal cells from patients with different response outcomes to therapy.	Semester 2
Doyle, Sean (Molecular Biotechnology Lab.)	**Antimicrobial resistance: Is zinc homeostasis a bacterial Achilles heel?** Antimicrobial resistance is one of the major problems facing biomedicine. We have been amongst the first to suggest that interference with bacterial zinc homeostasis is a potential strategy to overcome antimicrobial resistance. In this project will develop methods to explore whether fungal metabolites can shuttle zinc into or out of bacterial cells or sequester it internally. We will also investigate the sensitivity of a key bacterial species to fungal metabolite exposure to determine if there is a mechanistic link between growth inhibition and altered zinc homeostasis. Techniques used will include bacterial cell culture, SDS-PAGE, RP-HPLC and mass spectrometry.	
	***Aspergillus fumigatus*: mechanism of celastrol-mediated growth inhibition.** *Aspergillus fumigatus* is a key opportunistic fungal pathogen of humans and has been identified by WHO as a critical pathogen against which new medicines must be developed. In addition, COVID-Associated Pulmonary Aspergillosis (CAPA) is now known to be one of the main reasons why critically ill COVID-19 patients succumb to the disease in ICU. We have discovered that the plant metabolite celastrol causes growth inhibition of *A. fumigatus*, however the mechanism by which this inhibition is occurring is unclear. Thus, the goal of this project is to undertake defined biochemical experiments to assess	

	the possible mode of action of celastrol. We hope to explore if it affects cell wall structure and intracellular redox homeostasis in *A. fumigatus*. Techniques used will include fungal cell culture, fungal cell wall integrity analysis and intracellular fluorescence staining	
	Diagnostic applications of siderophores for infectious disease detection. We are in the process of attempting to develop a siderophore-specific ELISA to detect fungal infection in animals. The project will involve microbial siderophore purification, assessment of antibody interaction with siderophore-protein conjugates, optimisation of assay performance, evaluation and enhancement of siderophore detection, comparative sensitivity of siderophore detection by RP-HPLC and possibly antibody modification. Data analysis and presentations will also be required. Techniques used: microbial culture, metabolite purification and bioconjugation, ELISA and SDS-PAGE have significant industry applications. Chemistry experience preferable, but not essential.	Semester 2
	Fungal Molecular Microbiology Anyone with a strong interest in fungal molecular microbiology should contact Professor Sean Doyle sean.doyle@mu.ie with their own ideas to discuss the potential for executing same in his laboratory.	
English, Karen (Cellular Immunology Lab)	**Using cell therapy to control allergen induced trained immunity in macrophages.** Macrophages are involved early on in the immune response and play a key role in the detection, engulfment and destruction of bacteria and clearance of damaged or dying cells. Recent evidence shows that macrophages can develop a non-specific memory. Following an encounter with pathogenic stimulus they become trained. The good news is that once trained by an initial infection, macrophages are very good at quickly fighting off secondary infections. The bad news is that this training effect can lead to the development or exacerbation of autoimmune or cardiovascular diseases. MSCs have the capacity to calm immune cells including macrophages. This project will investigate the training effect of the common Asthma allergen house dust mite (HDM) in macrophages and the capacity for MSCs to block HDM-induced training.	Semester 1
	Can cell therapy alter the pro-inflammatory macrophage response in Duchenne muscular dystrophy? Duchenne muscular dystrophy is an X-linked lethal disorder affecting ~1 in 5000 males. The primary cause of DMD is loss of dystrophin required for mechanical muscle function. Evidence from human and animal model studies supports an integral role for a maladaptive immune response in the disease promotion. Recently, it has been shown that macrophages derived from a mouse model of DMD (mdx) exhibit a trained immune phenotype. The bad news is that this training effect likely contributes to the exacerbation of DMD. Blocking this trained immune phenotype in macrophages may help to reduce disease severity in DMD and could be used as an adjunct therapeutic approach for gene therapy. MSCs have the capacity to calm immune cells including macrophages. This project will investigate the trained immune phenotype in macrophages from mdx mice and the capacity for MSCs to block training	Semester 1
	The role of macrophage migration inhibitory factor (MIF) in driving trained immunity. Macrophage migration inhibitory factor (MIF) is a proinflammatory cytokine expressed by a range of immune cells. We have recently identified that MIF drives trained immunity in macrophages exposed to the allergen house dust mite (HDM). However, it remains to be determined if MIF can also drive trained immunity to other training agents. This project will compare trained immunity mediated by a number of training agents (HDM, Beta-Glucan and LPS) in macrophages from wildtype or MIF-transgenic mice	Semester 2
	Can mesenchymal stromal cells block beta glucan induced trained immunity? Beta-Glucan, an immunomodulator derived from the fungal cell wall drives a trained immune phenotype in macrophages. The process of training involves epigenetic and metabolic changes and allows the macrophages to respond very quickly to a secondary (and different) pathogenic stimulus. The good news is that once trained by an initial	Semester 2

	infection, macrophages are very good at quickly fighting off secondary infections. The bad news is that this training effect can lead to the development or exacerbation of autoimmune or cardiovascular diseases. MSCs have the capacity to calm immune cells including macrophages. This project will compare the training effect of Beta-glucan versus whole glucan particles in macrophages and the capacity for MSCs to block training.	
Fitzpatrick, David (Genome Evolution Lab.)	**Antifungal resistance in *Candida auris*. The role of CNVs** *Candida auris* is an emerging fungal pathogen that poses a significant threat to global health. It is resistant to multiple antifungal drugs and can cause severe infections, particularly in hospitalized patients with compromised immune systems. One way in which *C. auris* generates resistance is via Copy Number Variations (CNVs). CNVs are a type of genetic variation that involve changes in the number of copies of a particular DNA segment in the genome of an individual compared to a reference genome. CNVs can encompass relatively small regions of DNA, such as a few kilobases, or they can be much larger, involving entire genes or even multiple genes. In this project we will analyse the genomes of multiple *C. auris* isolates to detect CNVs associated with pathogenicity. The project is entirely computer based and there is NO expectation that students are familiar with programming.	Semester 1
	Antifungal resistance in *Aspergillus fumigatus*. The role of CNVs. *Aspergillus fumigatus* is a filamentous fungus belonging to the genus *Aspergillus*. It is a common saprophytic mould found in various environments, including soil, decaying organic matter, and indoor environments. While it is generally not harmful to healthy individuals, *A. fumigatus* can cause opportunistic infections in people with weakened immune systems, such as those with compromised lung function or immunodeficiencies. One way in which A. fumigatus generates resistance is via Copy Number Variations (CNVs). CNVs are a type of genetic variation that involve changes in the number of copies of a particular DNA segment in the genome of an individual compared to a reference genome. CNVs can encompass relatively small regions of DNA, such as a few kilobases, or they can be much larger, involving entire genes or even multiple genes. In this project we will analyse the genomes of multiple *A. fumigatus* isolates to detect CNVs associated with pathogenicity. The project is entirely computer based and there is NO expectation that students are familiar with programming.	Semester 1
	Antifungal resistance in *Candida albicans*. The role of CNVs. *Candida albicans* is a type of yeast that is commonly found as part of the normal human microbiota, residing in various mucosal surfaces of the body, including the mouth, gastrointestinal tract, and female genital tract. While it is usually harmless in healthy individuals, *Candida albicans* can become an opportunistic pathogen and cause infections, particularly in individuals with weakened immune systems or underlying medical conditions. One way in which *C. albicans* generates resistance is via Copy Number Variations (CNVs). CNVs are a type of genetic variation that involve changes in the number of copies of a particular DNA segment in the genome of an individual compared to a reference genome. CNVs can encompass relatively small regions of DNA, such as a few kilobases, or they can be much larger, involving entire genes or even multiple genes. In this project we will analyse the genomes of multiple *C. albicans* isolates to detect CNVs associated with pathogenicity. The project is entirely computer based and there is NO expectation that students are familiar with programming.	Semester 1
Graciet, Emmanuelle (Plant Biochemistry Lab.)	**Investigating the effects of waterlogging (and hypoxia) on pathogen resistance in plants.** Hypoxia stress is a low oxygen condition often caused by waterlogging. Hypoxic conditions have an adverse effect on plants such as reduced growth, lower yield and compromised fitness in response to invading pathogens. This project will investigate how hypoxia affects the ability of *Arabidopsis thaliana* plants to fight fungal infection by *Sclerotinia sclerotiorum*. Prior to pathogen inoculation, hypoxia will be triggered using different approaches, including hypoxia chambers, anaerojars and waterlogging. Different Arabidopsis mutants will also be used to identify genes of relevant to plant responses to	Semester 1

	combined hypoxia/Sclerotinia treatments. *Methods: microbiology approaches to culture fungi, plant growth, plant pathogen inoculation, imageJ, statistical analyses, RNA extractions, RT-qPCR*	
	Investigating the effects of hypoxia on plant immune response. Hypoxia stress is a low oxygen condition often caused by waterlogging. Hypoxic conditions have an adverse effect on plants such as reduced growth, lower yield and compromised fitness in response to invading pathogens. This project will investigate how hypoxia affects the ability of *Arabidopsis thaliana* plants to fight fungal infection by *Sclerotinia sclerotiorum* by exploring how different aspects of a plant's immune response are affected by hypoxia treatment before inoculation. This will include assessing cell death, ROS production, as well as the expression immunity-related genes. *Methods: microbiology approaches to culture fungi, plant growth, plant pathogen inoculation, imageJ, statistical analyses, RNA extractions, RT-qPCR, DAB staining, conductivity measurements.*	Semester 2
	Reoxygenation after flooding in plants. Flooding is a source of stress for plants and results in important crop losses every year. One of the main stress associated with flooding is a reduction in oxygen availability (hypoxia) to roots and shoots. Equally stressful, though, is the return to normal oxygen conditions after flooding, which is called 'reoxygenation'. While signaling pathways in response to flooding have been dissected, much less is known about reoxygenation. In this project, the response of different mutants plants of *Arabidopsis thaliana* to reoxygenation will be studied, as well as the response of different commercial varieties of oilseed rape (*Brassica napus*) after flooding. *Methods: plant growth in controlled conditions, in vivo photosynthesis measurements, RNA extraction, gene expression analyses (RT-qPCR).*	Semester 2
Hogan, Andy (Metabolic Immunology Lab.)	**Killer MAITs - Harnessing MAIT cells as an effective anti-cancer therapy.** MAIT cells are a subset of cytotoxic innate T cells capable of rapidly killing cancerous target cells. The signals required for MAIT cell cytotoxicity are still emerging and are the focus of this project. We aim to co-culture MAIT cells with cancerous target cells for different time points before assessing their production of killer molecules.	Semester 1
	Stop or Go – investigating the cytokine responses of MAIT cells. MAIT cells are a subset of innate T cells capable of rapidly launching a protective immune response against bacteria, viruses and many cancers. MAIT cells can be activated via their T cell receptor or via soluble cytokines such as IL-18. The profile of cytokines MAIT cells respond to remain unexplored. This project aims to map cytokine responses (e.g., IL-33, IFNy or IL-36) of human MAIT cells.	Semester 1
	Checks & balances - Investigating of regulation anti-viral responses in human MAIT cells. MAIT cells are a subset of innate T cells capable of rapidly launching an anti-viral immune response. The exact signals and regulation of anti-viral MAIT cells are still emerging and will be the focus of this project. MAIT cells will be activated with type I interferons and downstream signalling pathways and cytokine responses will be mapped.	Semester 2
	Fuelling our MAITs – nutritional requirements for MAIT cell effector responsesin cancer? Amino acids are critical nutrient for many immune cells, supporting metabolism and functionality. Limitations of amino acids in cancer have been linked to defective anti-cancer immune cells. The amino acid requirements of MAIT cells are poorly understood. In this project we will map the amino acid requirements of MAIT cells using rtPCR and ELISA.	Semester 2
	Mapping natural killer (NK) cell function and metabolism. Natural Killer (NK) cells are critical in our defences against viruses and cancer. We now know that NK cells require energy to perform these protective duties. In the setting of diseases such as cancer, the tumour microenvironment has a significantly altered nutrient	Semester 1

	profile, which can render NK cells dysfunctional. This project aims to map the metabolic machinery of human NK cells using an ublished high-dimensional proteomic dataset. **In silco project**	
	Mapping natural killer (NK) cell function and metabolism. Natural Killer (NK) cells are critical in our defences against viruses and cancer. We now know that NK cells require energy to perform these protective duties. In the setting of diseases such as cancer, the tumour microenvironment has a significantly altered nutrient profile, which can render NK cells dysfunctional. This project aims to map the metabolic machinery of human NK cells using an ublished high-dimensional proteomic dataset. **In silco project**	Semester 2
Kavanagh, Kevin (Medical Mycology Lab.)	**Evaluation of ability of novel carbohydrate lectins to disrupt the adherence of** *Candida albicans* **to epithelial cells.** The yeast *Candida albicans* is capable of inducing a range of superficial and systemic diseases in immuno-compromised patients. In order to cause disease *C. albicans* must adhere to epithelial tissue and form a biofilm which is achieved by the use of specific and non-specific adherence mechanisms. This project will evaluate the ability of selected carbohydrate lectins to block the adherence ability of *C. albicans* and to inhibit biofilm formation (in collaboration with Dr. Trinidad Velasco-Torrijos).	Semester 1
	Characterisation of the proteins secreted by *Fusarium solani***.** *Fusarium solani* causes over 1 million cases of fungal keratitis in the developing world and is commonly found in soil and decaying vegetation. Infection of the eye can result from direct physical injury (e.g. thorn), or fungal spores attaching to the cornea. How this fungus infects the eye is not clearly understood and this project will use proteomic analysis to characterise the proteins secreted by the fungus that may play a role in the infection process.	Semester 1
	Characterisation of response of ex vivo pig lung to *Aspergillus fumigatus***.** The filamentous fungus *Aspergillus fumigatus* is widely distributed in the environment and can cause a variety of life limiting infections in immunocompromised patients. The ability of A. fumigatus to colonise and disseminate within a host can be studied using ex vivo pig lung (EVPL) samples and shows strong similarities to the disease development processes in vivo. In this project cellular, proteomic and analytical techniques will be applied to characterise the response of EVPL to A. fumigatus in order to establish the role of specific fungal virulence factors in the development of pulmonary disease	Semester 2
	Evaluation of ability of novel carbohydrate lectins to disrupt the adherence of *Candida albicans* **to epithelial cells.** The yeast Candida albicans is capable of inducing a range of superficial and systemic diseases in immuno-compromised patients. In order to cause disease C. albicans must adhere to epithelial tissue and form a biofilm which is achieved by the use of specific and non-specific adherence mechanisms. This project will evaluate the ability of selected carbohydrate lectins to block the adherence ability of C. albicans and to inhibit biofilm formation (in collaboration with Dr. Trinidad Velasco-Torrijos)	Semester 2
Lopez, Lorna (Human Genomics Lab.)	**Tissue Expression Enrichment Analysis for Genome-Wide Association Study Results of Autism, ADHD and sleep related phenotypes - a comparison.** Introduction and objective: Sleep problems are highly prevalent in the neurodevelopmental conditions, autism (AUT) and attention deficit hyperactivity disorder (ADHD). Insomnia is much more common in AUT and ADHD than in the general population, and such patients are more likely to have an evening, rather than a morning, chronotype. Both AUT and ADHD are highly heritable (~90%), meaning that the phenotypic variation explained by genetic factors is very high. The hypothesis of this study is that the observed correlations in SNP effects can partly be explained by AUT and ADHD associated SNPs affecting genes expressed in common tissues or cell types. The aim of this study is to identify these tissues and cell types. The student will learn about GWAS, post-	

	GWAS analysis and the complex genetics of sleep and neurodevelopmental conditions. The student will also gain experience and learn the fundamentals of programming in Bash and R and using web-based bioinformatic interfaces.	
	Tissue Expression Enrichment Analysis for Genome-Wide Association Study Results of Schizophrenia, Bipolar Disorder and sleep related phenotypes - a comparison. Introduction and objective: Sleep problems are a core symptom of bipolar disorder (BP) and are present in up to 80% of people with schizophrenia (SCZ). Such sleep problems include insomnia, which refers to a difficulty initiating and maintaining sleep. An evening chronotype has been associated with many neuropsychiatric disorders, including SCZ and BP. Both SCZ and BP are highly heritable (~80%), meaning that the phenotypic variation explained by genetic factors is very high. The hypothesis of this study is that the observed correlations in SNP effects can partly be explained by SCZ and BP associated SNPs affecting genes expressed in common tissues or cell types. The aim of this study is to identify these tissues and cell types. Skills / knowledge student will gain: The student will learn about GWAS, post-GWAS analysis and the complex genetics of sleep and neurodevelopmental conditions. The student will also gain experience and learn the fundamentals of programming in Bash and R and using web-based bioinformatic interfaces.	
Masterson, Joanne (Allergy, Inflammation Remodelling research Lab.)	**Lactate: Friend or foe in esophageal epithelium.** lactate is a by-product of glycolysis and despite being long considered as a waste product, it has recently been identified as a metabolite required for cell function. Our lab has linked defects in epithelial cells with limited glycolytic capacity and therefore lactate production. This project aims to identify whether lactate is required for esophageal cell function. To answer this question, we will assess the impact of lactate on epithelial cell function. The student will become familiar with experimental approaches including in vitro assessments and may involve a range of techniques including metabolic assays, RT-PCR, and western blot methods.	Semester 1
	Hide and go seek: The curious case of the disappearing esophageal stem cell. Stem cells in adult tissues are important regulators of homeostasis, regenerating tissues on a constant basis. Our understanding of the critical pathways involved in regulating the esophageal epithelial stem cell and its functions are limited. Recent evidence suggests stem cells may be depleted in allergic esophageal disease Eosinophilic Esophagitis. This project aims to identify if this is truly the case and what mechanism's may underly this. The student will become familiar with experimental approaches including in vivo assessments and may involve a range of techniques including immunofluorescence, microscopy, quantitative histopathology, or in vitro assessments involving RT-PCR, and western blot methods.	Semester 1
	Gasping for O_2: How important are epithelial hypoxia responses in esophageal homeostasis and the allergic disease Eosinophilic Esophagitis. Our lab has previously confirmed the important role for the hypoxia inducible transcription factor, HIF-1a in esophageal epithelial barrier function. Surface epithelial alteration is a histological hallmark in the disease and comprises part of the clinical histologic scoring tool. Mechanisms underpinning these alterations are limited. This project aims to uncover whether epithelial HIF-1a is an important molecule in this process in both healthy and inflamed tissues where HIF-1a expression has been genetically altered. The student will become familiar with experimental approaches including in vivo assessments and may involve a range of techniques including immunofluorescence, microscopy, quantitative histopathology, or in vitro assessments involving RT-PCR, and western blot methods.	Semester 1
McNamee, Eoin	**RNA degradation as a way to control macrophage inflammatory responses.** Macrophages are a critical immune cell that acts as sentinels in our tissues, patrolling for infection or damage. However, their over-activation leads to a variety of inflammatory	Semester 2 only

