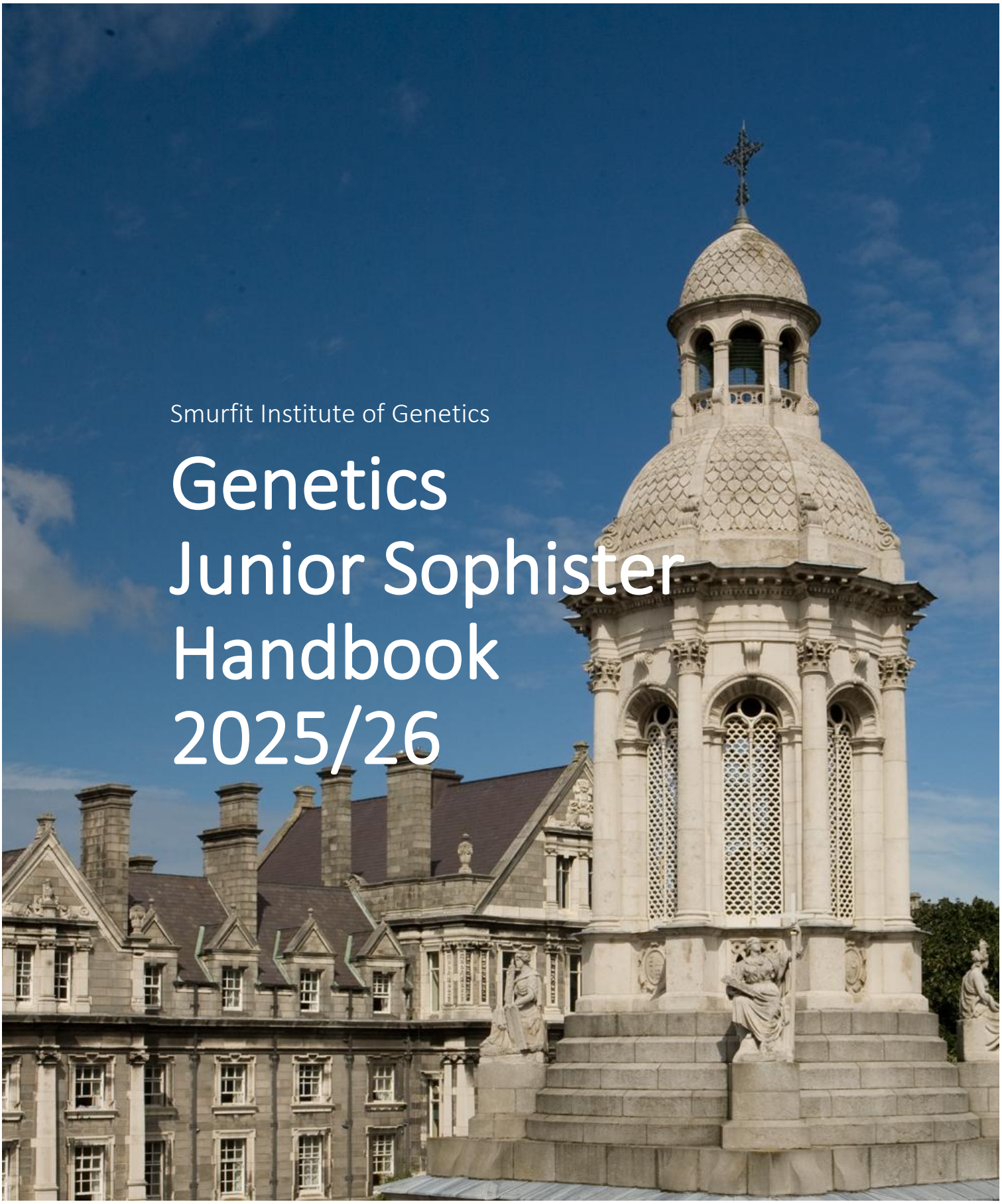
Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



Smurfit Institute of Genetics

Genetics Junior Sophister Handbook 2025/26

Contents

1. General Course Information

1.1 Introduction

It is a pleasure for me to welcome you to your Junior Sophister year in Genetics. Our Department is relatively young (established in 1958) considering the age of the Trinity College. Nevertheless, in its short history it has been responsible for big discoveries such as the location of the gene behind retinitis pigmentosa and incubator of spin out companies such as IdentiGEN or Genable. Our graduates have gone on to positions very influential positions all over the world.

In your first year you will be exposed to core concepts of Genetics and more specialized subject be explored in the following year. Our philosophy has a strong focus on developing analytical skills. It will be important for you to learn different subject but also to think critically and be able to apply your knowledge to the solution of problems. We also believe that communication skills are an essential part on the education of our graduates and students are required to write scientific reviews and make oral presentations we have a module each year dedicated to improving your written and oral presentation.

You are probably aware of all the different activities that the University provides you beyond the normal academic program. I encourage you to participate in different activities and societies as this is a unique experience in your university years. In this respect, students from our department run the Genetics Society.

Finally, I would also like to make you aware that College offers to you a wide range of support services (personal, financial, career and academic). All this information is available in the College webpage. However, your personal tutor will be able to guide you should you require any such support.

With best wishes for the year ahead,
Juan Pablo Labrador,
JS Genetics Coordinator and
Director of Undergraduate Teaching and Learning, School of Genetics and Microbiology.

1.2 Contact Details

Course Coordinator: Juan Pablo Labrador labradoj@tcd.ie
Executive Officer: Alicia Vega genetics@tcd.ie
Head of School: Jane Farrar Jane.Farrar@tcd.ie
DUTL: Juan Pablo Labrador labradoj@tcd.ie
School Manager: Laoise Quinn laoise.quinn@tcd.ie

Module code	Module	Coordinator	Email
MIU33302	Molecular genetics I - Regulation of gene expression	Prof Kevin Mitchell Prof Carsten Kroger	Kevin.Mitchell@tcd.ie Carsten.Kroeger@tcd.ie
GEU33301	Bioinformatics	Dr Karsten Hokamp	KAHOKAMP@tcd.ie
GEU33303	Molecular genetics II - Genome structure and dynamics	Prof Frank Wellmer	WELLMERF@tcd.ie
GEU33007	Molecular Genetics Laboratory	Dr Michael Dolan	MJDOLAN@tcd.ie
GEU33008	Analytical Genetics Laboratory	Prof Juan Pablo Labrador	LABRADOJ@tcd.ie
GEU33035	Genetic Analysis of Nervous Systems	Prof Juan Pablo Labrador	LABRADOJ@tcd.ie
GEU33045	Genomics & Systems Biology	Dr Michael Dolan	MJDOLAN@tcd.ie
GEU33055	Developmental Genetics	Prof Seamus Martin	MARTINSJ@tcd.ie
GEU33075	Evolutionary and Population Genomics	Prof Lara Cassidy	CASSIDL4@tcd.ie
GEU33085	Science Structure, Discussion and presentation for Genetics	TBC	
GEU33215	Medical Genetics	Prof Jane Farrar	Jane.Farrar@tcd.ie
BIU33150	Biochemistry for Biosciences	Prof D Nolan	denolan@tcd.ie
BIU33250	Introduction to Immunology & Immunometabolism	Dr Aisling Dunne	aidunne@tcd.ie
BIU33475	Basics of Neurobiology	Prof Gavin Davey	gdavey@tcd.ie

NOTE: Minor changes to that described in this JS Genetics Handbook may be undertaken during the academic year and will be notified through email to students.

1.3 Key Locations

The course will be taught in the Smurfit Institute of Genetics and Moyne Institute of Preventive Medicine.

See the maps to each institute below:

- Smurfit Institute of Genetics: https://www.tcd.ie/Genetics/contact/
- Moyne Institute of Preventive Medicine: https://www.tcd.ie/Microbiology/contact/

Teaching venues:

- LTEE3 (East End)
- Dawson (Smurfit Institute of Genetics, 2nd floor)
- Genetics meeting room (Smurfit Institute of Genetics)
- Moyne lecture theatre (Moyne Institute of Preventive Medicine)

UG study areas:

- Genetics library
- Genetics attic room

1.4 Key dates

Module	Module name	Type	Semester	Week	submission date	Submission time
BIU33150	Biochemistry for Biosciences	MCQ 1 (24%)	1	TBC	TBC	TBC
GEU33085	Genetics Analysis presentation	Presentations (15%)	1	8	Wed 15th Oct	12:00-13:00
GEU33007	Molecular Genetics Laboratory	Lab report 1 (50%)	1	10	Fri 31st Oct	17:00
GEU33075	Evolutionary and Population Genetics	poster submission	1	13	Mon 17th Nov	09:00
GEU33075	Evolutionary and Population Genetics	poster presentation (35%)	1	13	Thurs 20th Nov	12:00-15:00
GEU33075	Evolutionary and Population Genetics	Reflective essay (5%)	1	13	Fri 17th Nov	17:00
MIU33302	Molecular genetics I	Group presentations	1	14	Tue 25th Nov	11:00-12:00 & 14:00-15:00
GEU33085	Science Structure, Discussion and Presentation for Genetics	Presentations (15%)	1	14	Wed 26th Nov	10:00-13:00 14:00-16:00
MIU33302	Molecular genetics I	Group presentations	1	14	Thu 27th Nov	15:00-16:00
MIU33302	Molecular genetics I	Group presentations	1	14	Fri 28th Nov	10:00-11:00
GEU33075	Evolutionary and Population Genetics	MCQs (60%)	1	15	Thu 4th Dec	10:00-12:00
GEU33007	Molecular Genetics Laboratory	Lab report 2 (50%)	1	15	Fri 5th Dec	17:00
BIU33150	Biochemistry for Biosciences	MCQ 2 (16%)	1	TBC	TBC	TBC
GEU33085	Science Structure, Discussion and Presentation for Genetics	written review 4000 words (70%)	2	20	Mon 5th Jan	9:00
GEU33301	Bioinformatics	Bioinformatics Assessment (33%)	2	26	Mon 16th Feb	11:00-13:00
GEU33008	Analytical Genetics Laboratory	MCQ (50%)	2	27	Tuesday or Wednesday	TBC
GEU33035	Genetic Analysis of Nervous Systems	Test (50%)	2	29	Mon 10th Mar	15:00-16:00
GEU33301	Bioinformatics	Programming Assessment (33%)	2	29	Thu 12th Mar	10:00-12:00
BIU33250	Introduction to Immunology & Immunometabolism	MCQS (30%)	2	29	TBC	TBC
GEU33008	Analytical Genetics Laboratory	Lab report (50%)	2	30	Friday 20th Mar	17:00
GEU33035	Genetic Analysis of Nervous Systems	class participation/essay (50%)	2	31	TBC	TBC
BIU33475	Basics of Neurobiology	continuous assessment (Literature Review) (30%)	2	33	April (TBC)	TBC
GEU333301	Bioinformatics	Report submission (34%)	2	33	Thu 9th April	11:00-13:00

1.5 Timetable

Timetable will be circulated to students. Please be advised that the timetable might slightly vary subject to Lecturers availability.

1.6 Behaviour in the Department

We expect high standards of personal behaviour in the Department consistent with its professional status. Please do not invite students from other Departments or friends into the Smurfit Institute, and when you are in the building please keep the noise down. Alcohol and smoking are absolutely forbidden. Students are not permitted to go on the roofs of the buildings.

1.7 Safety

Please make sure that you have received and have read the Science Faculty Safety Manual. Remember also that you are responsible for your own safety and that you have a responsibility not to endanger others by your actions. *(Refer to Appendix IX Safety Statement)*

1.8 Textbook

We recommend Introduction to Genetic Analysis by Anthony J. F. Griffiths, Susan R. Wessler, Sean B. Carroll, and John Doebley (current edition is 12th edition, 2020).

Department's web address: http://www.tcd.ie/Genetics
Keys – from the Genetics Executive Officer, €10 deposit.

1.6 Internships/Summer Vacation Research Experience outside Ireland

We encourage Junior Sophisters to gain experience working in a research laboratory during the summer vacation. Each year the Department awards 6 travel bursaries (4 Bill Vincent Awards, David McConnell award and James Watson award) on the basis of performance in the Senior Freshman exams, to enable students to carry out a vacation research project outside of Ireland. Prof. Matthew Campbell will advise interested students about placements in various research labs. However, it is the student's responsibility alone to arrange: air travel, Visas (where appropriate), work permits, and any insurance requirements. These arrangements should be made as far in advance as possible from the departure date – preferably in early January

1.7 Study Abroad/Erasmus

We offer our undergraduate students the opportunity to partake in Erasmus and Study Abroad programmes during their Junior Sophister year.

Students interested on a student exchange should contact the Genetics Department Office (genetics@tcd.ie) on their Senior Freshman year if their first moderatorship choice is Genetics or Human Genetics. Students will only be allowed to go on an exchange if they are expected to obtain a high 2.1 overall grade on their 2nd year (SF) passing all modules on first attempt. Students should realise that allowing a provisional exchange is dependent on finally achieving the above mentioned grade on a first attempt. A full year exchange will be considered only for students achieving a first overall grade on their first attempt.
Exchanges with other universities are organised by students and once the exchange information is provided it will be evaluated by the School of Genetics and Microbiology. A committee will evaluate the proposal to make sure essential content is provided, the level of the modules is adequate and all proposed modules can be attended. If approved, it will be formalised on an exchange student declaration form.
Before the exchange approval the following information will have to be provided:

- Signed Study Abroad declaration (Appendix VI)

- A full list of modules available that are being considered
- Matching of international modules to Genetics/Human Genetics core modules
- Preferred modules should be highlighted for evaluation
- Information on the module content
- ECTS and ECTS equivalence for each module (some equivalence tables on Appendix VII)
- Clear information of the course/year structure abroad*:
- (i) Semester the module is taught
- (ii) What modules are core modules and which are optional
- (iii) Whether modules belong to different years (timetabling information will be required)

* As much information as possible, including timetabling information, if possible, will have to be provided to make sure that the proposed modules can actually be taken. Timetabling information is mandatory if modules belong to different years of a course.