(Mucosal Immunology Lab.)	diseases and aberrant responses to infections. The MK2 kinase is a master regulator of RNA-binding proteins and has the capacity to control the inflammatory protein circuits that a macrophage produces. Using gene silencing and drug intervention studies *in vitro*, this project will assess the role of MK2 in controlling the response of macrophage to defined inflammatory stimuli and shape macrophage function. Potential techniques covered by this project include *in vitro* cell culture, ELISA, western immunoblot, RNA degradation/deadenylation assays or RNA stability assays.	
	miR-223 regulation of macrophage inflammation. MicroRNA's are non-coding RNA that regulate protein coding mRNA translation. In doing so, microRNA's shape how an immune cell responds to its environment. We have discovered that a microRNA, mir223, regulates inflammatory responses of macrophages and is a critical control switch for innate immunity. However, exact mechanistic details are still missing. Using gene silencing and drug intervention studies *in vitro*, this project will assess the role of mir223 in controlling the response of macrophage to defined inflammatory stimuli and shape macrophage function. Potential techniques covered by this project include *in vitro* cell culture, ELISA, western immunoblot, Transient transfections gene-silencing.	Semester 2 only
	miR-223 regulation of experimental Lupus autoimmunity. MicroRNA's are non-coding RNA that regulate protein coding mRNA translation. In doing so, microRNA's shape how an immune cell responds to its environment. We have discovered that a microRNA, mir223, regulates inflammatory responses of macrophages and neutrophils, controlling the innate immune response. However, its role in shaping adaptive and chronic immune responses in autoimmunity is unclear. Using archived tissue and serum samples, this project will investigate how miR-223 controls the chronic autoimmune responses to pristane, an environmental oil used to induce a SLE-lupus-like autoimmune disease in mice. Potential techniques covered by this project include pathology, ELISA, auto-antibody assessment, HepG2 autoantibody localisation	Semester 2 only
	Detection of bovine respiratory syncytial virus (BRSV) in nasal swabs from calves. Infection with BRSV is associated with respiratory disease in young beef and dairy cattle. It is considered a primary BRD pathogen. While initial infection is generally quite severe, subsequent reinfection tends to be milder. Notably, infection with BRSV predisposes the lower respiratory tract to secondary bacterial infection and a predilection to pneumonia. BRSV is an RNA pneumovirus in the Paramyxovirus family and was named for its characteristic cytopathic effect—the formation of syncytial cells. Morbidity tends to be high and mortality can be as high as 20%. The current project aims to optimize a method for the detection of BRSV in beef calves. To do this, viral nucleic acids will be isolated from the calf nasal swabs and tested for the presence of BRSV using reverse-transcriptase polymerase chain reaction (RT-PCR). Techniques used will include RNA isolation, RT-PCR and Agarose gel electrophoresis. Signalling Lab.)	Semester 2 only
Miggin, Sinead (Immune	**Optimisation of a method for the detection of bovine herpes virus 1 (BoHV-1) in nasal swabs.** Infectious bovine rhinotracheitis (IBR) caused by bovine alpha herpes virus 1 (BoHV-1) is one of the most important contagious diseases in cattle and has led to significant economic losses to the dairy and beef agricultural industry worldwide. Infection with BoHV-1 is primarily linked to a respiratory illness known as infectious bovine rhinotracheitis (IBR). Given the economic losses incurred due to decreases in cow milk yield and calf growth rate, it is important to identify animals infected with BoHV-1. The current project aims to optimise a methodology for the isolation of BoHV-1 DNA from calf nasal swabs and test for the presence of BoHV-1 using polymerase chain reaction (PCR) where the assay will amplify a region encoding a highly conserved glycoprotein B gene of BoHV-1. Techniques used will include DNA isolation, PCR and Agarose gel electrophoresis.	Semester 2 only

Nugent, Jackie (Plant Molecular Biology Lab.)	**Assessing the role of cytoplasmic organelles (plastids and mitochondria) in plant stress responses.** Plants continually adjust how they grow and develop in response to environmental signals. Recent studies suggest that cytoplasmic organelles (mitochondria and plastids) act as important environmental sensors capable of perceiving stressful environmental conditions and triggering genetic and physiological responses that ultimately regulate the balance between plant growth and plant protection/defense. To study the contribution of organellar variation to plant stress responses we generated a panel of *Arabidopsis* cybrid lines - plant lines with the nucleus of one accession and the cytoplasm from another accession. The aim of this project is to assess stress-responses in parental and cybrid lines using phenotypic and gene expression analyses. Project students will gain experience and competence in a range of lab techniques/skills including good experimental design, microscopy, plant handling, RNA extraction, quantitative-PCR, data handling, statistics and data analysis and presentation.	
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O'Dea, Shirley (Cell Engineering Lab.)	**Gene editing lung cancer cells.** Crispr/Cas9 is a versatile gene-editing technology that can be used to modify, delete or correct precise regions of DNA. It works by cutting DNA at the selected sites. Once the DNA is cut, the cell's own repair machinery will add or delete pieces of genetic material, or to make changes to the DNA. Crispr/Cas9 is used for a wide range of research and clinical applications, including deletion of oncogenes in cancer cells. In this project, we will use Crispr/Cas9 to delete genes in lung cancer cells. Techniques will include cell culture, various cell assays, transfection and flow cytometry	
	Interaction between the floral and stomatal developmental programmes.	

O'Maoileidigh Diarmuid (Plant Evolution & Genetics Lab.)	Floral organs are photosynthetically active, which is an important source of energy for plants that cannot be replaced by foliar (leaf) photosynthesis. We are interested in understanding how the genetic programme underlying photosynthesis interacts with the floral developmental programme. We have identified the floral organ identity protein AGAMOUS (AG) as a timer controlling stomatal emergence on the fruits of Arabidopsis thaliana. You will explore this interaction further by yeast-two-hybrid analysis	
	Interaction between the floral and photosynthetic developmental programmes. Floral organs are photosynthetically active, which is an important source of energy for plants that cannot be replaced by foliar (leaf) photosynthesis. We are interested in understanding how the genetic programme underlying photosynthesis interacts with the floral developmental programme. We have identified the floral organ identity protein AGAMOUS (AG) as a regulator of aspects of photosynthesis on the fruits of *Arabidopsis thaliana*. You will explore this interaction further by genetic analysis	
	Analysis of the *cis* regulatory elements controlling the expression of *GOLDEN-2-LIKE2.* Floral organs are photosynthetically active, which is an important source of energy for plants that cannot be replaced by foliar (leaf) photosynthesis. We are interested in understanding how the genetic programme underlying photosynthesis interacts with the floral developmental programme. *GOLDEN-2-LIKE2* (*GLK2*) is predominately expressed in the fruits of Arabidopsis thaliana whereas its paralog *GLK1* is predominately expressed in leaves. You will analyse two mutant lines that have lesions in the promoter of *GLK2* for how chlorophyll levels are affected in these plants and analysis *GLK1* and *GLK2* expression by RT-PCR.	
Ohlendieck, Kay (Muscle Biology Lab.)	**Proteomic and bioinformatic analysis of the cellular stress response in skeletal muscle.** The up-regulation of a large and diverse group of molecular chaperones plays a key role in the highly coordinated response of skeletal muscles to severe levels of cellular stress during excessive physical exercise, traumatic injury, neuromuscular disease or the natural aging process. Molecular chaperones, such as the large family of heat shock proteins and certain protein-modifying enzymes, are involved in the prevention of protein misfolding, the avoidance of the detrimental accumulation of proteotoxic aggregates and aiding protein refolding. This project focuses on the biochemical, mass spectrometry-based proteomic and bioinformatic analysis of heat shock proteins that are involved in the cellular stress response	Semester 1 only
	Biochemical and bioinformatic analysis of bioenergetic pathways in skeletal muscle. Biochemical pathways are of central importance for providing and supporting the energy needs for the physical demands that are associated with excitation-contraction-relaxation cycles of the skeletal muscle system. Individual muscle fibres can be divided into fast-glycolytic versus slow-oxidative types. The bioenergetic mechanisms that are linked to anaerobic versus aerobic muscle metabolism differ according to contractile fibre type specifications. This project focuses on the biochemical, mass spectrometry-based proteomic and bioinformatic analysis of key enzymes that are involved in bioenergetic pathways in fast versus slow twitching skeletal muscles	Semester 1 only
	Biochemical and bioinformatic analysis of the extracellular matrix in skeletal muscle. The extracellular matrix of skeletal muscle fibres, which consists of the epimysium, perimysium and endomysium, plays a key role in the provision of force transmission and the external support for the continued stabilization, maintenance and repair of contractile fibres. Importantly, the processes that regulate and support cell adhesion and cell migration during muscle development and fibre regeneration involve extensive cell-matrix interactions. This project focuses on the biochemical, mass spectrometry-based proteomic and bioinformatic analysis of structural and matricellular proteins that are involved in the maintenance of the matrisome of skeletal muscles	Semester 1 only
	Analysis of circulating nucleic acids in chronic liver disease.	Semester 1 only

Robinson, Mark (Chronic Disease Immunology) Robinson, Mark	Chronic liver disease is associated with the development of immune dysregulation and systemic inflammation. The immune triggers driving systemic inflammation are unclear. Circulating nucleic acids are an important danger-associated molecular pattern (DAMP), recognised by the immune system. This project will analyse circulating nucleic acids in patients with chronic liver disease	
	Investigating the diversity of inflammatory responses to SARS-CoV-2 infection. Interferons are one of the key immune defences against viral infection. Expression of interferons induces an array of interferon-stimulated genes (ISGs) in host cells. The precise ISGs induced upon viral infection can differ markedly between individuals, which presumably influences the overall host response to infection. This data-based project will utilise high-throughput RNA sequencing datasets from peripheral blood cells infected with SARS-CoV-2 and analyse the distinct induction of ISGs between individuals.	Semester 1 only
	Endogenous retrovirus expression in patients with chronic liver disease. The human genome contains a large number of endogenous retrovirus sequences. This includes both mutated and potentially viable protein-coding sequences. This retroviral DNA is usually silenced but can become expressed in a process known as derepression. Chronic inflammation can potential trigger this derepression. This project will examine the expression of retroviral DNA sequences in patients with chronic liver disease, a condition often associated with systemic inflammation	Semester 2 only
Schroeder, Martina (Host-Pathogen Interaction Lab.)	**Expression analysis of DDX3X isoforms that may explain the oxymoronic behaviour of DDX3X during disease.** DDX3X is a human RNA helicase whose dysregulation has been linked to several diseases, including viral infections, cancer and neurodevelopmental delay. Puzzlingly, it can have both oncogenic and tumour suppressive effects, and it can also be pro- or antiviral in different viral infections. We have recently started to investigate whether the expression of different DDX3X splice variants and protein isoforms can explain some of this oxymoronic behaviour. The student will use PCR-based methods to detect expression of different transcript variants in human cDNA samples derived from different cell types. The aim is to first validate our method for detecting DDX3X transcript variants (with a focus on a particular exon-skipping variant, transcript variant 3 (TV3)) and to then produce initial data about the potential cell-type specific expression of TV3 compared to the main isoform 1 (TV1). The student will also carry out in silico alignments and use web-based resources like Uniprot to make predictions about potential functional differences between TV3 and TV1.	Semester 1 only
	Investigate whether and how DDX3X regulates the expression of mTOR. DDX3X is a human RNA helicase whose dysregulation has been linked to several diseases, including viral infections, cancer and neurodevelopmental delay. One of its main cellular functions seems to be the regulation of gene expression at the level of translation initiation by remodelling RNA structures in 5'UTRs of specific mRNAs. mTOR is a key regulator of metabolic reprogramming and as such is very important for cellular adaptations to stress. Because general protein synthesis is greatly repressed during cellular stress, one key open question is how synthesis of proteins that are critical for the stress response, like mTOR, is specifically maintained during these conditions. In this project, the student will analyse whether DDX3X overexpression or knockdown affects translation initiation from this element in the mTOR 5'UTR using luciferase reporter gene assays. The student will use mammalian cell culture and transfection of mammalian cells, as well as luciferase reporter gene assays during this project. This project has the potential to be expanded into a PhD project should a student be interested in submitting PhD scholarship applications. If convincing data is generated, there is also potential for authorship on a resulting publication in a peer-reviewed scientific journal	Semester 1
	Analyse regulation of translation initiation by DDX3X.	Semester 2 only

	DDX3X is a human RNA helicase whose dysregulation has been linked to several diseases, including viral infections, cancer and neurodevelopmental delay. One of its main cellular functions seems to be the regulation of gene expression at the level of translation initiation by remodelling RNA structures in 5'UTRs of specific mRNAs. Using a transcriptome-wide protein-RNA crosslinking method (PAR-CLIP), we have recently identified DDX3X mRNA targets in uninfected and virus-infected cells. Our aim is to understand DDX3X's contribution to the regulation of host gene expression during a viral infection. The student will be involved in confirming the regulation of selected DDX3X mRNA targets using luciferase reporter gene assays. To this end, the student will use mammalian cell culture, transfection of mammalian cells with plasmids, shRNA knockdown of DDX3X, and luciferase reporter gene assays. Should convincing data emerge on an interesting target, there is potential to expand this into a PhD project proposal for students interested in submitting PhD scholarship applications	

Capstone Group 3. BI448 Prior Research Project. (Available to pre-approved students only)

This 15-credit module completed in semester 1 accredits prior research experience in the previous 12 months by students who have performed research, usually as a summer scholarship or summer school. The benefit to a student is that you can get credit for having learned skills and performed recent research. You still need to write up your work, but you will free up a lot of time during term. However, the department must assure that your experience is recent, thorough and of good quality. You will still need to give an oral presentation and prepare a short report and a write-up on your work for assessment. Students who have taken a research-intensive project (min 5 weeks duration) in the previous 12-month period may gain accreditation for that research in lieu of a conventional research project. Typical examples of such research include (but are not limited to) an HRB summer student scholarship, a Maynooth University SPUR scholarship, Irish Cancer Society Summer scholarship etc.

To select this option, the department must first check that the quality of your experience meets our standards. You must therefore have submitted a description of the research /course on a form available on **BI420** moodle page and submit to the 4th year coordinator by **4pm 28th September 2023**. Email Bernard.Mahon@mu.ie Subject line: BI448. We recommend you use your Maynooth email account in all correspondence with the University.

For assessment, students are required to:
Either a) prepare a short **2,500**-word literature review on their research topic, provide a 12 minute oral presentation of their research findings to a department academic, and a written thesis outlining their research goals, methods, findings and outcomes. Details will be available on the BI448 moodle page)
OR b) (with the support of your research supervisor) a 12 minute oral presentation of their research findings to a department academic plus a draft scholarship application in the format of the IRC studentships (or other student identified source) with an identified investigator/mentor. Your mark will be based on a draft application prior to any significant input from your supervisor. This option is considered attractive for students who wish to apply for a John & Pat Hume PhD scholarship [MU John & Pat Hume Doctoral Awards | Maynooth University] or a Government of Ireland postgraduate scholarship [Funding | Irish Research Council]. Choice of assessment will be determined by the module coordinator after a communication with Group 3 students early in semester 1.

Capstone Group 4: BI447. Sandbox Research Project

Students for this option **have already been selected by interview at the end of third year**. Entry to this module is therefore closed to further applicants.
Students work in small groups to undertake a 16-week research project over two semesters for 20 credits. The goal of the project is to solve or advance a solution for a real-world scientific problem in a local industry. Typically, the problem will be set by a "sponsor" from industry, social enterprise or other who may also input to update meetings and the final assessment. An academic from the department will act as an advisor and will be responsible for assessment and

overseeing the project. Projects may be based off-campus depending on the nature of project and sponsor. Assessment is by a) Engagement: 30%; b) Final report (<**2,500** words) 50%, c) Oral presentation 20%. Engagement will be assessed by a combination of attendance, minutes of student meetings and reports from the sponsor. Non-engagement in group work or non-attendance without valid support, may lead to a pro-rata cap on mark. More details are available on the BI447 moodle page.

DESCRIPTIONS OF LECTURE MODULES AVAILABLE 2023/2024

(SEE **Course Finder** FOR FULL MODULE DESCRIPTIONS)

You must register (and successfully complete) sufficient lecture modules to achieve 60 credits.