We do not currently have pre-arranged agreements with universities in the Coimbra group, but some such as the University of Groningen, Netherlands, have a program that is quite compatible with Genetics and Human Genetics for an Erasmus exchange and lectures are in English. See Coimbra group members here. Your first point of contact would be the person listed on the link. However, specific information about modules, timetabling etc may require you to contact specific departments within each university.

2. Scholarships and Prizes

2.1 Prizes in Genetics

The following prizes are awarded annually to students who have excelled during the Junior Sophister year:

a. Dawson Prize in Genetics - awarded to the best qualified student in Genetics (based on overall JS assessment results) who in addition wishes to carry out research in the summer prior to entering the Senior Sophister year.
b. Ronald A Fisher Prize in Genetics – awarded to Sophister student who has excelled in oral presentation of a subject of his/her choice within the field of Genetics. This prize is awarded based on presentations made on the field trip.
c. Larry O'Hara Prize - a new prize is available and students will be provided with details on the first term

2.2 Gold Medal in Genetics

Gold medals are awarded by the Board to candidates of the first class who have shown exceptional merit in assessments for their honours bachelor degree. To be eligible, candidates must pass each year which counts towards their degree result, on the basis of a single annual attempt (which includes deferrals), and achieve the overall degree mark specified for their programme, which is set at 75 per cent or above. See https://www.tcd.ie/academicregistry/exams/gold-medals/ for individual programme thresholds.

Various studentships, scholarships, exhibitions, and other prizes are awarded to students on the results of honour and other examinations, provided that sufficient merit is shown. Monetary awards are sent directly to prize winners unless otherwise stated under the regulations for the particular prize. For details see Part D – Prizes and other awards (Calendar 2024/25)

A book prize is awarded to each candidate obtaining an annual result of an overall first class honours grade in an honour course. These prizes are not awarded in the Senior Sophister or final year. Book prizes may be collected from the Academic Registry by the award holder in person.

3. Academic Writing

3.1 Use and Referencing of Generative IA

Aligned with the College Statement on Artificial Intelligence and Generative AI in Teaching, Learning, Assessment & Research (2024), the use of GenAI is permitted unless otherwise stated. Where the output of GenAI is used to inform a student's document or work output, this usage should be acknowledged and appropriately cited, as per Library guidelines on acknowledging and referencing GenAI. From an academic integrity perspective, if a student generates content from a GenAI tool and submits it as his/her/their own work, it is considered academic misconduct in accordance with College Academic Integrity Policy.

3.2 Academic Integrity and Referencing Guide

Students of Trinity College Dublin must commit themselves to acting responsibly and ethically, embracing integrity in all actions and interactions as members of the College community, in keeping with the Council approved Statement of Integrity.

All students need to complete the Ready Steady Write plagiarism tutorial, a resource developed by the Centre for Academic Practice and eLearning (CAPSL) at Trinity College Dublin, to help you understand and avoid plagiarism and develop your academic writing skills and academic integrity. It is designed so that you can view it from beginning to end or in sections and topics.

Reference/Source

Calendar Part II, B: General Regulations & Information, 'Academic Integrity'
Statement of Principles on Integrity
Academic Integrity Policy
Library Guides - Academic Integrity
Coversheet Declaration

4. Teaching and Learning

4.1 JS course structure

The Junior Sophister year is comprised of modules totaling 60 European Credit Transfer System credits (ECTS). There are 40 credits of core modules compulsory for all Genetics students and 20 credits of open modules and Trinity Electives spread equally over two semesters in the academic year. The different possible combinations are described in the following module structure table for Genetics.

Genetics	
Semester 1	**Semester 2**
Modules	
MIU33302 - Molecular genetics I - Regulation of gene expression (5 credits)	GEU33301 Bioinformatics (5 credits)
GEU33007 Molecular Genetics Laboratory (5 credits)	GEU33303 - Molecular genetics II - Genome structure and dynamics (5 credits)
GEU33075 Evolutionary and Population Genetics (5 credits)	GEU33008 Analytical Genetics Laboratory (5 credits)
GEU33085 Science Structure, Discussion and Presentation for Genetics (5 credits)	GEU33035 Genetic Analysis of Nervous Systems (5 credits)
Open Modules Scenario I	
GEU33045 Genomics and Systems Biology (5 credits)	GEU33055 Developmental Genetics (5 credits)
Trinity Elective (5 credits)	GEU33215 Medical Genetics (5 credits) **OR** BIU33250 Introduction to Immunology and Immunometabolism (5 credits) **OR** BIU33475 Basic Neurobiology (5 credits)
Open Modules Scenario II	
GEU33045 Genomics and Systems Biology (5 credits)	GEU33055 Developmental Genetics (5 credits)
BIU33150 Biochemistry for Biosciences (5 credits)	Trinity Elective (5 credits)
Open Modules Scenario III	
GEU33045 Genomics and Systems Biology (5 credits)	GEU33055 Developmental Genetics (5 credits)
Trinity Elective (5 credits)	Trinity Elective (5 credits)

Please consider your Open module/Trinity Elective pattern choices carefully as changes will not be permitted. If necessary, please seek advice from the relevant Course Advisor

4.2 Semester 1 Modules

4.2.1 MIU33302 Molecular genetics I - Regulation of gene expression

1. Module Code MIU33302
2. Module Name Molecular genetics I - Regulation of gene expression
3. Semester taught Semester 1
4. Contact Hours 30 hours
5. Module Personnel Kevin Mitchell, Carsten Kroger, Mani Ramaswami, Adrian Bracken
6. Learning Aims This module will examine the principles and processes of regulation of gene expression, in prokaryotes and eukaryotes. It will be anchored around the problems that organisms have to solve in order to survive. These include modulating the cellular economy and maintaining homeostasis in response to dynamically changing internal and external states. This is crucial in microbes for adapting to environmental change and in multicellular organisms for coordinating cellular differentiation and development and regulating cellular, tissue- level and organismal physiology. The module will cover mechanisms and principles of regulation of transcription, chromatin regulation, gene regulatory motifs and networks, epigenetics, mRNA splicing, mRNA turnover, translation, non-coding RNA functions, and protein folding and localisation.

7. Module content (subject to change):

Week	Date & Time	Lecture Topic & Lecturer
4	Tue, 16th Sep 12:00-13:00	Cellular cognition (regulating the cellular economy) (KM/CK)
4	Thu, 18th Sep 15:00-16:00	Regulation of transcription in prokaryotes - I (CK)
4	Fri, 19th Sep 10:00-11:00	Regulation of transcription in prokaryotes - II (CK)
5	Tue, 23rd Sep 12:00-13:00	Regulation of transcription in prokaryotes - III (CK)
5	Thu, 25th Sep 15:00-16:00	Group project discussion (KM/CK)
5	Fri, 26th Sep 10:00-11:00	Regulation of transcription in eukaryotes - I (MR)
6	Tue, 30th Sep 12:00-13:00	Regulation of transcription in eukaryotes - II (MR)
6	Thu, 2nd Oct 15:00-16:00	Splicing as regulatory mechanism (MR)
6	Fri, 3rd Oct 10:00-11:00	RNA quality control (NMD) and mRNA turnover (MR)
7	Tue, 7th Oct 12:00-13:00	Gene regulatory motifs (KM)
7	Thu, 9th Oct 15:00-16:00	Gene regulatory networks (KM)
7	Fri, 10th Oct 10:00-11:00	Dynamical systems and landscapes (KM)
8	Tue, 14th Oct 12:00-13:00	Tips on presentations (KM)
8	Thu, 16th Oct 15:00-16:00	Group project meetings (KM/CK/AB/MR)
8	Fri, 17th Oct	Group project meetings (KM/CK/AB/MR)

	10:00-11:00	
9	Tue, 21st Oct 12:00-13:00	Chromatin biology – I (AB)
9	Thu, 23rd Oct 15:00-16:00	Chromatin biology – II (AB)
9	Fri, 24th Oct 10:00-11:00	Chromatin biology – III (AB)
10		Review Week
11	Tue, 4th Nov 14:00-15:00	Non-coding RNAs I (CK)
11	Thu, 6th Nov 15:00-16:00	Regulation of translation – I (CK)
11	Fri, 7th Nov 10:00-11:00	Non-coding RNAs II (KM)
12	Tue, 11th Nov 14:00-15:00	Regulation of translation – II (KM)
12	Thu, 13th Nov 15:00-16:00	Protein folding and posttranslational modifications (KM)
12	Fri, 14th Nov 10:00-11:00	Protein localization (KM)
13	Tue, 18th Nov 14:00-15:00	Review / discussion (KM/CK)
14	Tue, 25th Nov 11:00-12:00	Group Presentations (KM/CK/MR/AB)
14	Tue, 25th Nov 14:00-15:00	Group Presentations (KM/CK/MR/AB)
14	Thu, 27th Nov 15:00-16:00	Group Presentations (KM/CK/MR/AB)
14	Fri, 28th Nov 10:00-11:00	Group Presentations (KM/CK/MR/AB) – if needed

NOTE: Venue Moyne lecture theatre

8. Learning Outcomes:
At the end of this module, students should:

- Have a working knowledge of the mechanisms of regulation of gene expression in Pro- and Eukaryotes.
- Understand the principles underpinning cellular cognition, homeostasis, regulation of the cellular economy, and multi-cellular development
- Be able to deploy this knowledge and understanding to address novel problems involving these topics.
- Know how to independently research a topic in the scientific literature.
- Have experienced the dynamics of a group project and presentation.

9. Recommended Reading List:
Anthony J.F. Griffiths et al. Introduction To Genetic Analysis. 12th edition. New York, NY :W.H. Freeman & Company, 2020.

Further reading on specialist topics will be provided during the presentation of the module.

10. Assessment Details:

50% continuous assessment (group project (50%) – group presentation.
50% end of semester exam (1.5-hour exam paper at the end of semester 1).

Group project:
Students will be placed into groups of four or five and given a topic related to the principles of the module. They will be expected to research the literature on this topic and prepare a short presentation to the class, using Powerpoint or similar software. The goal is for students to learn how to independently explore and assess the scientific literature, to work in a group towards a common goal, to get some experience in communicating effectively, and to deepen their understanding of the principles of the module by exploring a particular topic in detail. The group exercise will be assessed on the basis of the presentation.

End of semester exam:
The students will be asked to answer 1 essay-type question and 8 short answer questions (3-5 sentences).

11. Module Coordinators: Kevin Mitchell (Kevin.Mitchell@tcd.ie)
Carsten Kröger (Carsten.Kroeger@tcd.ie)

4.2.2 GEU33007 Molecular Genetics Laboratory

1. Module Code GEU33007
2. Module Name Molecular Genetics Laboratory
3. Semester taught Semester 1
4. Contact Hours 5 hours per week
5. Module Personnel Mike Dolan
David Noone (+ 4 demonstrators)
6. Learning Aims This comprises a set of robust experiment-based projects in molecular genetics that have given us consistently good results in the Junior Sophister class environment for many years. The central theme of the module is: gene expression and its regulation.
Aims: To provide hands-on training and experience of widely used experimental strategies and techniques in molecular genetics/ molecular biology, which include: the isolation and purification of genomic and plasmid DNA; the polymerase chain reaction (PCR); the use of agarose and polyacrylamide gel electrophoresis in the analysis of DNA, RNA and proteins; genetic transformation of *E. coli*; gene cloning and analysis in plasmid vectors; *lacZ*, GUS and GFP reporter gene assays.
7. Module content: Programme of laboratory practicals

Date	Project No.	Page	Day
	Week 4		
Wed 17 Sep	Pr 1. Exploring gene regulation in *E. coli*: the *lac* operon	p5	1 of 5
	Pr 2. Gene transfer and expression in plant cells Transformation of *Agrobacterium* with pC-TAK1	p12 p13	1 of 6
Fri 19 Sep	Pr 1. Induction of the lac operon: measuring lacZ expression Alpha-complementation and its significance in lacZ	p7	2 of 5
	Week 5		
Wed 24 Sep	Pr 1. PCR amplification of *lac* operon sequences	p9	3 of 5
	Pr 3. Exploring the genome and proteome of phage Growth and isolation of phage λ	p17 p18	1 of 7
	Pr 2. Purification of *Agrobacterium* transformants	p13	2 of 6
Fri 26 Sep	Pr 1. Agarose gel analysis of *lac* operon PCR products	p10	4 of 5
	Pr 3. Recovery of precipitated λ virions	p18	2 of 7
	Week 6		
Wed 1 Oct	Pr 3. Purification of λ virions on a CsCl step gradient	p18	3 of 7
	Pr 2. Liquid culture of *Agrobacterium* (pC-TAK1)	p13	3 of 6
	Pr 1. Sequence analysis of *lac* operon PCR products	p10	5 of 5
	Pr 3. Extraction of phage λ DNA	p19	3 of 7
Fri 3 Oct	Pr 2. Transformation of leaf cells via *Agrobacterium*	p13	4 of 6
	Pr 3. Restriction digestion of phage λ DNA	p19	4 of 7
	Week 7		
Wed 8 Oct	Pr 4. Creating a library of λ genes in a plasmid vector Isolation and gel analysis of pUC19 plasmid DNA	p23 p24	1 of 7
	Pr 4. Restriction digestion of pUC19	p25	1 of 7
	Pr 3. Gel analysis and processing of λ DNA digests	p20	5 of 7