FAILURE TO ATTEND AND ENGAGE IN THE CONTINUAL ASSESSMENT COMPONENT OF A MODULE WILL HAVE A SIGNIFICANT EFFECT ON YOUR FINAL MODULE GRADE, AND MAY BE COMMENTED ON IN STUDENT REFERENCES

Copies of previous exam papers may be used as a guide to the types of question which might be set, but you are reminded that courses are continually evolving and the content will not remain the same from one year to the next. Past examination papers can be obtained from the Library homepage, https://www.maynoothuniversity.ie/library at the bottom left of the screen in Quicklinks. However memorising answers is not recommended as exam preparation at 4th year.

BI403 Plant Biotechnology

In the first half of the course, the commercial use of tissue culture methods for rapid clonal population of crop plants is followed by a consideration of the potential for producing valuable chemicals in cell cultures, and the potential for mutation breeding at the cell level. The remainder of the course looks at the procedures for genetic transformation of crops, examines the relative merits of nuclear vs plastid transformation, and reviews the progress in relation to a range of traits including herbicide, pest, stress and disease resistance, improved nutritional and storage quality of foods, and the production of valuable pharmaceuticals.

The different methods for transforming crop plants are explained, including infection with modified pathogens such as *Agrobacterium tumefaciens*, and direct DNA delivery methods such as particle bombardment (the "gene gun"), and chemically or electrically induced uptake into protoplasts. The importance of regulation of gene activity, and stability of the transgene are considered, alongside ethical and safety concerns about exploiting the technology. Particular traits, which can be tackled by this approach, are evaluated as a number of case histories. Foremost among these are those which have already led to a marketed product, e.g. tomatoes with a long storage life, cotton resistant to boll weevil, and herbicide resistant soybean. Several other characters are under development in this rapidly moving field, and new case histories will be introduced every year. **BI403**

BI405 Advanced Immunology

This module will provide the students with a detailed understanding of the immune system, including the signalling pathways and effector molecules that mediate immune effector functions. Topics covered include: Innate Immunity, Pattern recognition receptor signalling, the Major Histocompatibility complex, antigen processing and –presentation, T and B cell activation, Immune effector mechanisms, Cell migration and Inflammation, Transplantation immunology, the immune response to viruses and viral immune evasion. **Assessment:** Total marks 100%. 70% for two hour written examination at the end of the semester, **30% continuous assessment: Moodle based assessment 10%; MCQ 20%.**

Pass standard: 40% overall with minimum 30% in written exam and 40% in continuous assessment. **BI405**

BI406 Behavioural Ecology

This module will enable students to develop an understanding of the adaptive value of behaviours to animals and how these behaviours evolve. Specific topics covered include the altered behaviour of parasitised animals (parasite manipulation and alternative explanations), optimal foraging (how animals make decisions about what food to eat and where to look for it) and a range of topics associated with reproductive behaviour (sexual selection, sperm competition,

partitioning of reproductive effort between mating and parenting, mating systems, and sexual conflict). The overall objective is to understand how behavioural strategies contribute to animals' fitness. **BI406**

BI407 Tumour Biology

The course is lecture based with prescribed additional reading and self-directed private study. The course examines the question "What is Cancer?" To answer this, the following topics are explored: Control of the Cell division cycle; Cyclins and cyclin dependent kinases; Oncogenes, Tumour suppressor genes; DNA and RNA tumour viruses; Familial cancers; a detailed study of the role of the Rb gene; P53 as the guardian of the genome; Cell death; Positive and negative induction of apoptosis; the execution phase of apoptosis; beyond the molecular biology of cancer; how the body resists neoplasia; tumour progression; Angiogenesis, how diagnosis is made; the major therapeutic interventions (existing therapies and new therapies). **Assessment: Assessment:** Total marks 100%. 75% for two hour written examination at the end of the semester, **25% continuous assessment:** Moodle based assessments (5%), 1 MCQ 20%

Pass standard: 40% overall with minimum 30% in written exam and 40% in continuous assessment. **BI407**

BI410 Plant Developmental Biology

The course is lecture based with prescribed additional reading and recommendations for self-directed study. Topics may vary from year to year but typically include: meristems and their importance for plant development, how meristem architecture is established and maintained; changes in meristem identity; how flower pattern is established. An evolutionary approach to aspects of plant development is emphasized as much as possible.

On successful completion of the module, students should be able to:

- Discuss current views on the molecular and genetic factors that regulate aspects of plant development e.g. meristem architecture, meristem identity, flower development.
- Explain how developmental models established for model species can contribute to our understanding of how plant diversity has been generated.
- Evaluate recent primary literature relevant to enhancing their understanding of this subject.
- Take personal responsibility for their learning.

Assessment: Total marks 100%: 80% for two hour written examination at the end of the semester, 20% for continuous assessment.**Pass standard:** 40% overall with minimum 30% in written exam. **BI410**

BI411 Bioethics & Biotechnology

Module Content: How ethicists work; basic Western ethical ideas including classical and preference utilitarianism, Kant and deontological theory, rights approaches, virtue ethics, feminist thought, the void; application to issues in biology, biotechnology, medicine and environment. Current cases histories with stakeholder analyses: these may include genetic engineering, cloning, patenting of biological material. Detailed knowledge of relevant biotechnological science will form a central part of the bioethics component of this module. Fungi are amazing reservoirs of bioactive molecules, such as penicillin and statins, which are used to treat human diseases. Collectively, these molecules are known as natural products (NP) or secondary metabolites (SM) and are made by fungi, and bacteria, using processes known as non-ribosomal peptide synthesis or polyketide synthesis. This course will provide the student with a thorough understanding of these biosynthetic processes at the molecular and proteomic level. This topic is of special relevance as many microbial genome mining programmes are identifying ever more genes involved in NP biosynthesis. Consequently, research in this area is beginning to reveal a range of new molecules with biomedical potential. **BI411**

BI433 Translational Clinical Research

This module focuses on examples of how fundamental laboratory-based research has led to improvements in the diagnosis of, or therapy for, diseases. Students will also gain understanding of technologies used for bioproduct generation and the *in vitro* diagnostics and blood product industry. The module examines the development of novel diagnostics/therapeutics and show how these have been brought through clinical trials, obtained regulatory clearance, and introduced into routine clinical practice. Case studies focus on the development of an innovative Parvovirus diagnostic assay or high sensitivity detection systems. How murine animal models are used in medical research to identify new drug

targets will be discussed. Candidate biologic therapies in clinical use for the treatment of inflammatory diseases and the development of 'checkpoint inhibitors' for cancer immunotherapy will be explored. The course also focuses on the different types of molecular targets that can be exploited in drug development with specific emphasis on how basic research around receptor signaling pathways has contributed to the discovery of new anti-inflammatory drugs. This module examines the link between fundamental research and clinical practice and demonstrates how the two activities are mutually beneficial in terms of patient care and therapy. **BI433**

BI435 Molecular Ecology & Biogeography

This module considers the broad topic of natural history in a global context. Section 1 begins with a general recap on the principles of DNA variation, and how this understanding influences our reading of observed patterns of genetic variation in natural populations. We also consider the utility and application of molecular markers to understand inheritance, natural selection and genetic divergence using standard population genetics techniques. To support the development of our understanding, we consider a wide range of field examples, including case studies of gene-flow in the wild, including animal and wind-based dispersal patterns and gene flow between crops and wild plants. We also apply this knowledge to consider Conservation genetics of endangered mammals. In section 2, we review the theory of Plate-tectonics and the inferred dynamics of past climate cycles and glaciations. We then consider historical biogeography in the broad sense, and the tracing of historical migrations using nuclear, mitochondrial and chloroplast DNA markers; with special emphasis on the postglacial colonization of Europe by animals and plants and the biogeographic impact of continent collisions, illustrated by case studies of recent invasions in Europe and Tropical Central America and Southeast Asia. In each case we review evidence for dispersal waves, hybridization zones and extinction events. **BI435**

BI436 Medical Mycology

Fungal pathogens are a major cause of superficial and systemic disease in immuncompromised (e.g. HIV+ patients) and immunodeficient (e.g. transplant recipients) patients and may contribute to over 4% of hospital-based deaths. The diagnosis and treatment of fungal infections can be difficult and there is a limited range of effective anti-fungal agents currently in use. This module will examine the molecular and cellular mechanisms employed by fungal pathogens to colonise and disseminate within the host, and to evade the immune response. Specific sections will examine the biology of the yeast *Candida albicans* and its ability to colonise mucosal surfaces. The role of toxins in the pathogenesis of *Aspergillus fumigatus*, a pulmonary pathogen, will be discussed. The emergence of 'new' fungal pathogens will be studied and the factors that have lead to their emergence will be characterized. Other areas to be studied include means of diagnosing fungal infections, treatment options, mode of action of antifungal agents, and the immune response to fungal infection. **BI436**

BI437 Neuromuscular Biology

This advanced module focuses on the molecular and cellular mechanisms of normal skeletal muscle functions, as well as the molecular pathogenesis of selected neuromuscular disorders. Specific sections will be concerned with the biochemistry, physiology, cell biology and ultrastructure of skeletal muscle fibres, focusing on the molecular mechanisms underlying development, differentiation, fibre transitons and metabolic adaptations to changed functional demands. The diagnosis of muscle diseases and pathobiochemical aspects of major neuromuscular pathologies will be examined, including a discussion of disorders related to myasthenia gravis, myotonia, motor neuron disease, malignant hyperthermia, x-linked inherited muscular dystrophy, disuse atrophy and sarcopenia of old age. Cell biological and biochemical research tools in the study of the molecular pathogenesis of genetic, autoimmune and pharmacogenetic muscle disorders are described. The potential sites for genetic and cell biological interventions at different stages of the neuromuscular disease process will be discussed. **BI437**

BI439 Antibiotics: Discovery, Modes of Action & Resistance

The series of lectures would start with a short introduction into how the antibiotics that we use today were discovered and developed over the past century. This would incorporate the discovery of the first antibiotics all the way to the use

of screening genomes for the 'next big thing', to explaining that most pharmaceutical companies have abandoned their R & D in this area. The next section would introduce the students to the different classes of antibiotics, how they differ and how they interact with the bacteria to inhibit their growth or kill them. This section would also give a brief introduction to the pharmacodynamics and pharmacokinetics that are necessary for the antibiotic to function in the body. The following lectures would be a discussion of the different mechanisms of resistance and emerging resistance problems and epidemics of resistance currently of concern. The techniques used to measure antibiotic susceptibility or resistance in hospital laboratories and the molecular methods that we can now use would be described to highlight how a combination of phenotypic and molecular tools can aid the understanding of resistance. There will also be a section on the origins of antibiotic resistance and how resistance mechanisms may have entered into the human food chain or other possible routes of transmission to human pathogens and the importance of human waste in the propagation of resistance in the water supply and environment. The module would encompass human, agricultural and environmental antibiotic use and resistance to discuss the problem from a One Health perspective. **Lecture content** (two lectures for each topic):

* Antibiotic history and discovery from 20th to 21st century.
* Antibiotic classes, mode of action and bacterial inhibition or killing.
* Pharmacokinetics and pharmacodynamics of antibiotics.
* Mechanisms of antibiotic resistance.
* Emerging antibiotic resistance problems and epidemics worldwide.
* Measuring antibiotic resistance in a hospital laboratory.
* Molecular methods used to detect the emergence and spread of resistance.
* Origins and transfer of antibiotic resistance prior to the pathogen.

BI439

BI440 Control of Protein Activity

Proteins are fundamental cellular components that regulate practically all processes in the cell. The control of their activity and abundance is essential for their physiological function and therefore needs to be tightly regulated. This course focuses on the cellular mechanisms leading to the control of protein activity and abundance and describes how changes in protein function affect biological processes (e.g. transcription, developmental programs, immunity…). Topics covered include basic notions of protein structure; changes in protein activity through protein-protein interactions; control of protein activity by ligand binding; regulation of protein activity and localization by different types of covalent modifications; role of signaling cascades involving kinases; control of protein stability by the ubiquitin/proteasome system. These topics will be introduced and illustrated using examples from a wide range of research areas, as well as from different organisms such as bacteria, yeast, plants and animals. **BI440**

BI441 Fungal & Bacterial Secondary Metabolism

Fungal and bacterial secondary metabolites have great potential due to their potent physiological influences on cellular functions such as antibiotics, antivirals, antifungals, antiapoptotics, cytotoxics, immunosuppressives, and deadly mycotoxins. Therefore, they are extremely important for medical, biotechnological and chemical applications. The focus of this advanced module is the fungal and bacterial secondary metabolites and the control of their production by genetic and epigenetic factors. Specific sections found in this module will be connected with chemical biology, genetics, epigenetics and fungal molecular biology. The major classes of microbial natural products and their biosynthetic pathways will be introduced. Potential impact of the bioactive metabolites in biotechnology, medicine and chemical biology will be discussed in depth. The term "gene clusters" will be introduced by analogy to prokaryotic operons. Control of gene clusters in fungi at the chromatin and epigenetic level will be examined by examples of histone modifications. Cellular signaling elements (MAPK, PKA, PKC) regulating the biosynthesis of fungal secondary metabolites will be analyzed. **BI441**

BI443 Clinical Proteomics: Discovery, Validation & Medical Utility

This advanced module focuses on the field of clinical proteomics, which can be divided into the analysis of body fluids and tissues. Soluble biomarkers will be discussed, which are found in biofluids including blood, urine and saliva, are considered

indicator biomolecules that assist in detecting diseased conditions at an early stage, make discrimination between different diseases, and are useful for monitoring progression and response to specific therapeutic strategies. Established clinical biomarkers such as carcinoembryonic antigen (CEA) will be discussed and problems associated with their diagnostic utilities will be addressed. Expression of tissue-based proteins (up-regulation or down-regulation) in various pathological conditions will be explored with emphasis on metabolic and signalling pathways as potential therapeutic targets for treatment of disease. The relationship between biomarkers and therapeutic targets will be examined and the role of companion diagnostics in this area assessed. Underpinning clinical proteomics are the recent developments in quantitative mass-spectrometry, array-based high-throughput protein microarrays and novel fractionation technologies, which will be examined in detail. The role of other "omic" methodologies that are complementary and synergistic to clinical proteomics will be reviewed, specifically looking at metabolomics as an example. **Assessment:** Total marks 100%; 80% for two hour written examination at the end of the semester; Continual Assessment 20% (made up of 2 MCQ's – 10% each, the first MCQ in the middle of the lecture series and the second MCQ at the end). **BI443**

BI444 Human Nutrition and Metabolic Disease

Module Objective: To expose students to biochemical and cellular aspects of human nutrition and metabolic disease. This advanced module focuses on the molecular and cellular mechanisms of human metabolism, as well as the pathogenesis of selected metabolic disorders. Specific sections will be concerned with:

1. The major macro and micro nutrients, and the bodies physiological response to their intake,
2. The biochemical and cellular regulators of food intake and bodyweight,
3. The diagnosis of metabolic disease and pathobiochemical aspects of major metabolic disease will be examined, including Obesity and Type 2 Diabetes Mellitus (T2DM).

The current therapeutic strategies for treating metabolic diseases including lifestyle modification, GLP-1 analogues and bariatric surgery. Discussing the impact each has on the biochemistry and physiology of food intake and the cellular regulators of metabolism. **Learning Outcomes:**

- Outline the major macronutrients and micronutrients.
- Discuss the factors which regulate food intake and bodyweight.
- Discuss the cellular players involved in the regulation of bodyweight.
- Identify the main diagnostic methods of detecting metabolic diseases in humans.
- Define major aspects of metabolic diseases including obesity and T2DM.
- Define the major strategies for treating metabolic diseases in humans.
- Examine the mode of action of defined interventions including molecular and cellular aspects.