Fri 10 Oct	Pr 4. Gel analysis and processing of pUC19 digests	p25	2 of 7
	Pr 4. Ligation of pUC19 and λ DNA fragments	p26	2 of 7
	Week 8		
Wed 15 Oct	Pr 3. SDS-PAGE analysis of λ virion proteins	p20	6 of 7
	Pr 4. Preparation of 'competent' *E. coli* cells and transformation with ligated pUC19-λ DNA	p27	3 of 7
Fri 17 Oct	Pr 4. Inspection of transformation plates and inoculation of miniprep cultures	p27	4 of 7
	Pr 3. Interpretation of SDS-PAGs of virion proteins	p21	7 of 7
	Week 9		
Wed 22 Oct	Pr 4. Isolation of putative pUC19-λ recombinant plasmids Restriction digestion of plasmid DNAs	p27	5 of 7
Fri 25 Oct	Pr 4. Agarose gel analysis of digested plasmid DNAs	p28	6 of 7
	Assignment of the First Lab Report		
	Week 10 – (Reading Week)		
	Week 11		
Wed 5 Nov	Pr 5. Exploring light-induced gene expression in plants 1. Differential regulation of rRNA gene expression	p30-31	1 of 4
	Pr 2. Detection of transgenes in regenerated leafy shoots a. Detection of the the *Kan*^{r} gene by PCR b. Detection of the GUS gene via reporter activity	p14	5 of 6
Fri 7 Nov	Pr 5. Agarose gel analysis of rRNAs	p31	2 of 4
	Pr 2. Agarose gel analysis of *Kan*^{r} PCR products	p15	6 of 6
	Pr 4. Sequence analysis of pUC19-λ clones	p28	7 of 7
	Week 12		
Wed 12 Nov	Pr 5. Exploring light-induced gene expression in plants: 2. Regulation of RUBISCO synthesis	p32-33	3 of 4
	Pr 5. Exploring light-regulated gene expression in plants: 3. Regulatory properties of the *RbcS* promoter	p34-36	3 of 4
Fri 15 Nov	Pr 5. Interpretation of RUBISCO gels Discussion: Regulation of gene expression by light	p33	4 of 4
	Assignment of the Second Lab Report		
Wed 19 Nov Fri 21 Nov	Pr 6. Exploring reporter gene expression in the mouse brain with immunofluorescence (TBC)		
	Lab Report writing (17 – 21 Nov)		

NOTE: Labs will run on Wed 14:00-17:00 and Fri 15:00-17:00. Venue Biolab

8. Learning Outcomes: On successful completion of the module, students will be able to:

- isolate and purify genomic and plasmid DNA;
- assemble the reagents required to amplify DNA using the polymerase chain reaction (PCR);
- analyse DNA and RNA using agarose gel electrophoresis;
- make protein extracts and analyse them using SDS-polyacrylamide gel electrophoresis;
- transform *E. coli* and *Agrobacterium* using plasmid DNA;
- grow, isolate and purify bacteriophage;
- clone DNA fragments in plasmid vectors;
- use Agrobacterium to introduce genes into the plant nucleus;
- perform *lacZ*, GUS and GFP reporter gene assays.

9. Recommended Reading List: published primary research papers and reviews

10. Assessment Details:

Students prepare two Laboratory Reports of equal weighting.
Students are notified of the first Laboratory Report during Week 7 on October 10th; and the second report during the final practical during week 12 on November 15th.
The first report is due at 17:00 Irish Time, October 31st 2025.
The second report is due at 17:00 Irish Time, December 5th 2025.

11. Module Coordinator: Mike Dolan MJDOLAN@tcd.ie

4.2.3 GEU33075 Evolutionary and Population Genetics

1. Module Code GEU33075
2. Module Name Evolutionary and Population Genetics
3. Semester taught Semester 1
4. Contact Hours Lectures 24 hours; tutorials: 5 hours
5. Module Personnel Lara Cassidy, Russell McLaughlin, Ross McManus
6. Learning Aims This module provides an in-depth exploration of genetic variation, from its origins to its evolutionary consequences. The information in DNA is not always transmitted accurately from one generation to the next. DNA sequences can change spontaneously by the process of mutation and inaccurate DNA repair, resulting in genetic variation (polymorphism) within populations. Variable sites at different positions in the genome get shuffled into new combinations by the process of genetic recombination that occurs during sexual reproduction. Whether a particular allele survives for a long time in a population or goes extinct depends on the evolutionary forces acting on the population. If a new allele is advantageous to the population, Darwinian natural selection will tend to increase its frequency in the population; alternatively, if the new allele is disadvantageous natural selection will tend to eliminate it. However, selection is only one of several evolutionary processes that change allele frequencies within populations over generations. In this module, students will learn about the origin of genetic variation, its distribution within populations and long-term changes brought about by evolutionary processes.
7. Module content

Week	Day & Time	Lecture Topic & Lecturer
4	Mon 15th Sept 9:00-10:00	Introduction to evolutionary and population genetics (Cassidy)
4	Mon 15th Sept 10:00-11:00	Tutorial: Introduction (Cassidy and McLaughlin)
4	Tue 16th Sep 14.00-15.00	RMM L1: Spectrum and mechanisms of DNA mutation I (McManus)
4	Tue 16th Sep 15.00-16.00	RMM L2: Spectrum and mechanisms of DNA mutation II (McManus)
4	Fri 19th Sep 11:00-12:00	RMM L3: Exogenous and structural causes of mutation (McManus)
4	Fri 19th Sep 12:00-13:00	RMM L4: Mutation and health (McManus)
5	Mon 22nd Sep 09:00-10.00	RMcL L1: Genetic variation and its detection I (McLaughlin)
5	Mon 22nd Sep 10.00-11.00	RMcL L2: Genetic variation and its detection II (McLaughlin)
5	Mon 22nd Sep 14.00-15.00	RMcL L3: Alleles and genotypes: Hardy-Weinberg equilibrium (McLaughlin)
5	Mon 22nd Sep 15.00-16.00	RMcL L4: Alleles and genotypes: inbreeding (McLaughlin)
5	Fri 26th Sept 11:00-12:00	RMcL L5: Effective population size (McLaughlin)
5	Fri 26th Sept 12:00-13:00	RMcL L6: Genetic drift, fixation F-statistics and population structure (McLaughlin)
6	Mon 29th Sep 09:00-10.00	RMcL L7: Linkage disequilibrium (McLaughlin)
6	Mon 29th Sep 14.00-15.00	RMcL L8: Applied population genetics: complex traits and GWAS (McLaughlin)
6	Mon 29th Sep 15.00-16.00	RMcL L9: Applied population genetics: population structure and PCA (McLaughlin)
7	Mon 6thOct 09:00-10.00	LC L1: Evolutionary change in sequences: measuring evolution (Cassidy)

7	Mon 6th Oct 10.00-11.00	LC L2: Evolutionary change in sequences: patterns and models (Cassidy)
7	Mon 6th Oct 14.00-15.00	LC L3: Evolutionary change in sequences: the molecular clock (Cassidy)
7	Mon 6th Oct 15.00-16.00	LC L4: Evolutionary change in sequences: molecular phylogenetics (Cassidy)
7	Tue 7th Oct 11:00-12:00	Poster Tutorial venue Lara / Russell office
7	Tue 7th Oct 14:00-15:00	LC L5: Evolutionary change in sequences: applied phylogenetics (Cassidy)
7	Tue 7th Oct 15:00-17:00	Poster Tutorial venue Lara / Russell office
8	Mon 13th Oct 09:00-10.00	LC L6: Genome evolution: gene duplication (Cassidy)
8	Mon 13th Oct 10.00-11.00	LC L7: Genome evolution: concerted evolution (Cassidy)
8	Mon 13th Oct 14.00-15.00	LC L8: Genome evolution: whole genome duplication (Cassidy)
8	Mon 13th Oct 15.00-16.00	LC L9: Genome evolution: gene loss and base composition evolution (Cassidy)
8	Mon 13th Oct 14:00-15:00	LC L10: Genome evolution: Transposition (Cassidy)
9	Tue 21st Oct 14:00-17:00	Poster Tutorial venue Lara / Russell office
9	Fri 24th Oct 11:00-13:00	Final Poster tutorials venue Lara / Russell office
10	Review week	
13	Mon 17th Nov 9:00	Project hand-in deadline online submission 9:00am
13	Thurs 20th Nov 14:00-17:00	Project presentation (venue Atrium)
13	Fri 21st Nov 17:00	Reflective report online submission 5:00 pm
15	Thu 4th Dec 10:00-12:00	MCQ Exam venue (MAC LAB)

NOTE: Venue LTEE3 Groups for tutorials will be facilitated by course coordinator.

Description of each Lecture

- **Introduction to evolutionary and population genetics** (Cassidy)
  This lecture introduces molecular evolution and provides historical context, including ideas presented by Lamarck, Weissmann and Darwin. Core principles, including selection and neutral mutations, are also introduced.
- **Spectrum and mechanisms of DNA mutation I (**McManus)
- **Spectrum and mechanisms of DNA mutation II** (McManus)
  These two lectures explore the different ways that DNA can change (mutate) between individuals, leading to genetic variation within a population and a substrate on which evolution acts. Types of DNA mutation are described, along with the molecular biological mechanisms bringing about these changes.
- **Exogenous and structural causes of mutation** (McManus)
  This lecture extends our view of the origin of mutation beyond molecular mechanisms to include exogenous (eg environmental) factors and structural changes.
- **Mutation and health** (McManus)
  The consequences of mutation on human health are discussed.

- **Genetic variation and its detection I** (McLaughlin)
- **Genetic variation and its detection II** (McLaughlin)
  These two lectures describe in detail some core methodologies and technologies used in the identification and study of genetic variation in DNA. Methods include polymerase chain reaction, electrophoresis, Sanger sequencing, whole-genome SNP genotyping and next-generation sequencing. Technologies are also compared and contrasted for their relative advantages and constraints in the context of conducting population genetic studies on genetic variation.
- **Alleles and genotypes: Hardy-Weinberg equilibrium** (McLaughlin)
  In this lecture, we define the expected relationship between allele and genotype frequencies in an idealized population, and the interpretation when observation deviates from expectation. Statistical methods for assessing the probability of observed data under a null model are detailed, and the conclusions that can be drawn from the results of these tests are discussed.
- **Alleles and genotypes: inbreeding** (McLaughlin)
  The concept of inbreeding (mating between related individuals) is introduced and our model for expected genotype frequencies under various inbreeding scenarios is updated. This forms the basis of ensuing lectures.
- **Effective population size** (McLaughlin)
  In this lecture we state how populations are modelled as idealized populations with effective sizes that can – sometimes counterintuitively – be far from actual census sizes. We discuss the various parameters that affect effective population size and their consequences in the population, including resilience in agriculture and animal breeding.
- **Genetic drift, fixation, F-statistics and population structure** (McLaughlin)
  Here we explore genetic drift (the random long-term change in allele frequencies) and the ultimate long-term fate for all genetic variation: either loss or fixation. We explore the role of parameters such as population size on defining the rate of fixation of an allele in a population. We then set a statistical framework for the analysis of variance of genotype frequencies in a population and their use in defining the fixation index, a useful tool for identifying genetic structure (non-random patterns) in populations.
- **Linkage disequilibrium** (McLaughlin)
  This lecture introduces the new concept of linkage disequilibrium – the statistical correlation of adjacent alleles – and its uses in modern genomics.
- **Applied population genetics: complex traits and GWAS** (McLaughlin)
- **Applied population genetics: population structure and PCA** (McLaughlin)
  In these final three lectures, we apply some of the techniques and methods that have been discussed in previous lectures to understand the genetic basis of traits in a population and genomic descriptors of population differentiation. We explore the design and typical execution of a genome-wide association study (GWAS), from its motivation to the statistical considerations in controlling false positives and technical bias. We qualitatively discuss the application of principal component analysis (PCA) in delineating population structure and controlling GWAS, and finish with a tour of modern, population-scale genome sequencing studies such as the UK Biobank.
- **Evolutionary change in sequences: measuring evolution** (Cassidy)
  In this lecture we learn how biological entities are compared on the molecular level and introduce the concept of molecular homology. In part two, we discuss the evolutionary forces that cause related sequences to diverge through time. We define a substitution event and introduce the molecular clock and neutral theory.