BI444

DEPARTMENT OF BIOLOGY STAFF RESEARCH INTERESTS

Name & Qualifications	Key Words	Research Interests
Dr O. Bayram, MSc PhD	Secondary metabolism, Mycotoxins, Fungal development, Cell signalling, Epigenetics, Gene expression, Protein-protein interactions	https://www.maynoothuniversity.ie/biology/our-people/ozgur-bayram#2
Dr M.P. Butler BSc PhD	Cancer, Toll-like Receptor Signalling, sex differences in immune responses.	https://www.maynoothuniversity.ie/biology/our-people/marion-butler#2
Dr J.C. Carolan B.A (Mod) PhD	Proteomics, Mass Spectrometry, Genomics, Molecular Biology, Bumblebees, Crop-pest Interactions	https://www.maynoothuniversity.ie/biology/our-people/james-carolan#2
Dr N. Curran BSc PhD	Plant Biology	https://www.maynoothuniversity.ie/people/noreen-curran
Dr J. Devaney BSc PhD	Ecology, Forest Ecology, Climate Change, Biodiversity-Ecosystem Function, Invasive species	https://www.maynoothuniversity.ie/biology/our-people/john-devaney#2
Dr. T. Dirilgen BSc PhD	Ecology, Biodiversity (aboveground and belowground), Soil-Plant-Pollinator interactions, Soil biology and ecology, Sustainability	
Dr P. Dowling BSc PhD	Oncoproteomics, Biomarkers, Detection, Biofluids, Mass Spectrometry	https://www.maynoothuniversity.ie/biology/our-people/paul-dowling#3
Professor S. Doyle BSc PhD	Disease diagnosis, Antimicrobial resistance, *Aspergillus fumigatus,* proteomics, nonribosomal peptide synthesis, Disease diagnosis, immunoassays and enzymology.	https://www.maynoothuniversity.ie/biology/our-people/sean-doyle#2
Professor K. English MSc PhD	Cellular therapy, mesenchymal stem cells, immune modulation, pre-clinical models of inflammatory disease, organ transplantation, acute respiratory distress syndrome, asthma, gene therapy, muscular dystrophy	https://www.maynoothuniversity.ie/biology/our-people/karen-english#2
Dr D.A. Fitzpatrick BSc PhD	Computational Biology, Bioinformatics, Genome Evolution, Phylogenomics, Genomics, Transcriptomics, Proteomics, Fungi, Metabolic pathways, Genome sequencing, oomycetes.	https://www.maynoothuniversity.ie/biology/our-people/david-fitzpatrick#2
Dr E. Graciet MSc PhD	Protein degradation, biochemistry, plant molecular biology, plant-pathogen interactions, abiotic stresses, crop improvement	https://www.maynoothuniversity.ie/biology/our-people/emmanuelle-graciet#2
Dr A. Hogan BSc PhD	Immunology, obesity, cancer, metabolism, immunometabolism	https://www.maynoothuniversity.ie/biology/our-people/andrew-hogan#2
Dr. G. Hoysted BSc PhD	Fungal biology, Microbial Ecology, Mycorrhizal Interactions, Plants, Bacteria, Above-below ground interactions, Sustainability	

Professor K.A. Kavanagh BSc PhD	*Aspergillus, Candida,* Fungi, Innate immunology, Insect, Medical mycology, metal-cell interactions, Proteomics	https://www.maynoothuniversity.ie/biology/our-people/kevin-kavanagh#3
Dr L.M. Lopez BA PhD	Genomics, Human Health, Circadian Rhythms, Sleep, Neurodevelopmental Conditions.	https://www.maynoothuniversity.ie/biology/our-people/lorna-lopez#2
Dr A.M. Maher BSc PhD	Entomopathogenic nematode, microbes, symbiosis, biodiversity	https://www.maynoothuniversity.ie/biology/our-people/abigail-maher#2
Professor B.P. Mahon BSc PhD	Cell Biology, Immunology, microbiome/immune interaction	https://www.maynoothuniversity.ie/biology/our-people/bernard-mahon#2
Dr J. Masterson BSc PhD	Allergy, Inflammation, Epithelial Cell Biology, Stem Cells, Fibrosis, Mucosal Barrier, Cellular Metabolism	https://www.maynoothuniversity.ie/biology/our-people/joanne-masterson#2
Dr E. McNamee BSc MSc PhD	Autoimmunity, Mucosal Immunology, Translational Immunology, Chemokines, microRNAs	https://www.maynoothuniversity.ie/biology/our-people/eoin-mcnamee#2
Dr C. Meade BSc PhD	Ecology, Molecular Ecology, Sustainability, Biogeography	https://www.maynoothuniversity.ie/biology/our-people/conor-meade#1
Dr S. Miggin MSc PhD	Innate immunity, toll-like receptors, inflammation, Type-2-Diabetes, Osteoarthritis	https://www.maynoothuniversity.ie/biology/our-people/sinead-miggin#2
Dr. D. Movia BSc PhD	Alternatives to animal modes, non-animal preclinical research, lung cancer, nanomedicine	
Professor P. Moynagh BA(mod) PhD	Molecular Immunology, Inflammation, Inflammatory Diseases, Signal Transduction,	https://www.maynoothuniversity.ie/biology/our-people/paul-moynagh#3
Dr J.M. Nugent MSc PhD	Plant molecular biology, evolution and development	https://www.maynoothuniversity.ie/biology/our-people/jackie-nugent#3
Dr S. O'Dea BSc PhD	Cell therapy, cell engineering, cancer research	Shirley O'Dea | Maynooth University
Dr D. O'Maoileidigh BSc PhD	Plant development, flower development, fruit development, photosynthesis, transcription factors, genomics	https://www.maynoothuniversity.ie/people/diarmuid-omaoileidigh
Professor K. Ohlendieck DipBiol PhD DSc	Skeletal muscle biology, protein biochemistry, proteomics, biomarker discovery	https://www.maynoothuniversity.ie/biology/our-people/kay-ohlendieck#3
Dr R. Owens BSc PhD	Pathogenic fungi, secondary metabolites, proteomics, antimicrobial agents, food proteins	https://www.maynoothuniversity.ie/biology/our-people/rebecca-owens#3
Dr M. Robinson BBioMedSc PhD	Natural killer cells, liver disease and cirrhosis, tissue-resident immune cells, immunosenescence	https://www.maynoothuniversity.ie/biology/our-people/mark-robinson#2
Dr M. Schroeder BSc PhD	Host-Pathogen interactions, Pattern recognition receptor signaling, Regulation of gene expression, RNA Biology	https://www.maynoothuniversity.ie/biology/our-people/martina-schroeder#2
Professor F. Walsh BSc PhD	Antibiotic resistance, microbiomes, infectious diseases, bacteriology, metagenomics	https://www.maynoothuniversity.ie/biology/our-people/fiona-walsh#2

When should I email a lecturer about a module?

This communication guideline tells you:
- how your lecturers and module coordinators will communicate with the class
- how your lecturers and module coordinators will communicate with individual students
- how students can best communicate with lecturing staff and with each other

1. General guidelines

- you should **indicate your name and student number** in any e-mail you send to a lecturer.
- you should always check that your question(s) has/have not already been answered in documents posted on Moodle and Teams, or in a previous e-mail or module announcement.
- regarding general questions on module content, seek to find module information on Course Finder first.
- unless an emergency, seek to contact lecturers and module coordinators during normal working hours.
- members of staff will do their best to answer new queries within 48h (working days). Allow 48h for a reply before contacting the same person or a different staff member in relation to the same query. If your query has already been answered in a previous e-mail or post, your reply will be of a low priority and take longer.

2. Class announcements by lecturers and module coordinators

Class announcements can be done using three platforms:
- e-mails to the class. We will always use your MU e-mail address.
- and/or lecturers' announcements on a specific module's Moodle page
- and/or using the chat function in a specific module page on Teams

Class announcements can be used by your lecturers to send reminders, but also to answer queries received by e-mail from individual students, if the query is relevant to the whole class. In this case, you may not receive an individual reply to your original e-mail. It is your responsibility to check e-mails regularly, Moodle and Teams as well. We encourage you to turn on automatic notifications. A lecturer or module coordinator may not prioritize replying to your e-mail if the answer is already available to the class. Read the class material first!

3. Lecturing staff communication with individual students

If a query received by e-mail does not affect the whole class, lecturing staff will do their best to answer to the student individually in a timely manner (e.g. within a couple of days). While we are happy to help you study and provide an environment that promotes learning, some queries are not acceptable and cannot be answered.

4. What queries are NOT acceptable?

- asking for answers or corrections to previous exam questions. This query is not acceptable, because it is your work that is assessed and so your submissions need to reflect your own writing, ideas, and thoughts.
- asking for details of calculation, answers or corrections for lab-write ups or theses before these are handed in. This query is not acceptable, because it is your work that needs to be assessed. Practical-related questions should be asked to demonstrators or lecturers during the lab sessions (in teaching labs or on Teams). Technical and project queries can be resolved in meetings with your project supervisor.
- demonstrators should not be asked to provide details of calculations or to pre-correct your lab write ups at any time. All questions to demonstrators should be asked during the during the lab sessions (online or in teaching labs).
- asking for slides or lecture notes of a module that you are not registered for.

5. Communication among students in a class

Students in a class can use multiple 'official' platforms to communicate among themselves. We encourage these because they foster group work and mutual help. Posts and communications on different platforms (Moodle, Teams, e-mails) should be linked to the course/module, courteous and respectful. Note that these platforms are accessible to the whole class, including lecturers.

Platforms available:

- Class discussion forum on a specific module's page on Moodle Or
- Teams chat on a specific module's Teams group.

Communications to lecturers that do not include your name, student number (and preferably subject code) risk being missed and unanswered. Communications in the days immediately prior to deadlines and exams, should be specific and brief. Answers are likewise likely to very brief during these periods.

COMPLETING YOUR 4TH YEAR THESIS/ LITERATURE PROJECT/ WRITTEN DISSERTATION

The following sections cover information relevant for your 4th year written work (eg Literature project etc). We encourage you to read this section thoroughly, understand clearly the responsibilities you have in relation to writing an original thesis, and use the indicated resources to help improve your written work.

GUIDELINES FOR UNDERGRADUATE DISSERTATION/ PROJECT MODULES

The ORAL Component.

For all Capstone projects you have to make a 12-minute, in-person, presentation, with an additional 5 minutes allowed for questions. Oral presentation is a **compulsory** part of your degree and necessary to show that you have developed communication and presentation skills for complex topics, as well as to verify your understanding. **It cannot be delivered on TEAMS or remotely**. If you are hospitalized, or have a registered disability (with the University disability office), and consider that this might hamper your oral presentation, then please inform your supervisor at the **start of your project** who can discuss reasonable accommodations to help you. If you are not registered with the disability office, or have other issues, please engage in early communication with your supervisor who can direct you to supports available. All students are expected to meet the established assessment criteria and fulfil the required academic work and this includes the in-person oral presentation. If something goes wrong on the day or you are nervous, don't worry your supervisor has experience and clear guidelines to help you complete it successfully.

The audience for your oral will include the supervisor, one other member of staff, other fourth-year project students and possibly other research workers (postgraduate and postdoctoral fellows) from the relevant laboratory. You are required to e-mail your presentation (usually in PowerPoint form) to your supervisor at least one day before your talk. Your supervisor will prepare your presentation for the computer projector. If you have any questions about how to deliver your talk, please contact your project supervisor, alternatively more information on improving your oral presentation skills can be found online[1][2]. If your presentation is too large to e-mail as an attachment, please send it via HEA filesender: https://www.heanet.ie/services/hosting/filesender

Assessment Criteria for 4th year Oral presentations

Your lecturers use the criteria below to grade your oral work using the scale described on page 62. As stated earlier, your oral **demonstration of understanding and higher order thinking skills** (ability to synthesise material, analyse data and evaluate meanings) are what is being assessed. So, prepare well with these in mind.

Skill/ Competence demonstrated in oral presentation
Relevance of material/content presented orally (facts, examples, published work) 15%
Demonstration of understanding material. (synthesis, analysis, evaluation) 20%
Organisation of material (logic, coherence, structure**)** 15%
Timekeeping 10%
Quality of presentation 10%
Clarity of presentation 10%
Questions 20%

The Written Components

All capstone projects have at least one significant written component for assessment. A key learning objective for undergraduate thesis modules at the MU Biology Department is that you develop a sense of ownership and responsibility for your dissertations/projects. In supervisor-student relationships during the preparation of theses, responsibility is two-way. You will have expectations in terms of support and advice from the supervisor, and a supervisor will have expectations regarding independent research by you, time-keeping, regularity of work and

[1] Hartigan L & Higgins M. How to prepare and deliver an effective oral presentation *BMJ* 2014; 348 doi: https://doi.org/10.1136/bmj.g2039

[2] Bourne PE. Ten simple rules for making good oral presentations. *PLos Comput Biol* 2007;3:e77

reporting, etc. In the end, it is your dissertation/project, you are expected to take full responsibility for researching, writing and editing your own work.

Note: The following guidelines relate to staff-student interactions in preparation of all written theses. Additional specific guidelines for Literature and Laboratory projects, respectively, are provided below.

WRITING A 4TH YEAR DISSERTATION/THESIS: ESSENTIAL INFORMATION FOR ALL WRITTEN WORK

Your Responsibilities

The goal of the dissertation/thesis is to show you have developed higher order thinking in synthesizing, analysing and evaluating complex scientific material. You have to demonstrate the skills that you have developed over your previous years of study. It is essential that what you write is your own work and not a copy of someone else's work (plagiarism) or work written by someone else (essay mills) or by artificial intelligence (eg ChatGPT). To assist with this task, we provide you with several important aids:

(i) a central writing webpage (**Thesis Online Resources**, accessible on your Moodle thesis module page and the **All Biology Students 2024** Moodle page) where you will find multiple online resources to assist with completing your dissertation, including the many services offered by MU;

(ii) an online self-assessment tool 'Turnitin' (see below); and

(iii) a clear guide to what is, and is not, acceptable in terms of originality: *the Maynooth University Department of Biology Plagiarism policy* (see below).

Please familiarise yourself with all of the above, and remember - it is mandatory to follow the guidelines for turnitin and plagiarism. You must not use any AI or LLM tool (eg Grammarly, ChatGPT etc) to prepare your thesis.

Thesis preparation and development

For the BI423 Literature project 10% of your final mark is awarded for your demonstration of progression and development over the duration of the project. Details below.

Brief guide to literature searching

Before beginning any major writing (or a review of literature associated with your lab project) go to the Dissertation **Thesis Online Resources (TOR)** page to access guidance on how to proceed with literature searches for peer-reviewed material. The most common starting point are databases of peer-reviewed material, or scientific information search engines. Peer-reviewed material means material has been reviewed by scientists prior to publication in scientific journals. **You must exercise great caution in using or citing material which is not found in peer-reviewed journals as this material can be subjective in nature and, on occasion, blatantly biased to promote a particular viewpoint!**

You should note that scientific articles are often presented as follows: Abstract, Introduction, Materials & Methods, Results and Discussion. The databases/search engines listed in the dissertation **Thesis Online Resources** page will enable you to access the entire article while others will only give access to abstracts and you may then have to get the entire article either in library (paper or internet access to journals) or by inter-library loan. You should deposit the complete reference pdf in your TEAMS folder or at a minimum the abstract

You will be given further direction on accessing literature by your project supervisor and in the talks on Moodle in a series of library videos on Accessing information in the week of October 2nd and thereafter (subject to confirmation)**.** The material presented above is for quick reference only.

Assessment Criteria

Your lecturers use the criteria below to grade your oral work using the scale described on page 59. These measure how well you have built on your writing skills developed in earlier years. For final year work the emphasis shifts from writing process/skills (25%) which you have developed in years 1-3, towards critical engagement/higher order thinking/ understanding (75%)

Skill/Competence demonstrated in written material
Writing Process Skills/Composition (25%)
Writing Process (Structure/format as per guidelines, composition -spelling, grammar, use of passive voice) 10%
Writing Skills (abstract) **5%**
Writing Skills (referencing & citation) **.** (appropriate in text citation, correctly formatted bibliography, source material acknowledged) **10%**
Critical engagement & demonstration of understanding /higher order thinking (75%)
Understanding/ Use of evidence. (Breadth of survey/Adequacy of introduction, active comparison source material) **15%**
Understanding/ Use of evidence including hypotheses/research directions or trends in the current literature. **10%**
Analysis/ Relevance (including analysis of experimental approaches & methodologies) **10%**
Analysis/Relevance (evaluation and relation to findings in field) **15%**
Narrative structure & evidence of personal input Clarity/cohesiveness of Conclusions & Discussion; Logic and structure of narrative, evaluation of findings) (**25%**)

Essay Preparation and Submission – the *Turnitin* facility

As you will know from BI305 in third year, all Biology dissertations at Maynooth University must be submitted to the online *Turnitin* Facility on moodle.

Please note

1. The onus is on you to validate your work using *Turnitin*.
2. You should submit your completed work only once you have checked it on *Turnitin* and are satisfied that your written work is truly your own and not a copy of something else
3. Submitted dissertations or theses that are deemed to contain copying/ plagiarism or to have features of AI (eg ChatGPT) use will be dealt with according to the departmental policies on plagiarism and academic integrity (see page 49)

How to use *Turnitin* on Moodle - Recap

There are two steps to using *Turnitin* on Moodle. Once you have signed up for your Literature Review/ Laboratory Project Module, you will be able to access the *Turnitin* portal via the appropriate module page on Moodle. *Turnitin self-check* will be available on your dissertation module Moodle page throughout semester. In addition, each student also has an independent self-check facility supported on their personal moodle interface. Both facilities perform the same function. *Turnitin final submission*, available only on your dissertation moodle page, will be available from two weeks before the final submission date.

Step 1. During essay **preparation –** use *Turnitin self-check*

Submit your draft essay to *Turnitin self-check* to get an originality report and revise as appropriate.

Step 2. When your essay is **complete** - use *Turnitin final submission* before the submission deadline

The final originality report (and an AI detection report) for this submitted copy will only be available to your essay supervisor.

Submission of your Thesis

You are required to submit your thesis as an online document only. Your thesis must follow the text and composition guidelines for your specific essay module (see detailed description of the 4th year dissertation module relevant to you, below). We have introduced a new **2023 Dissertation Cover Page**, which is available to download on your moodle dissertation page. This must be inserted as page 1 in your final (.doc or .pdf) dissertation submission document.

For **Turnitin** *self-check* you should **only** upload, as a single (.doc or .pdf) document:

1. Abstract
2. Main Body text, including subtitles/ sections, figures, tables, legends and in-text citations. For Research Projects, this section includes materials and methods, results & discussion (see below)

For **Turnitin** Final Submission you should **only** upload, as a single (.doc or .pdf) document:

1. 2023 Dissertation Cover Page
2. Abstract and Essay Title
3. Table of Contents (if included)
4. Main Body text, including:
    a. Section and subsection titles (Literature Projects)
    b. Materials and methods, results & discussion (Research Projects, see below)
    c. All figures & legends
    d. All tables & legends
    e. All in-text citations
    f. Full Bibliography
    g. Appendices

At all times during the preparation of your dissertation you can access 'Turnitin Help for Students' on moodle at **Moodle Help for Students.**
For Turnitin problems, you can contact Moodle Support for further assistance a**t moodlesupport@mu.ie**

SPECIFIC GUIDELINES FOR BI423 LITERATURE PROJECT

The literature project prepares you to discover scientific literature, synthesise, analyse data and to use data to make decisions and recommendations. Your aim is to research literature in an area and discuss the topic under consideration, including reference to opposing views on the subject where appropriate. Your supervisor will allocate you to a broad topic, but you must refine this into a specific focus typically as a question. The thesis should not be simply a reproduction of information from review articles or book chapters, but should include your interpretation of the subject, organised to develop the reader's understanding as you think appropriate and written with authority, by one who understands the evidence and issues. The thesis should be broken into sections which should have a *General Introduction*, *Discussion* (should be broken into subsections with appropriate subheadings for sections dealing with different topics), *Conclusions* and *References*. The Conclusions should draw together the discussion points made during the discussion. At the end of the assignment, you should understand your topic fully and be capable of presenting the findings and defending your conclusions at a seminar/oral on your thesis topic. Additional advice material for academic writing can be found at Academic Writing Support and at Starting the Process - Academic Writing - LibGuides at National University of Ireland, Maynooth.