- **Evolutionary change in sequences: patterns and models** (Cassidy)
  In this lecture we consider evolution as a series of substitution events and introduce substitution models, which can be used to describe the patterns and rates of sequence evolution. We discuss the assumptions of these models and violations to them. The concept of functional constraint is introduced, as well as the Ka/Ks ratio method for detecting the action of purifying and positive selection on protein-coding sequences.
- **Evolutionary change in sequences: the molecular clock** (Cassidy)
  The concept of the molecular clock and its applications are explored in more detail. We learn how to calibrate a molecular clock with an outgroup and use it to estimate species divergence times. The core assumption of the clock - a constant rate of substitution – is explored and the causes of non-constant rates of evolution across lineages are introduced.
- **Evolutionary change in sequences: molecular phylogenetics** (Cassidy)
  This lectures explains the construction of phylogenetic trees from sequence data to describe the evolutionary relationships between species. The aims of the field of phylogenetics are outlined and students are given a refresher in phylogenetic terminology and the concept of reproductive isolation. Methods for reconstructing and rooting trees are described in turn. Methods for assessing tree reliability are also given.
- **Evolutionary change in sequences: applied phylogenetics** (Cassidy)
  This lecture provides examples of real-world applications of phylogenetics. This includes the characterization of the last common ancestor of all life and the closest living relatives of cetaceans (whales and dolphins). Viral phylogenetics is also introduced.
- **Genome Evolution: Gene Duplication** (Cassidy)
  This lecture answers the question: 'where do new genes come from?' The mechanisms and evolutionary consequences of gene duplication are discussed. In part two, several examples of gene duplication driving phenotypic evolution are provided (globins, olfactory receptors and primate opsins).
- **Genome Evolution: Concerted evolution** (Cassidy)
  This lecture defines and explores concerted evolution, the process which results in the non-independent evolution of genes that are closely related in sequence. Duplicated genes within a species may remain similar due to the horizontal spread of mutations by unequal crossing over and gene conversion. Both mechanisms are discussed in turn. The concerted evolution of rRNA repeats, globin genes in primates, and ribonucleases in ruminants are given as examples.
- **Genome Evolution: whole genome duplication** (Cassidy)
  The concept of polyploidy is defined and its incidence in the natural world explored. The mechanisms and evolutionary consequences of true polyploidy are discussed. In part two, we learn about the process of diploidization, whereby a polyploid species reverts to a diploid state through structural rearrangements of the genome and gene loss.
- **Genome Evolution: gene loss and base composition evolution** (Cassidy)
  This lecture covers two distinct topics. In part one, we learn about the mechanisms and consequences of gene loss. We ask why a single copy gene may be lost from a species and cover several examples of gene loss in humans and other species. In part two, we learn about base composition - the proportions of the four bases within DNA. We ask why GC content differs across species and discuss both mutational and selection-based hypotheses for this variation. We also look at GC and AT skews on the two strands of the DNA helix, as well as codon usage bias.
- **Genome Evolution: transposition (mobile genetic elements)** (Cassidy)
  Transposition is discussed in this lecture – the process by which genetic elements are

transferred "horizontally" between organisms rather than the more conventional "vertical" inheritance of genetic material from parent to offspring. Types of transposable elements are introduced and their prevalence in nature outlined. The evolutionary consequences of transposition are also discussed.

8. Learning Outcomes

On completion of this module, students will be able to:

- Describe and explain the origin of genetic variation through mutation
- Describe and explain the consequences of genetic variation in health and disease
- Identify suitable technological approaches to the detection and study of different types of genetic variation
- Describe the relationship between population genotype and allele frequencies under panmixia and inbreeding
- Define effective population size (N_e), identify population parameters that influence N_e and describe practical consequences of low N_e even in large census populations
- Specify the long-term evolutionary trajectories of alleles under genetic drift and define fixation
- Define and quantitatively describe population structure using F-statistics
- Define linkage disequilibrium and describe its use in population genomics
- Explain the design of genome-wide association studies for complex traits and their use of population genetic principles to control bias
- Discuss modern population-scale genome sequencing efforts to understand human health and disease
- State the neutral theory of molecular evolution
- Describe the nature and consequences of evolutionary change in DNA and protein sequences, including codon usage bias
- Define the relationship between mutation accumulation and evolutionary time and its use in the molecular clock
- Construct phylogenetic trees based on evolutionary relationships between related sequences
- Define homolog, paralog, ortholog and ohnolog and describe concerted evolution of paralogous genes within species
- Describe large-scale evolutionary changes to genetic sequences, including transposition, gene and genome duplication and gene loss

9. Recommended Reading List

Introduction to Genetic Analysis, 11th ed. (Griffiths, Wessler, Carroll, Doebley) – chapters 15-18
Principles of Population Genetics, 4th ed. (Hartl & Clark)

10. Assessment Details

This module will be graded through an invigilated MCQ examination (60%) on 4th Dec (MAC Lab) and continual assessment (40%).
The continual assessment is subdivided into:
Group poster project (35%) submission on 17th Nov and presentation on 20th Nov, which includes an individual contribution mark, and a short reflective essay (5%) submission 21st Nov.

For the MCQ, each student will receive a random set of questions that capture the entire breath of the module. These questions will be designed to test for both quick recall and reasoning skills. Students may be asked to solve mathematical problems, interpret tabular data and phylogenetic diagrams. There will be no negative marking.

For the group project, students will be placed in groups of 3-4 individuals and asked to produce a scientific poster that addresses a specific research question that is currently relevant or under debate

in the field of evolutionary and population genetics. Please note that this is not the general format of a scientific poster, which typically is a presentation of a specific research project carried out by an individual or team. The assessment poster is better thought of as a mini-literature review. Students will present their poster at an in-person event in the Smurfit Institute of Genetics.

When you have completed your poster, each group member will write a succinct reflective report that critically reflects on their involvement in the project and evaluate what was produced by your team.

11. Module Coordinator: Lara Cassidy (**cassidl4@tcd.ie**)

3.2.4 GEU33085 Science Structure, Discussion and Presentation for Genetics

1. Module Code GEU33085
2. Module Name Science Structure, Discussion and Presentation for Genetics
3. Semester taught 1
4. Contact Hours 12
5. Module Personnel Anahit Hovhannisyan, Marco Capodiferro, Laititia Chauvel, Adrian Bracken, Dan Bradley, Matthew Campbell, Lara Cassidy, Mike Dolan, Jane Farrar, Seamus Martin, Kevin Mitchell, Juan Pablo Labrador, Aoife Mc Lysaght, Russell Mc Laughlin, Mani Ramaswami, Frank Wellmer.
6. Learning Objectives: This module has the following learning objectives: (1) discussion of the design and implementation of a genetical analysis of a biological phenomenon; (2) discussion of genetical analysis in model organisms – with particular focus on understanding why *C. elegans* is a powerful model system; (3) discussion of mathematical genetics; (4) discussion of how to research, design and write a literature review on a genetical subject; (5) to write a 4,000 literature review on an assigned genetic topic; (6) discussion of science communication: how to assemble and present a talk on a genetical topic.
(7) Students will make a 15 minute presentation on their literature review at the annual field-trip.