BI423 Thesis preparation and development (10%)

After your initial discussion with your supervisor, you will be assigned a unique secure folder on TEAMS. **You will be assessed on the contents of this folder (10% project mark)** and should demonstrate steady progress thoughout the course of the module. In this folder you must keep:

- A pdf copy of every source paper you cite in your thesis/dissertation. Thus you will accumulate a library of papers to be used in your thesis. A steady accumulation of papers that correspond to your bibliography will be marked highly, whereas a last minute deposition will be marked down. Fake references or references cited in your work but not present in your folder will be penalised.
- An early outline and at least two intermediate drafts of your thesis (eg at end of semester 1 and another a few weeks before submission). This creates a digital paper trail that can be used as evidence against your use of AI. Again demonstrating steady progress will be marked highly, whereas a last minute deposition of a finished thesis will be marked down.

THE LITERATURE PROJECT IS NOT TO EXCEED 5,000 WORDS. The dissertation **word count** includes the main body text of the thesis, comprising headings, text and in-text citations/ references. Not included in the word count is the abstract (which has its own separate word limit of 200 words), table of contents, table legends and table text, figure legends, bibliography/ reference list, and appendices.

Quotations. In general, use direct quotations only where the wording matters to your case, and always credit the author e.g. "Rowan (1932) described the elytra 'in all cases strongly grooved and colourful' but later work (Dods, 1946; Frish, 1983) suggests that the grooving is quite variable and in some cases the elytra are more dull than Rowan thought". It is not acceptable to transcribe large tracts of text from reviews or journal articles. Write your literature survey in your own words.

Reference Material. Familiarize yourself with the background literature relating to the project. As suggested above, go to the Dissertation **Thesis online resources** link Course: MC:BI_ALLBIOL — All Biology Students 2024 (2023-24:Year-long) (maynoothuniversity.ie), you will find multiple resources to help with your initial literature review, as well as training options within MU regarding critical skills in *researching the scientific literature*, *writing*, and *referencing/citation*. You should discuss the outcome of your literature review with your supervisor approximately 3 weeks after beginning the project. Your supervisor may provide you with additional resources if you have been unable to access them. Deposit pdf of every paper you cite in the TEAMS folder assigned to you by your supervisor.

Referencing. It must be possible to identify the source of all material which is not your own. The MU Biology Department uses the **Harvard referencing style**, and all dissertations **must** be written in this format. All references should be given fully, and in alphabetical order, in the reference list at the end of the literature survey.

Typing. Always use a spell-checker. Recommended font is Times New Roman (size 12). The thesis should be double-spaced.

Diagrams. Should be created by you. Where based on published illustrations/data these should be re-drawn by you to demonstrate the point you wish to make. The legend should contain a credit e.g. "Re-drawn from Adams (1989)", and of course Adams will appear in the reference list at the end. If, for instance, your point concerns a few chemical groupings on a large molecule, you might consider using lines to pick out all or part of the overall shape of the molecule and draw in more fully the few groups that are essential to your discourse. State in the legend any software used to create the diagram (eg Biorender)

Material beyond your competence. Where your presentation carries you into e.g. advanced mathematics or chemistry that you cannot reasonably be expected to master; deal only with the conclusions as set out by the author.

Complex original ideas. Some topics allow you to develop ideas of your own. You may like to discuss them with your Supervisor before incorporating them in your essay.

When submitting your literature project you will be required to sign a declaration on the **2023 Dissertation Cover Page** stating that you have read and understand the department's Policy on Plagiarism, and that your project is your own work. Please see the sample Cover Page will be available for you to download from your dissertation moodle page. This must be downloaded, signed and placed as page 1 of your final submission dissertation.

Advice on AI /software tools to assist your writing.

You **must not** use AI or large language models in any way to assist your thesis/dissertation. The department currently uses sophisticated tools to detect this. Use of AI or material that has features typical of AI will be subject to additional verification assessment by the academic integrity committee as detailed below page 48-50. You are not allowed to use paraphrasing or summarising tools such as (but not limited to) Grammarly. You are also strongly advised not to use *MyBib* for citation/bibliography construction. Instead use the software provided free to students by the University such as Endnote, Mendeley etc. Use the skills you have developed in earlier years and advice fom your supervisor.

You are recommended to use

- PubMed or other reputable portals to find primary literature.
- Endnote, Mendeley (or the citation manager embedded in MS Word) to manage and format your references. Free versions are available to all MU students

(https://nuim.libguides.com/ReferenceManagementSoftware/Overview) and you should have learned to use these in your third year courses (eg BI305). Avoid MyBib as a reference tool.

- BioRender may be used to create diagrams or other similar software where you create the material (but not an AI tool). State the tool used in a figure legend.
- Excel, Prism or similar programmes may be used to prepare graphs and figures and perform appropriate statistical analyses.

Supervisor Meetings

In the week following the assignment of topics (2-6 Oct), students should contact their supervisor to arrange a first meeting. Further meetings will be arranged by agreement.

Role and Responsibilities of Supervisor

- To set the essay/ project topic and provisional title
- To set up a folder in Microsoft TEAMS for each student supervised
- To provide general background information on the subject area including some starter references and deposit pdf of these in the student's TEAM folder
- To inform student of expected standard of research and citation (eg. the Harvard format)
- To brief student on the importance good essay structure, and provide feedback to the student later in the process regarding their proposed essay title, focus and structure, and to inform the student of the consequences of using AI or plagiarism
- To inform student of likely challenges in terms of planning and deadlines
- To make clear to the student that further reasonable contact (eg attendance at lab meetings) is welcome, including additional meetings as the student progresses with their work

Role and Responsibilities of Students

- Following the first meeting with your Supervisor, to read around the broad topic and inform Supervisor of your chosen essay title (if applicable).
- To deposit in your TEAM folder **all of the material you cite as pdf**, and the early drafts of your thesis (typically an initial outline, a draft before end of semester 1 and one about 2 weeks before submission)
- To understand the University policy on Plagiarism and Academic integrity, and to present and discuss only your own work or that supported by a citation
- Consider seriously the advice and recommendations of the supervisor regarding research work, citation and time management
- Understand that the supervisor is there to assist with the task of completing a dissertation to standard and on time through advice which you should follow
- Understand that it is not within the remit of the supervisor to correct any essay or project dissertation text prior to submission.

PLAGIARISM & THE 4TH YEAR RESEARCH THESIS- Your responsibilities:

Your thesis will inevitably draw on the work of others. The effective use and evaluation of existing material are among the skills that you are expected to develop in University. In all cases, when you build on the work of others you must cite the source of the material (an idea or opinion, a quote, data, diagrams etc). It must be acknowledged in a standard form of referencing. Details of the referencing format are given above but here are some practical tips to help you:

1. You must present a work of scholarship in your own words and diagrams.
2. If you state a fact or rely on data from another source, you must acknowledge that source in the form of a citation in the text. Citations must be listed in a bibliography/reference list. The only exceptions are "common knowledge" where citation is not needed eg "The leaves of many plants are green" or "Whooping cough is a childhood respiratory disease" or "Glucose is a six Carbon sugar". Such knowledge is ubiquitous and does not need citation. Knowing when or when not to cite is a skill you can demonstrate in your thesis.

3. If you use a diagram or figure from another person's work, you must cite this in the legend and the bibliography. Do not reproduce the copyright material of others without permission.
4. If the exact words used by someone else are important to your argument, then you may use these within quotation marks and must cite the source. Be sparing in using direct quotes, only do so when the precise wording is essential.
5. If you have paraphrased someone else's argument, data or conclusions, then this must be acknowledged by citation.
6. Paraphrasing that dominates your work, does not include your own intellectual input or is simply a rewrite of another person's effort is still plagiarism, even if you do use citations. You must provide an intellectual input that adds to the existing material. This point is particularly relevant to students wishing to follow postgraduate study. It should be a warning that your approach is poor if you find yourself changing words to get your Turnitin score lower.

   In summary, your work will rely on the work of others. You should understand that material and think about it.

Use your own words to describe the essential point that is relevant to your thesis, and cite your source in the text as well as the reference/bibliography section. If you are worried about what constitutes plagiarism, contact your project supervisor.

When submitting in your literature/laboratory project you will be required to sign a declaration, on your 2023 Dissertation Cover Page, stating that you have read and understand the department's Policy on Plagiarism, and that your project is your own work. Please see the sample Cover Page available for you to download from your dissertation moodle page.

This must be downloaded, signed and placed as page 1 of your final submission dissertation.

Department of Biology Policy on Plagiarism and Use of AI tools

Definition of Plagiarism

Plagiarism involves an attempt to use an element of another person's work, without appropriate acknowledgement in order to gain academic credit. It may include the unacknowledged verbatim reproduction of material, unsanctioned collusion, but is not limited to these matters; it may also include the unacknowledged adoption of an argumentative structure, or the unacknowledged use of a source or of research materials, including computer code or elements of mathematical formulae in an inappropriate manner.

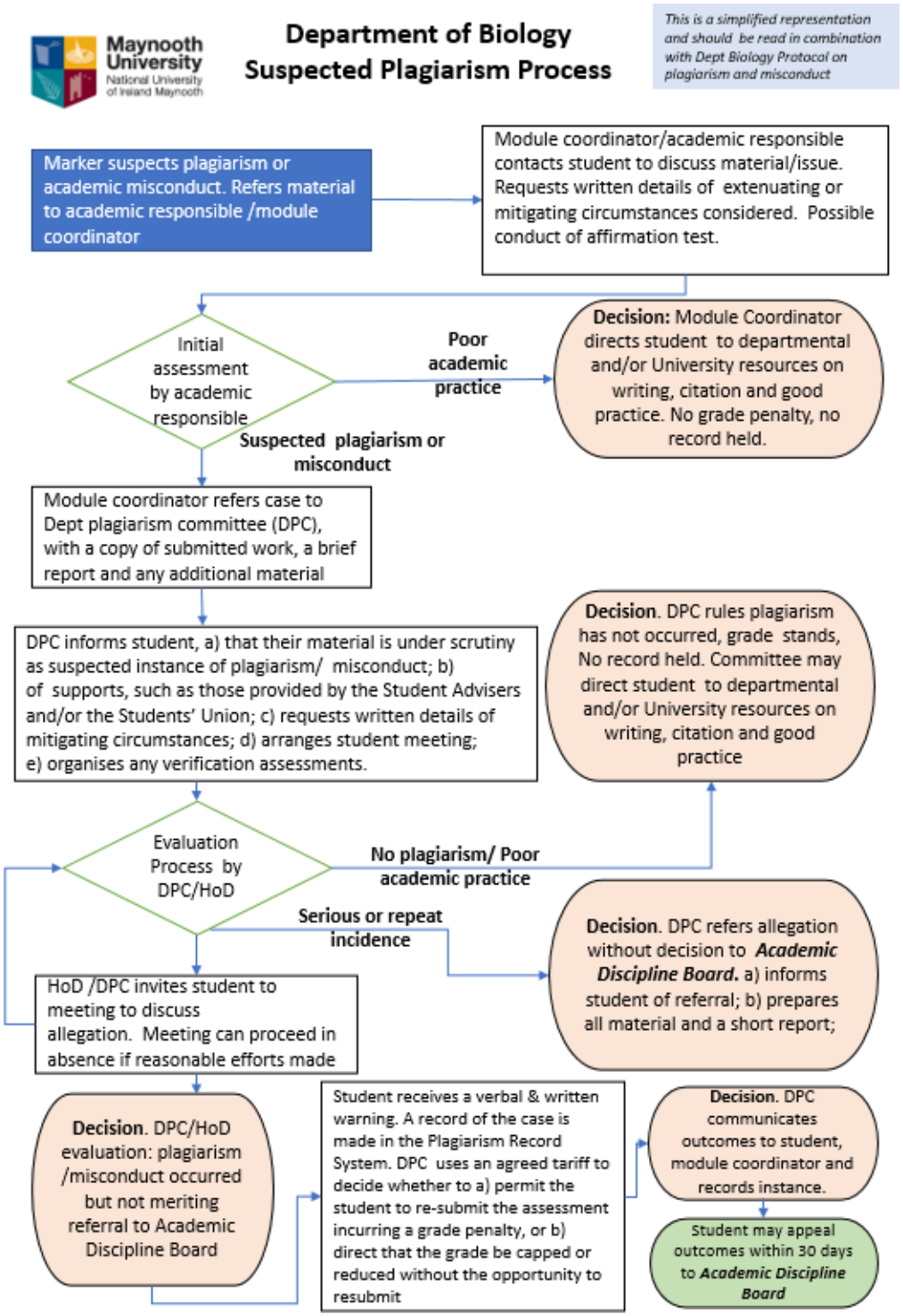
The policies of the University apply within the Department of Biology, as contained on the Maynooth University website (https://www.maynoothuniversity.ie/university-policies/rules-regulations-students). Plagiarism is a form of academic dishonesty and will be **treated with the utmost seriousness** wherever discovered. Now that you have reached your final year, you have had sufficient training to know what plagiarism is, there is no valid excuse for it to occur and whereas in earlier years the approach was to re-educate students when plagiarism occurred, in fourth year the consequences can be very serious.

Summary of Characteristics/Available Decisions within the Department to guide academics.

	Decision	Characteristics (not exhaustive)
A	Allow the result to stand.	This will be where the academic responsible (or other eg DPC) considers that any misconduct or plagiarism is very minor (a small number of sentences/<10% total etc) and the result remains a fair reflection of the understanding by the student. The latter may be demonstrated by a verification assessment or otherwise.
B	Adjust the result for the module to reflect the	This will include cases where the academic refers the case to the DPC and the DPC believes that the initial mark is not a fair reflection of the student's understanding, and is able to determine an appropriate mark. The mark adjustment should

	performance demonstrated by the student	be proportionate to the extent of the plagiarism For example, in the instances of plagiarism such as one or two paragraphs or multiple non-contiguous sentences (between 10-30% overall), then a reduction of between 10-30% night be appropriate. If a student has written a passable assignment, but then pasted in additional material which would have resulted in a higher mark the mark could be reduced to the minimum passing grade. Alternatively, an additional "make up" assignment may be requested by the DPC to achieve the adjusted mark.
C	Set a mark of zero and allow the student to resit, in line with normal resit arrangements.	In instances of major plagiarism, where a significant part (for example >30%) of an assignment is found to be plagiarised, the Department will "award a mark of zero in the assignment" but allow the student to resit in line with normal resit arrangements. There will be no possibility of submitting a 'make-up' assignment, and previous work submitted in connection with the course may be subject to further scrutiny.
D	Set a mark of zero and allow the student to resit, but with a cap on the resit mark.	As "C" but the DPC may decide to cap the resit mark where it is the norm in the Department to cap resit, or where there is a potential advantage in late submission. For example, where access to the feedback given to the rest of the class would be a significant advantage, the department may decide to cap the mark. The department may also decide to cap the mark where it believes there was limited collusion or intentional use of external assistance, or similar.
E	Refer case to the Academic Discipline Board of Maynooth University.	This should be used in the more serious cases which include: a) Students who have had multiple exam/assignment integrity issues in different sittings b) Cases where there is evidence of intent. c) Cases of impersonation or material being purchased or suspected of purchase. This will normally be used for repeat offenders, but may also be used for first offences in the most serious cases such as buying essays, or premeditated cheating.

This policy will be implemented in the following manner for final year students: As far as practical and in line with Maynooth University policy, plagiarism will be assessed in the Biology department according to set criteria (levels A-E) reflecting the severity of the issue. Levels are derived from the MU University policy (Rules & Regulations for Students | Maynooth University). Thankfully plagiarism in the final year is rare but when it occurs it is often considered at level C or above and can have severe consequences. The following chart outlines the process:



The Academic Discipline Board of Maynooth University has powers to recommend students be suspended or expelled from the University.

All members of the Department providing a reference for a student **may be obliged to mention an instance of major plagiarism**, or two or more instances of minor plagiarism, when providing a reference for the student.

Responsible Use of Artificial intelligence tools for assignments submitted to the Biology Department.

This section lays out the departmental advice and policies on how to use artificial intelligence (AI) ethically and responsibly to support your learning. It details when AI may or may not be used in your assignments.

Be cautious when using AI tools for assignments.

ChatGPT does not "know" the material it presents is fake and if you do not understand the output, then neither do you. You must not use AI tools in your final year project

The key to appropriate use of large language model (LLM) tools (eg ChatGPT or others) is to use these tools cautiously, critically, and reflectively to support you in your learning, research and writing in Biology. They should not be a replacement for your critical reading in a topic and should build on your understanding of Biology (not replace it). Using clear, limited, and accurate prompts when interrogating AI based tools will certainly help you. However, tools such as ChatGPT do not verify or even discover information, these tools analyse text to give a most probable pattern that approximates to an answer to your prompt. (In other words, they simply spit out the most likely next word). This is an important consideration, ChatGPT can give you a very well-structured essay which is completely false. **This is why AI tools must not be used in your 4th year thesis or dissertations**. ChatGPT does not "know" the material it presents is fake and if you do not understand the output, then neither do you.

LLM tools do not verify material scientifically but do incorporate all the biases inherent in the interpretations of the material of others. Thus, ChatGPT can deliver overtly or covertly racist, sexist or other discriminatory material as apparent fact, when in reality, these have no scientific basis. It can be trained to "support" these outputs with fabricated references or misrepresented material of others. Such outputs should not be used in your work, but *can you tell the difference between real or fake material?* Using an AI tool properly takes more effort than you might expect, as you will need to check the veracity, and sources of the returned material and evaluate it critically before use. Be aware of the implicit and explicit biases in any text produced by AI tools and take steps to mitigate this in work you submit.

What are the acceptable uses of AI tools for Biology department assignments?

- Before using an AI tool, make sure you understand the basics of your topic, then use prompts that are clear, limited/focused, and accurate;
- Spend time verifying the material returned by your query or prompt;
- Remember that LLM/AI tools generate text without understanding the output, they generate, summarise and predict text, no matter how unscientific or false.

Whilst it is unacceptable to use AI tools in your fourth year project work, it may be acceptable in other modules but only if specifically stated by your lecturer.

What are unacceptable uses of AI tools for Biology department assignments?

If you attempt to present the outputs of AI based LLM such as ChatGPT or Quillbot as your own work, then you are attempting to present material that is not the result of your academic judgement or authorship. If you use these tools in the following ways, then you have breached the department and University standards of academic integrity and will be subject to the disciplinary procedures of the department and/or University (An Introduction to Marks and Standards, a guide for Students (Ver 03April2020).pdf (maynoothuniversity.ie).

You must not:

- **Use AI tools of any kind for any aspect of your final year project work (eg thesis, lit review etc)**
- Use AI tools to create blocks of text (including single paragraphs to complete assignments) and/or submit these as your own work
- Use AI tools to create diagrams, figures or tables and submit these as your own work. Instead learn to use BioRender or Excel to create diagrams and graphs, using your judgement.
- Use AI tools to support your preparation of an assignment without declaring which tools and/or how they were used. (You must not use AI/LLM tools for any form of 4th year thesis or dissertation in Biology)

- Use AI-generated false, or inaccurate references or submit AI-generated false, biased or discriminatory claims.

Consequences of unacceptable AI use in course material submitted to the Biology department could be large and impact you in many years' time.

Think of your future career. Future tools in the University may detect AI much more accurately than at present. **These may deployed retrospectively and you could face loss of your degree qualification**, public embarrassment, and even loss of a job. Students presenting content that has been generated using AI are subject to the same disciplinary procedures as plagiarism. This can potentially result in denial of a reference, or a permanent notice on your student academic transcript, with career-long negative implications. Where a marker (or detection software) of submitted material suspects the inappropriate use of AI tools, the following procedure applies. If the module coordinator considers the use to be non-trivial, the issue will be referred to the departmental academic integrity committee who will assess the case and have the option to perform a **verification assessment** in the form of a face-to-face interview as detailed in the University's Marks and Standards. Where a student does not engage fully with the departmental process or in the most serious instances, the case will be referred directly to the University's Academic Discipline Board without further consideration by the department.

Biology Dept Academic Integrity Committee
May 2023

ADDITIONAL GUIDELINES FOR BI445 LABORATORY PROJECT

Your project will provide you with an opportunity to get involved in hands-on research, usually on some aspect of the research already ongoing in your supervisor's laboratory. Your project also gives the examiners and future employers an indication of your ability and your initiative. But the other parts of your course are also very important so it is essential to remember this and not to spend too much of your time doing project-associated work. Read the advice above as well as the following:

A. Choosing your project. Try to choose a laboratory which interests you and which suits your scientific background and your general lab skills.

B. Project organisation. Initial steps.

- **Reference Material.** Familiarize yourself with the background literature relating to the project. Your supervisor will set up a folder for you in TEAMS and may provide you with a reading list or key review articles papers directly relevant to the project. Go to the **Thesis Online Resource** link on your dissertation Moodle page and you will find multiple resources to help with your initial literature review, as well as training options within MU regarding critical skills in *researching the scientific literature*, *writing*, and *referencing/citation*. You should discuss the outcome of your literature review with your supervisor no later than 3 weeks after beginning the project. Your supervisor may provide you with additional resources if you have been unable to access them.
- Become familiar with the equipment and experimental techniques that you will require for your project. It is essential that you become competent in all the research techniques to be used before you start proper experiments and make sure you understand the basis of the techniques.

C. Project organization. Lab work.

A percentage of your final project mark is allocated to your performance and dedication in the laboratory.

- Plan experiments carefully following discussion with your supervisor. Make sure suitable controls are included and sufficient replicates of the experiments are carried out.
- Use booking sheets for equipment in high demand.
- Check time scale of experiments and make sure it fits in with your lecture schedule and the permitted working hours in the laboratory.
- Make note of all the experimental procedures, including calculations for making up solutions etc. in your lab note book as you perform the work, rather than later on.

- Never rely on your memory. Write your results into your notebook immediately; preferably a hardbound notebook not on scrap pieces of paper.
- Analyse your results as you get them. Draw graphs, etc. now while the material is fresh in your mind and while you are not under too much pressure.
- Record the results from all experiments, even ones which did not appear to work.
- See all experiments through to the end.
- Show courtesy to other workers in your laboratory. Keep your work area clean and tidy; wash glassware and return reagents to shelves, fridges or freezers immediately after use; respect other people's laboratory property: glassware, stock solutions, media, etc.

D. Writing up your results. No matter how carefully you conducted and carried out your experiments and how excellent your results are, your overall mark can be pulled down considerably by a poor thesis. Therefore, it is important to leave sufficient time for writing up the thesis.

A research thesis should be no more than **5000 words** of text for Biological & Biomedical Science students. The **word count** includes the main body text of the thesis, comprising *headings*, *text* and *in-text citations/ references*. Not included in the word count is the abstract (which has its own separate word limit of 200 words), table of contents, table legends and table text, figure legends, bibliography/ reference list, and appendices; in addition, the whole thesis should not exceed 40 pages (including references).
Note that your mid semester **Literature Review** is considered a separate document and should be no more than **2500 words,** in both cases appendices would be separate. The thesis should be organised under the following sections:-

RESEARCH PROJECT THESIS LAYOUT

Typing. Always use a spell-checker. Recommended font is Times New Roman (size 12). The thesis should be double-spaced.

Title page/ Cover Sheet. For your project title be brief and accurate. Complete the appropriate sections in the 2023 Dissertation Cover Sheet

Acknowledgments page. Optional

Table of Contents. All pages should be numbered, and the Table of contents should have a list of all sections and subsections. You should also use a separate numbering system to denote each section and subsection as follows: 1. Introduction; 2. Materials and Methods 3. Results; 4. Discussion; 5. References and 6. Appendices (if any). e.g. the first subsection within Materials and Methods would therefore be numbered 2.1, etc.

Abstract. This should be **a maximum of 200 words** and should briefly summarize the aims of the project, how the problem was tackled and the key findings from the research. This should have the basic content of the thesis without extensive experimental details.

Introduction. This section covers the scientific background to your project and the rationale for the study. The Introduction should supply sufficient background information from your literature survey to allow the reader to understand and evaluate the findings of the study.

Materials and Methods. A clear and concise description of the techniques you used in the project. This should include sufficient information to allow the experiments to be repeated.

Results. The data is presented in this section in the form of figures (graphs, histograms), tables and drawings or photographs as appropriate, and a suitable text which should summarize the rationale, significant experimental observations and briefly explain the findings; reserve extensive interpretation of the results for the Discussion section. Each results sub-section should begin with text giving a brief description of the rationale and design of the experiments (not the methods as these will have already been covered under Materials and Methods) followed by details of the findings, referring to all the Figures and Tables.

Figures must have a legend **underneath** with the Figure number and title; followed by a short description of the Figure to make the information displayed understandable without frequent reference to the text. Tables must have the Table number and title **above** the Table, with the Legend (if any) underneath.

Discussion. The Discussion should provide an explanation and interpretation of your results and the presentation of evidence (from your own project work and from the literature) which justify the explanations proposed. The significance of your findings should be discussed in the context of published work and should not contain extensive repetition of the Results section or reiteration of the Introduction.

Referencing. It must be possible to identify the source of all material which is not your own. The MU Biology Department uses the **Harvard referencing style**, and all dissertations **must** be written in this format. All references should be given fully, and in alphabetical order, in the reference list at the end of the literature survey. Go to the Thesis Online resources page and you will find multiple resources to help with writing your disseration, as well as training options within MU regarding critical skills in *researching the scientific literature*, *writing*, and *referencing/citation*.

The reference section must contain all relevant sources (original articles from scientific journals, review articles and chapters from books. You must always reference original articles for techniques or statements of fact; reference to general textbooks and reviews can only be used when you are summarizing points in the Introduction and Discussion.

In the **Harvard** Style, all listed references must be cited in the text in parentheses after the relevant section of text.

You will be given further directions on accessing literature by your project supervisor and in the talks presented by library staff in early October. The material presented above is for quick reference only.

Appendix/Appendices. These are optional and can be used to tabulate raw data which was used to generate the contents of Figures and Tables of analysed data in the results section.

Assessment Criteria for 4th year thesis (Laboratory work)

Fourth year projects vary greatly in the degree of difficulty of the techniques and the ease with which data are obtained. This is taken into consideration by the examiners. So there is no need to be anxious and upset if some of your colleagues are amassing large quantities of data and despite your best efforts, your project appears to be moving very slowly. Keep in contact with your supervisor and if your supervisor is satisfied with your rate of progress, then you shouldn't worry too much about the progress of your colleagues' research. Most people get great satisfaction from doing project work. It is our hope in the Biology Department that you too will enjoy the intellectual challenge of your project and that it will give you some valuable first-hand experience of the procedures used in original research. Chapter 8 in Wedgewood, M.E. "Tackling Biology Projects", Macmillan (1987) gives some very valuable advice on the writing of a project report.

When submitting your laboratory project you will be required to sign a declaration on the **2023 Dissertation Cover Page** stating that you have read and understand the department's Policy on Plagiarism, and that your project is your own work. A sample cover will be available for you to download from your dissertation Moodle page.

This must be downloaded, signed and placed as page 1 of your final submission dissertation.

Once again markers are looking for demonstration of higher order thinking (eg synthesis, analysis and powers of evaluation) and critical engagement under each heading. The practical write-ups and your feedback should have prepared you well to write a strong thesis. Your lecturers use the criteria below to grade your project thesis using the scale described on page 62.

Skills/Competencies displayed in thesis work
Abstract Research problem, goals, significance, and outcomes/conclusions described and integrated in a concise, effective manner
Adequacy of introduction in-depth insight into background & published literature, meaningful connections between relevant components are communicated effectively
Referencing and citation Quality of citation choice/source material, Excellence of format, style
Hypothesis/ Aims Correct and clearly expressed
Description of methods Thorough and complete showing sufficient detail and understanding**.** Repeatable
Presentation and interpretation of results purpose of each approach/experiment is clear. Data is presented appropriately in figures, tables or text. Statistical tools correct.
Conclusions/ Discussion Good evidence of evaluation and contextualisation
General presentation Conforms to formats, free from error, correct use of scientific language/scientific terms.

The BI445 Mid-Semester Literature Review.

Biological Science and Biomedical Science students have an additional mid-semester literature review to complete. The word limit for this is 2,500 words. See the section above WRITING A 4TH YEAR DISSERTATION/THESIS: ESSENTIAL INFORMATION FOR ALL WRITTEN WORK" on how to write, submit and adhere to guidelines for this. The submission date is given below in the section "Important deadlines for Project Work".

ADDITIONAL GUIDELINES FOR BI447 SANDBOX PROJECT

The information above is relevant to Sandbox students with the following differences. Assessment is by a) Engagement: 30%; b) Final report (<**2,500** words) 50%, c) Oral presentation 20%. Engagement will be assessed by a combination of attendance, minutes of student meetings and reports from the sponsor. Non-engagement in group work or non-attendance without valid support, may lead to a pro-rata cap on mark. The final report will be shorter (2,500 words only) and structure will vary according to the project. Your supervisor will advise you on structure at the end of semester 1. The Oral may be as described above, although a facility for a group oral or split individual/group oral is available. More details will be made available on the BI447 moodle page.

ADDITIONAL GUIDELINES FOR BI448 ACCREDITED PRIOR RESEARCH PROJECT

Students who have taken a research-intensive project (min 5 weeks duration) in the previous 12-month period may gain accreditation for that research in lieu of a conventional research project. This has the benefit of freeing up a lot of time during the semester to focus on your other modules. [See page 21 above]. For assessment you may EITHER:

a) Oral (as BI423/BI445 above), with a mid-semester 2,500 literature review (as BI445 above) and a thesis write up (see BI445 for details-the max word count for this is 5,000 words but may be much shorter at the discretion of the supervisor); OR

b) Oral (as BI423/BI445 above) plus a draft scholarship application with an identified investigator/mentor. This is a specific encouragement for students wishing to apply for PhD scholarships. Speak to your project supervisor and module coordinator early in semester 1 if you wish to be assessed this way.

LATE SUBMISSION OF COURSEWORK

On occasion, a student may not be able to meet a course deadline on a literature/lab project due to unforeseen exceptional circumstances. If you find yourself in this position, you may request a later submission date. The fourth year modules covered by this policy are **BI423; BI445; BI447; BI448.**

If you require a later submission date, you should complete the online *Biology Department Late Submission Request Form* available via the **All Biology Students 2024** Moodle page. Please note that you will be required to upload your supporting documentation at the time of submission with the exception of illnesses of 2 days duration or less, which does not require supporting documentation.

All applications must be received 5 working days prior to the original submission date or 24 hours post submission date only in order to be considered. Submission with supporting documentation does not guarantee that an extension will be granted. Approval is at the discretion of the department. Further instructions on the process are available on Moodle.

The form should **NOT** be used to request extensions in relation to Lab Practicals, Lab Write-Ups or MCQ resits. In these cases, you should follow the procedure as outlined in the relevant section of this handbook.

The table below gives examples of instances where late submission requests may be considered.

Reason for Application	Details Needed	Supporting Documentation Needed
Medical Circumstances	• Specify details • (e.g. Illness, injury, hospital appointment, hospitalisation)	• Appropriate original supporting evidence must be supplied by a registered general practitioner for illnesses of 3 days or more.
Personal Circumstances	• Specify details (e.g., family illness)	• Appropriate original supporting evidence must be supplied by a registered medical practitioner or other health professional.
Bereavement	• Specify relationship (e.g., parent/ guardian, grandparent, sibling, spouse, child, friend)	• Appropriate supporting evidence must be supplied (e.g., RIP.ie notice).
Other	• Specify circumstances (e.g., jury duty, wedding of a sibling or other immediate family member, victim of crime; participation in a sporting/other event for MU.	• Appropriate original supporting evidence must be supplied.

IMPORTANT DEADLINES AND DATES FOR PROJECT WORK

BSc Biological & Biomedical Sciences Deadlines

Capstone	**Start work**	**Finish work**	**Lit review** (2,500 words)	**Final Thesis submission** (5000 words)	**Oral**
Group 1 Literature (BI423)	9 Oct	19 Feb		19 Feb [12 noon]	4-8 March
Group 2 Lab project (BI445) *Semester 1*	9 Oct	8 Dec	17 Nov [12 noon]	20 Dec [12 noon]	11-15 Dec
Group 2 Lab project (BI445) *Semester 2*	6 Feb	12 Apr	15 March	26 April [12 noon]	15-19 Apr
Group 3 Prior research (BI448)	Any time prior 12 months if pre-approved	Any time prior 12 months if pre-approved	17 Nov [12 noon]	20 Dec [12 noon]	11-15 Dec
Group 4 Sandbox project (BI447)	9 Oct AND 6 Feb	8 Dec AND 12 Apr		26 April [12 noon]	15-19 April

Extensions to these deadlines will not normally be granted, because there is a risk that you fail to allocate sufficient time for your revision and other modules. The deadlines are here to help students manage their workload. The process for requesting an extension on health grounds is given on page 56

A sample cover sheet for your project will be available on the appropriate moodle page. Please type in the following:

1. the title of your project,
2. statement that the thesis is submitted in fulfillment of the requirements for the degree,
3. your name,
4. student number,
5. the name of your project supervisor,
6. the word count for your submitted thesis
7. Date

The Library is a resource for your study

The library staff look forward to meeting you during your studies, whether that's online or in person. Library staff will help you with any questions you have about getting started.

MU Library will be essential to you for:

- finding the right **e-books** and **online material** to help you study & write your assignments and essays,
- borrowing physical **books,**
- short, free **online tutorials & quizzes** that will help you improve your information skills,
- approachable **library staff** who will help you find what you are looking for, and
- booking a **group study room** when you are working on projects with fellow-students.

Best thing of all? All the resources above are **FREE to use** when you are a student in MU!

Our library homepage is: https://www.maynoothuniversity.ie/library covering**:**

- up-to-date information about accessing the library,
- information on using all our services, including when off-campus, and accessing classes, and
- advice on connecting with us to get the support you need for your studies and assignments.

Your **MyCard** (student card) entitles you to access the library and to borrow books. Click the "*Using the Library*" tab *(see Fig. 2)* on the library homepage, for more information. If you have any **queries about finding material**, whether it is online, or on the shelf, library staff are here to help you. If you are off-campus, use the live-chat, anonymous *"Library Chat"* box on our homepage, or email your queries to library.information@mu.ie . We love to help you find and use what you need in your studies.

If you are visiting the library in person, staff are available at the desk to answer your queries and get you started with everything you need. The library is on the South Campus beside the Kilcock road. You can choose different study spaces*: from the open-access area on the ground floor (where food, drink and chat are allowed) with access to over 50 laptops and print facilities*, to the quieter areas on levels 1 and 2, with training rooms and meeting rooms*, or use the bookable group study-rooms (See links at the end of this piece) for your group and project-work*.

Using the correct information source is key to success in your studies. Every subject has **a dedicated Subject Guide** on our website (*see below*) that we recommend you look at. The range of subject guides is here: https://nuim.libguides.com/guides_tutorials and have sections on getting started, recommended books, databases, and links, as chosen by your lecturers. It also has information about reference styles, online tutorials and quizzes, a chance to email your query direct to a Teaching & Learning librarian, and lots of more useful information.

Use **LibrarySearch** *(see Fig. 4)* on the library homepage to search for specific books or articles, or even to see the range of material that we hold on your topic. The results give you details of e-books and e-journals you can read on your devices (on or off-campus) as well as information about where to find the print books on the library shelves.

Fig. 4: "LibrarySearch" searches the entire collection in MU Library- millions of free eBooks, articles and databases.

You can borrow a laptop from the laptop-bank (opposite the library desk) to use within the library, or you can log on to one of the library PCs to do your essays, or you can use your own laptop in the library too. We have a 3D printer available (ask us at the library desk) as well as a colour photocopier, in addition to many black and white photocopiers. You use your MyCard to load it with credit for printing. **IT Services** have a dedicated space at the main library desk where you can go if you need IT help.

Make sure to follow us on **Instagram** @library_mu, **Facebook** @MaynoothUniLibrary or on **Twitter** @mu_library. Contact us with your **queries** about

- using the library, finding locations within it, student services,
- finding information for your studies, or
- how to use any of our online content.

USEFUL LINKS AND CONTACTS:

- Library homepage: https://www.maynoothuniversity.ie/library
- A-Z of our Subject Guides: https://nuim.libguides.com/
- Book a group study room*: https://nuim.libcal.com/booking/MU_GroupStudyRooms
- Online tutorials (LIST online): http://nuim.libguides.com/list-online

Contact: library.information@mu.ie

AWARDS AND PRIZES

Biology Departmental Prizes:

Every year the department awards prizes. These include*:*

- ***Mason Technology Prize for best overall performance in 4th year:*** Medal + cash prize
- ***Biology Prize for best 4th year laboratory project***: certificate + cash prize

Biochemical Calculations Website: Biochemicalc™

http://www.biochemicalc.com

Students in the Department of Biology now have access to Biochemicalc™. This website, developed by Professor Sean Doyle (Biology) and Mr Dermot Kelly (Computer Science), allows students to:

1. Learn the fundamental concepts of biochemical calculations such as:

What are moles, nanomoles and micrograms? Why do I need to use moles in my calculations? How do I make laboratory solutions such as buffers? What is molarity?

2. Use online calculators to help solve biochemical problems.

The online calculators allow students to calculate the weights (in mg or g) of reagents required for making up laboratory solutions of defined molarity, calculate the volume of stock solutions required for preparation of a more dilute reagent, carry out % (w/v) dilutions, work out how to do serial dilutions etc…

3. Practice online questions to test their understanding of biochemical calculations.

Biochemicalc™ offers a suite of pre-formatted questions to help students judge if they understand key concepts required for becoming proficient at undertaking laboratory calculations. These questions are of varying difficulty and style, and are designed for use in association with the online calculators on the Biochemicalc™ website.

Although primarily designed for students in the 3rd and 4th years of our degree programmes, it will also be of assistance to students at earlier stages of study. Indeed it may be of use to students taking Chemistry, or any subject requiring knowledge of laboratory calculations. Postgraduates may also find aspects of Biochemicalc™ beneficial to their own research projects and also find use of its functionalities a useful “double-check” for their own laboratory calculations.

We encourage you to use Biochemicalc™ and please tell others if you’re happy with it. If not, please email: biochemicalc@gmail.com . **Biochemicalc™ was funded by the NUI Maynooth CTL Fellowship Programme**

EXAMINATION ASSESSMENT SCALE

Letter Grade	*Descriptive Heading*	*Representative %*	*Class*	*4th year Thesis/ Oral description*
A++	Answer which could not be bettered.	100	I	Very Good
A+	Exceptional answer displaying unexpected insight.	90	I	
A	Undoubtedly first class, flawless answer, demonstrating originality.	80	I	
A-	Almost flawless answer demonstrating some originality	70	I	
B+	Extremely high competence, perhaps displaying limited originality or technical flaws or minor errors	68	II-1	Good
B	Fundamentally correct and demonstrating overall competence.	65	II-1	
B-	Competent performance, substantially correct answer but possibly containing minor flaws or omissions.	60	II-1	
C+	Awarded on the basis of the answer being somewhat better than a C but below a B-.	58	II-2	Satisfactory
C	Basically correct, answer with minor errors or one major error/omission.	55	II-2	
C-	Awarded on the basis of the answer being somewhat below a C but better than a D+.	50	II-2	
D+	No more than adequate answer.	48	III	Barely satisfactory
D	Adequate answer with serious errors or omissions.	45	III	
D-	Lowest passing grade, barely deserving to pass.	40	P	
E+	The answer is inadequate and does not deserve to pass.	38	F	Un-satisfactory
E	The answer fails to address the question properly but displays some knowledge of the material.	35	F	
E-	Fails to address the question.	30	F	
F+	Little relevant or correct material but some evidence of engagement with question.	20	F	
F	Very little relevant or correct material.	10	F	
F-	Totally irrelevant answer.	0	F	

Pass standards for lecture modules

Pass standard	40% or higher
Compensation range	Marks of at least 35%, but less than 40%
Incomplete/Not passed	Marks below 35%

Please see the following link for Marks and Standards for programmes at Maynooth University:
https://www.maynoothuniversity.ie/exams/university-examinations-regulations-and-procedures
Past examination papers can be obtained from the Quicklinks section (lower left-hand side of the page) of the Maynooth Library web page. https://www.maynoothuniversity.ie/library These may be used as a **guide** to the **type of questions** on exam papers.

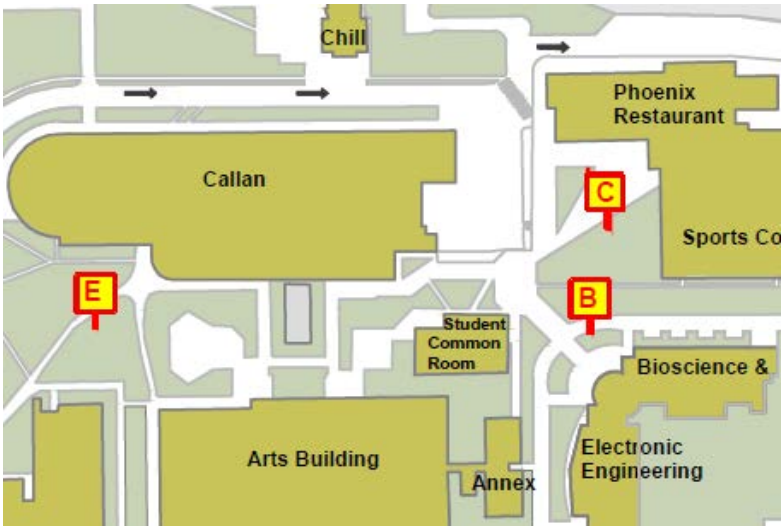
BIOLOGY LABORATORY SAFETY

For the protection of yourself and others please read the following notes carefully and obey the instructions. Students taking project work in a research lab should read and comply with the specific additional requirements in their assigned laboratory. It is your responsibility to make yourself aware and to comply with all safety requirements.

COVID-19 GUIDANCE:
If you have COVID: do not come on campus, follow the HSE guidance for self-isolation (https://www2.hse.ie/conditions/covid19/) and University guidance (https://www.maynoothuniversity.ie/coronavirus/response).

FIRE:

- On hearing the fire alarm or on discovering a fire, stop what you are doing and raise the alarm.
- If you are using a Bunsen, switch it off.
- Shut off the Bunsen gas supply to the lab.
- Leave in an orderly manner and close the door behind you. **Do not use the lift.**
- Make your way to the nearest assembly point B, C or E (see the map below).
- Remain at this location until instructed by security staff to return to the building.



PERSONAL PROTECTION:
Do not smoke, eat, drink or chew gum in any laboratory. University Policy prohibits storage of food and drink and food in all laboratories. You are required to wear a Howie style white laboratory coat with all buttons closed and sleeves fully extended at all times. Laboratory coats may be available for hire from the Biology Department.

You must also wear safety glasses at all times. Please contact the technical staff if you need to purchase a pair. Sandals, flip-flops and other open footwear are prohibited when chemical and biological agents are used.
Long hair must be tied back. You must wash your hands immediately at the end of the practical or as necessary in a research lab.

You will be provided with gloves for your personal protection. Unfortunately, they only protect the wearer and can easily contaminate surfaces. Remove all gloves before leaving the laboratory, even if for a brief period. Remove gloves while using laboratory equipment unless there are specific hazards present. Do not wear gloves when using Bunsen

burners unless specifically instructed by the lecturer in charge. If you need to transfer samples or equipment to another laboratory, remove one glove and use the ungloved hand to open doors etc.

PERSONAL INJURY:
You must cover any cuts or grazes with a plaster. Please inform your demonstrator. There are first aid cabinets in all teaching laboratories.
Report any accident or injury, however trivial, to a demonstrator.
We will explain specific hazards or disposal methods, if any. You must follow these instructions carefully.
Please inform your demonstrator or lab supervisor if you have any concerns relating to a pre-existing medical condition, or if chemical/biological agents used in a practical session may affect any pre-existing medical condition.

GENERAL SAFETY:
In accordance with university regulations, you will be expelled from the practical session or research lab. if you do not conduct yourself in an orderly manner, or if you deliberately act in an unsafe manner. We allow students in the teaching laboratory only during timetabled laboratory sessions. You may not use the laboratory at other times unless you obtain permission from the technician in charge. Undergraduate students should not enter the preparation laboratory, research laboratories, growth rooms, storerooms etc. without permission.

Proper regard to the correct use of equipment is required from all staff and students. Intentional interference with safety signs and safety features of any equipment is a criminal offence.
We expect you to leave your bench place and work area, including sink, clean and tidy.

It is particularly important to put microscopes away correctly:

- Remove slides. Your demonstrator will instruct you on how to dispose of slides and coverslips
- Check that a low power lens is in the viewing position.
- Clean all lenses with lens tissue.
- Unplug the microscope and wind flexes neatly, but not tightly.
- Cover the microscope.

You should be aware that we frequently transport chemicals and biological materials around the department. Therefore, it is very important that you walk with due attention in the corridors.

N.B. Follow the instruction of your demonstrator or supervisor at all times. Please check with them if you have any doubts or questions in relation to safety. University safety and public health procedures must be adhered to at all times. Instruction from demonstrators, academics and technical staff must be followed at all times. Failure to do so will result in automatic expulsion from the laboratory and the forfeit of any grades associated with that practical session and an "unexplained absence" will be awarded. *Repeat offenders will receive an automatic failure of continuous assessment.*

Preparing for practicals/work in labs

- Complete any advance requirements before attending (e.g. Read practical manual, watch any associated videos, complete any required exercises). Details of these requirements will be provided by your lecturer in advance.
- Practical manuals will be available on Moodle in advance of your practical with a printed copy provided to you during attendance at the practical.
- If you are unable to attend a practical, please refer to the instructions in your introductory handbook for completion of an absence form, along with submission of appropriate supporting documentation, as required

(Notification of Absence section). Please note the list of acceptable reasons for non-attendance, outlined in the Notification of Absence text.

Preparing for Laboratory Projects

In addition to attending and passing all the safety exercises in the General Methodology module, it is your responsibility to familiarise yourself with the specific safety issues in your assigned research laboratory and to comply with the specific safety measures. You should read the safety manual and protocols in your assigned lab. Do not commence project work until you have familiarised yourself with all safety protocols. As you learn new techniques it is your responsibility to make yourself aware of the safety issues and to always ask your supervisor if you have doubts or need more safety information.

The Department of Biology would appreciate if any student with a medical condition/allergy, or who is pregnant/breastfeeding, to document the details on the form which will be provided during your first workshop class. If the medical condition changes during the year, please inform your Senior Demonstrator or your Course Coordinator.

All staff involved in this process will respect the confidentiality of the students, ensuring that this information is provided to the relevant personnel on a need-to-know basis only.

NOTIFICATION OF ABSENCE

It is the responsibility of all students to be available for class throughout Semester I and Semester II between the hours of 0900-1800 Monday to Friday, in addition to occasional classes outside these hours (eg. field trips, academic visits).
If you are unable to attend Laboratory practicals, workshops or tests for any reason you must advise the Department of Biology by submitting an on-line **Absence Form** through the **Moodle** **All Biology Students 2024** either before your absence or within FIVE working days of the end of the period of absence. When submitting the absence form you will also be able to upload copies of your medical certificates or other relevant supporting documentation. Instructions on how to do this are on the Moodle page. **Failure to do so may result in the absence being counted as unacceptable and you will be given a mark of zero.**

Please note that if you are submitting a medical certificate, **the cert must be issued during the period of illness**. BACKDATED MEDICAL CERTIFICATES WILL NOT BE ACCEPTED FOR ANY REASON.

BI421 Research Methodology 1. All practicals are mandatory and failure to attend these practicals may impact your ability to commence your chosen Laboratory project or Advanced Practical combinations.

Students missing a practical MUST contact the academic in charge of the practical.

Medical certification must be provided for all missed practicals. Failure to provide certification could result in a penalty with your final grade.

BI425 Advanced Practicals/Professional Modules. Attendance of practical and professional modules is mandatory and medical certification must be provided for any practicals missed. Failure to provide certification could result in a penalty with your final grade.

If you miss one advanced practical or professional module lecture or workshop you must notify the academic in charge of the practical. If you miss more than one practical, lecture or workshop you must notify the Biology Office.

Please read and take note of your responsibilities relating to absence as, in signing a Notification of Absence Form, you agree that you have read and understood them.

It is your responsibility to:
Advise the department of any absence. Submit an Absence Form to your department through the **Moodle Absences** course with the relevant supporting documentation either **before** your absence or within **FIVE** working days of the end of the period of absence. 1. **Keep in touch** with your department should you be absent for a prolonged period. 2. **Make up any work** you have missed due to your absence. **3. Agree a revised deadline** with your department for any missed assessment(s) due to your absence. **Note that alternative arrangements for a missed test will only be made if a medical certificate is supplied.** 4. **Recognise that submission of an Absence Form does not automatically mean that the absence is acceptable** and that it is at the discretion of the department as to whether any absence is deemed acceptable or unacceptable. If the absence should be deemed as unacceptable it will be recorded as such and count against the minimum attendance level. 5. **Recognise that,** although a specific individual absence may be deemed acceptable, if your overall attendance and submission of work drops below the minimum level prescribed by your department, then **disciplinary procedures will still be followed.** 6. **Recognise that notification of absence, whether it is deemed acceptable or unacceptable, does not constitute grounds for appeal** against a course or programme failure or failure to progress to the next stage of study.

1. Notification of Absence Forms

Reason for absence	Documentation required *(all to be submitted online through Moodle)*
Illness up to and including 5 consecutive term-time days (excluding Saturdays and Sundays)	**Absence Form**
Illness for more than 5 consecutive term-time days (excluding Saturdays and Sundays)	**Absence Form plus** formal Medical Certification issued and dated during the period of illness and signed by the Medical Centre, your GP or hospital consultant
Unrelated to sickness	**Absence Form** plus supporting evidence

1. Supporting evidence

The following table gives examples of the kind of supporting evidence that you may be required to provide as justification of absence.

Absence	Evidence
Illness of LESS THAN FIVE consecutive term time days	Self-certification–**Absence Form** which must be submitted to the department through Moodle **within 5 working days of the end of the period of absence**. Should students submit repeated self-certifications, the department will require students to produce formal Medical Certification. **Note that alternative arrangements for a missed test will normally only be made if a medical certificate is supplied.**
Illness of MORE THAN FIVE consecutive term time days	Formal Medical Certification issued and dated during the period of illness and signed by the Health Centre or your GP or hospital consultant
Self-isolation without illness	Self-certification–**Absence Form** which must be submitted to the department through Moodle. **Notify in advance or within 1 day of scheduled continuous assessment component**. An alternative assignment/assessment may be made available for you to do remotely and submit online. Supporting evidence can include messages relating to close contacts or instructions to self-isolate.

Outpatient's appointment	Letter from outpatients or appointment card
Doctor or dental appointment	Appointment card
Documented personal problems	Letter from someone, e.g. counsellor, who has direct knowledge of the problem and/or is involved in supporting you
Illness of dependent or family member	Medical Certification and statement explaining illness and why personal attention is necessary
Bereavement	Formal certificate or note from family member who can vouch for the situation
Severe transport problem	A copy of online or newspaper reports on the problem to be submitted to the department **within 5 working days of the problem having occurred**
Court attendance	Official correspondence from the Court confirming attendance requirement
Victim of crime	Statement of events, police report and crime reference number
Involvement in a significant/prestigious event	Letter of invitation from the relevant organising body
Sport commitment at national/county level	Official correspondence from the relevant sporting body confirming the requirement to be available on specified dates

The following table gives examples of the kind of circumstances where absence **may** be deemed as 'acceptable' and 'unacceptable' for non- attendance. This is for general guidance; it does not represent an exhaustive list. All absences will be reviewed on a case-by-case basis.

Acceptable	Unacceptable
1. Illness 2. Displaying COVID-19-related symptoms 3. Self-isolating due to COVID-19 4. Hospitalisation 5. Outpatients appointment (where possible you should try to make any appointment outside of your class commitments 6. Doctor or dental appointment (you should try to make any appointments outside of your class commitments) 7. Documented personal problems 8. Illness of dependent or family member (until other arrangements can be made) 9. Bereavement 10. Severe transport problems (e.g. severe disruption of train travel due to signaling failure or track problems or major traffic incident on motorways, which can be verified by online or newspaper reports) 11. Court attendance or victim of crime 12. Representing College/county/ country at significant or prestigious event or sport commitment or involvement in such an event	1. Oversleeping 2. Misreading the timetable 3. Paid employment and voluntary work 4. IT and/or computer problems 5. Minor transport problems, e.g. being stuck in normal rush hour traffic, not permitting enough time in travel plans for minor unanticipated delays, missed public transport 6. Holidays 7. Family celebrations 8. Weddings 9. Accommodation issues, e.g. moving house 10. Extra-curricular sports activities 11. Driving test 12. Lack of awareness of attendance requirements and University Regulations in this regard

Multiple Choice Questionnaires and Notification of Absence

Throughout the year you will sit a number of Questionnaires, the majority of which are Multiple Choice Questionnaires (MCQs) which are generally comprised of questions that cover a significant proportion of the module.

It is important that you view the MCQs as official exams and are aware that different policies exist for missing an MCQ than for a practical. In addition, Maynooth University Exam policies and regulations will apply and be enforced during MCQs.

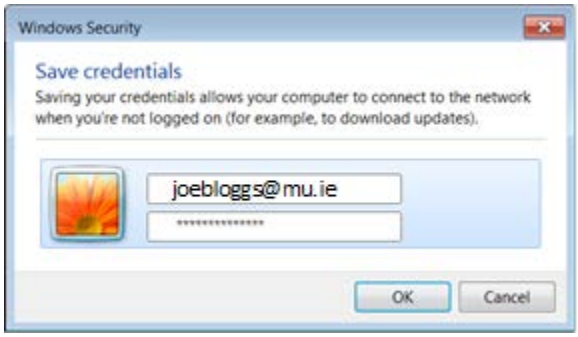
All MCQs are compulsory and failure to sit these exams will result in a **zero** grade.
If you foresee that you may not be able to sit an MCQ it is imperative that you contact the lecturer who is setting the exam **BEFORE** the MCQ.

Individuals who miss an MCQ may be permitted a resit if they have an acceptable reason and provide the appropriate evidence. Individuals who miss an MCQ without an acceptable reason and who did not contact the **lecturer who has set the exam** or **senior demonstrator** prior to the MCQ will not be offered a resit and will consequently be awarded a zero grade.

MCQs are exams and Maynooth University Exam policies and regulations apply during both. These can be viewed at the Maynooth University Examinations Office webpage.

Connecting to Maynooth University wireless networks:

Maynooth University along with many other institutions broadcasts the eduroam wireless signal for students and staff. Use your wireless client to connect to eduroam and when prompted enter your Maynooth username and password.



You may need to enter your credentials twice when connecting for the first time. Some users will see prompts regarding certificates and should choose the "Accept \ Continue" option at this prompt.

***If you enter your username in the format of **username@mu.ie** (not an email address) your Maynooth account will allow you to connect to eduroam in other participating institutions for example in UCD, DCU, TCD and many others around the world.*

Notices: Information for students will be posted on MOODLE and can also be notified by e-mail to your mumail address. These will include information on courses, questionnaire results etc.

E-mail: You should check your Maynooth University e-mail account on a DAILY basis. Messages to individual students from Staff will normally be made via e-mail, using the student's Maynooth University e-mail address. Delete messages regularly to ensure that your e-mail account is not over quota.

Moodle *https://moodle.maynoothuniversity.ie/*: This online learning environment is accessible both on and off campus. We use it for: (a) posting notices and announcements (b) to pass on information/ resources about individual modules and (c) recording absence. You will have access to all MOODLE areas relating to the modules for which you are registered as well as to general information areas entitled

- **All Biology Students 2024** a page also for recording absence and submitting supporting documentation.

Tips from the Biology department on getting better marks in your final year.

Many students are using the same learning strategies that suited them in secondary school, without realizing that these work less well with each year at University. We have compiled a short video on how to score better and elevate your exam marks- available on the moodle BI420 page.

How students fail or underperform in final year

The responsibility is on you to use your time wisely and get the balance right between external work, commitments, socializing and getting, the best qualification you can. Every year some students dedicate too much time to part time work (often in retail) and then fail or under-achieve in their exams in the summer. You need to be responsible and exercise good judgement in treating your studies seriously, and prioritizing your study. Here is some advice from past students who have failed or underperformed in fourth year - learn from their mistakes!!

1. **I missed too many lectures!** Our tip- If you do not attend lectures you will miss a lot of information that is not possible to pick-up from somebody else's notes. The lecturer may emphasise a point or explain something in a particular way that will stick in your mind. The lecturers often emphasize what is needed for an exam answer that moodle notes do not. There is a direct correlation between missing lectures and failing.

2. **I memorised essays but still got poor marks.** We are not examining for memory but for skills and competencies linked to higher order thinking. Your strategy for leaving cert will not work well. Memorising essays runs the risk of your guess being incorrect and failing to show you understand the question set. This is a common reason why students underperform. Our tip- Change your learning strategy, watch our "How to do better" video, and ask lecturers how to do better in exams.

3. **I failed on really simple stuff because I didn't submit it!** Our tip-Some compulsory modules (such as BI420 seminars) require continuous assessment (CA), these are very straightforward to do at the time, but if missed, you may discover you cannot pass the module or resit this in the autumn. DO the CA!

4. **I left things too late/ I didn't read my notes soon enough!. "**I only downloaded the moodle extra reading and lecture notes in the week before the exams – but then I couldn't make any sense of it and I had too much to do." Our tip: engage early with your material.

5. **It took a long time to get a study routine. "**I wish I had got into the habit of trying to do a few hours of study each day in semester 1" Our tip- this is great advice and a habit developed by students who do well.

6. **I missed the general methodology practicals!** See point #3.

7. **I trusted ChatGPT**. "I didn't realise ChatGPT is a sentence generator, not a search engine. I had my marks reduced because I used AI poorly." Our tip- Trust yourself and your years of study- don't risk your degree or future career by using a poor tool.

8. **I never asked questions!** "I didn't like to be the centre of attention in years 1 to 3, but I started to ask questions in final year." Our tip- your lecturers can be really helpful. They love their subjects and are a resource to help you- use them.

9. **I didn't prepare enough for the exams!** In September, the exams look to be very far away but they will arrive sooner than you expect! Our tip- Every hour of work before study week, is worth three after Christmas!. You need to start

working towards the exams from the first week of the year. Prepare like someone training for a marathon - train (attend lectures and practicals), build up your distances (study, attempt sample exam questions) and finish the race (pass your exam successively).

10. **I Began to panic!** "Other students were saying to me they had the entire modules covered and all the possible exam answers prepared. It was starting to freak me out. But I spoke to friends, worked at my own pace and stuck to my plan. I did the work and passed well" Our tip- Don't let gossip freak you out.

Other University Supports and Services

Academic Advisory Office: The Academic Advisory Office offers a convenient first point of contact for students who wish to seek advice or assistance with their general experience of University life. The office provides an ombudsman-like role for students who may be encountering difficulties in their programme of study. **Academic Advisory Office**

Examination Office: The Examinations Office is part of the University Registry and administers the examination timetable. It is responsible for the central administration of the University written examinations. The academic year is semesterised with examinations held in Semester One (January) and Semester Two (May) with a Supplemental/Resit autumn session in August. **Examination Office**

Student Health Centre: The Student Health Centre is an acute care/advisory service. The service is envisaged as an addition to the student's own family doctor or specialist medical service. It operates within resource constraints so certain service limitations apply. Students should continue to attend their own general practitioner. **Student Health Centre**

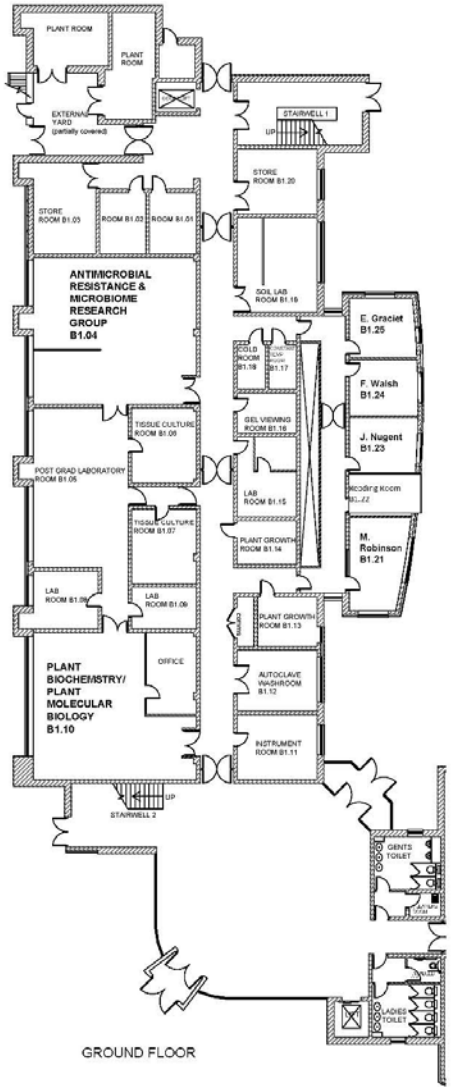
Student Services: Student Services is an integral part of the University community, enabling the promotion and development of its educational mission. Using a holistic approach, we offer a range of clearly defined services to support and empower students to achieve their personal and academic potentials and so enhance their life's journey. We strive to create a community which is open and caring and where diversity is expected and respected. **Student Services**

Maynooth Access Programme : The Maynooth University Access Programme (MAP) encourages under-represented groups to enter third level and provides these groups with support through their time at Maynooth. These groups include under-represented school leavers, mature students, students with disabilities and members of the Irish Traveller community.
Maynooth University Access Programme

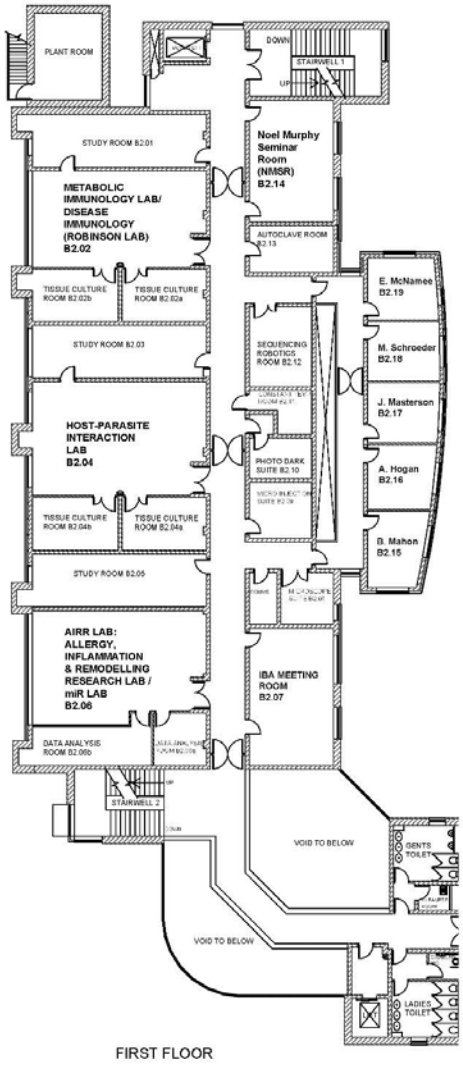
Timetables 2023/24: See link Timetables | Maynooth University

Map of Campus:
Campus Maps

MAPS OF THE DEPARTMENT



BIOSCIENCE BUILDING



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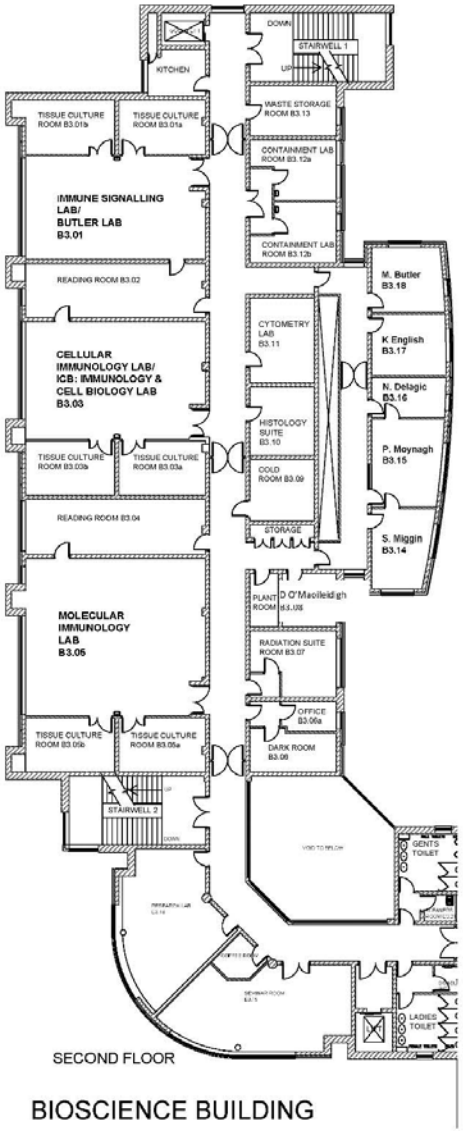

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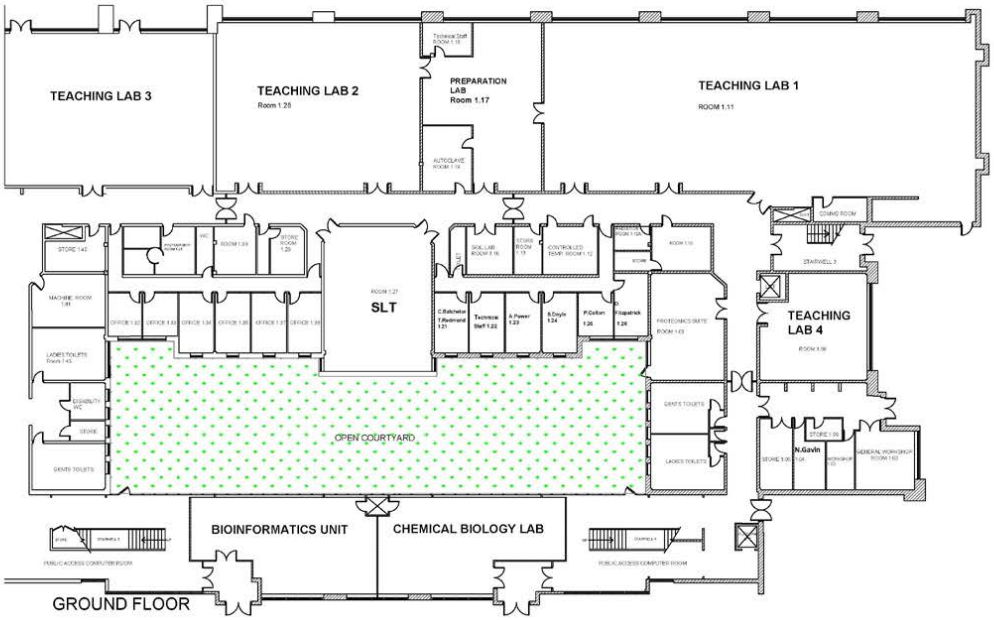

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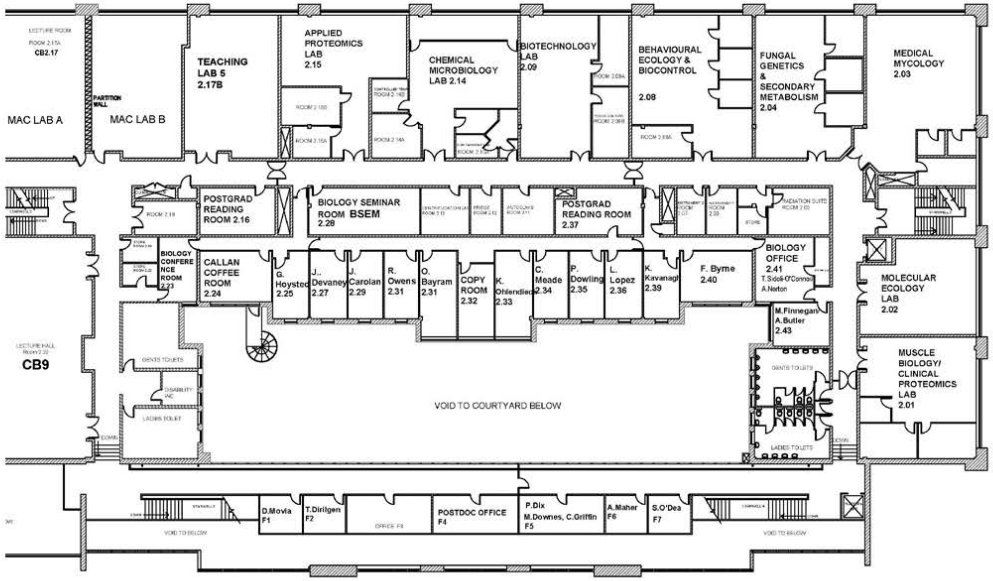

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