7. Module content: Programme of tutorials

Week	Day & Time	Programme of Tutorials GEU33085
4	Wed17th Sept 12:00-13:00	Genetic Analysis I: Introduction to C. elegans, a powerful model organism in Genetics. (Chauve)
4	Tue 16th Sept 9:00-10:00	Review I: How to write a literature review on a genetics/human genetic topic (Labrador & Cassidy) LTEE3
4/5	One to one meeting with supervisor	Review II: Supervisor and student meet to discuss the topic and how to structure the review (student to reach out supervisor and organise meeting)
5	Wed 24th Sept 12:00-13:00	Genetic Analysis II: Genetics analysis methods using C. elegans as a model system (part 1) (Chauve)
6	Wed 1st Oct 12:00-13:00	Genetic Analysis III: Genetic Analysis III: Genetics analysis methods using C. elegans as a model system (part 2) (Chauve)
7	One to one meeting with supervisor	Review III: Supervisor and student meet to discuss review structure produced by the student.
7	Wed 8th Oct 12:00-13:00	Genetic Analysis IV: Genetic Analysis IV: Studying gene interactions via epistasis analysis (Chauve)
8	Wed 15th Oct 12:00-13:00	Genetics Analysis Presentations
10	**Rview Week**	
11	Wed 29th Oct 12:00-13:00	Mathematical Genetics I: Networks/graph theory (Bradley & TBC)
12	Wed 12th Nov 12:00-13:00	Mathematical Genetics II: Game theory: Evolution of co-operation/altruism (Bradley & TBC)
13	Wed 19th Nov 12:00-13:00	Mathematical Genetics III: Bayesian statistics (Bradley & TBC)
14	Wed 26th Nov 14:00-16:00	Mathematical Genetics Presentations
20	Mon 5th Jan 9am	Assignment written literature review submission

NOTE: Venue: Dawson

- Week 4 **Review I: How to write a literature review on a genetical topic:** Discussion under the following headings: Topic / focus - Structure of review, themes, progression of ideas, literature survey, search databases, references.

- Week 4/5 **Review II: Discussion of the review topic assigned to each student review with the supervisors, under the headings listed above.** This is arranged by the supervisor / student at their mutual convenience.
- Week 7 **Review III:** Meeting with supervisor to discuss the review structure produced by the student – and to decide on the paper/review for the Field-Trip presentation. This meeting is arranged by the supervisor / student at their mutual convenience.
- Weeks 5 **Tutorial 1.** Genetic Analysis I: Introduction to C. elegans, a powerful model organism in Genetics.
- Weeks 6 **Tutorial 2.** Genetic Analysis II: Genetics analysis methods using C. elegans as a model system (part 1)
- Weeks 7 **Tutorial 3.** Genetic Analysis III: Genetics analysis methods using C. elegans as a model system (part 2)
- Week 8 **Tutorial 4.** Genetic Analysis IV: Studying gene interactions via epistasis analysis
- Week 11 **Mathematical Genetics I -** Networks/graph theory
- Week 12 **Mathematical Genetics II -** Game theory: Evolution of co-operation/altruism.
- Week 13 **Mathematical Genetics III -** Bayesian statistics.
- Week 14 **Mathematical Genetics IV –** Mathematical Genetics presentations.

8. Learning Outcomes: Students will have the following skills: (1) to research and write a scientific literature review; (2) to research, prepare and give a scientific oral presentation; (3) to design and perform a genetic analysis of a biological phenomenon; (4) to describe why model organisms are valuable for genetic analysis, with particular emphasis on the features that make ***C.*** *elegans* especially suitable; (5) to perform mathematical genetic analysis.

9. Recommended Reading List:

How to make a scientific presentation will be based on "*Giving a seminar: Suggestions for Graduate Students"* by John Roth.

Reading material for tutorials 1-4 will be presented during the first tutorial.

Reading material for the Mathematical genetics tutorials will be presented during the first tutorial.

10. Assessment Details: 15% Genetic Analysis
15% Mathematical Genetics Presentations
70% Written review, 4,000 words ((deadline, Monday of week 20, January 5th 9am)

11. Module Coordinator TBC

4.2.5 GEU33045 Genomics & Systems Biology

1. Module Code GEU33045 (Open Module)
2. Module Name Genomics & Systems Biology
3. Semester taught 1
4. Contact Hours 24
5. Module Personnel Mike Dolan, Adrian Bracken, Carsten Kröger, Kenneth Mok
6. Learning Aims The aim of this module is to equip students with a comprehensive understanding of the methods used in the fields of genomics, proteomics and metabolomics and how these methods are used for basic research, biotechnology, agriculture and medicine. To this end, several applications from work in diverse organisms (bacteria, fungi, plants, animals including humans) in addition to specific diseases and disorders (Schizophrenia and Cancer) will be presented. The module further introduces students to the field of systems biology and outlines how systems biology differs from the classic reductionist approach used in biology.

7. Module content:

Week	Day & Time	Lecture Topic & Lecturer
4	Mon 16th Sept 17:00-18:00	Introduction to Genomics and Systems Biology (Dolan)
4	Tue 17th Sept 17:00-18:00	History of DNA Sequencing I (Dolan)
5	Mon 22nd Sept 17:00-18:00	History of DNA Sequencing II: The Human Genome Project (Dolan)
5	Tue 23rd Sept 17:00-18:00	Modern Day DNA sequencing I: 2nd Generation Sequencing Technologies (Dolan)
6	Mon 29th Sept 17:00-18:00	Modern Day DNA sequencing II: 3rd Generation Sequencing Technologies (Dolan)
6	Tue 30th Sept 17:00-18:00	Reference Sequences and Alignment (Dolan)
7	Mon 6th Oct 17:00-18:00	Population Genomics (Dolan)
7	Tue 7th Oct 17:00-18:00	Transcriptomics: Revealing Gene Expression (Dolan)
7	Wed 8th Oct 17:00-18:00	How to Find Genes (Dolan)
8	Mon 13th Oct 17:00-18:00	Functional Genomics: Regulatory Genome and non-coding DNA (Dolan)
8	Tue 14th Oct 17:00-18:00	Single-cell and Spatial Transcriptomics I (Dolan)
9	Mon 20th Oct 17:00-18:00	Single-cell and Spatial Transcriptomics II (Dolan)
9	Tue 21st Oct 17:00-18:00	Bacterial genomes and comparative genomics (Dorman)
10		**Review week**
11	Mon 3rd Nov 17:00-18:00	Functional genomics in bacteria (Dorman)
11	Tue 4th Nov 17:00-18:00	*Revision of material, discussion and answering student questions (Dolan) - tutorial*
12	Mon 10th Nov 17:00-18:00	Introduction into the epigenome: histone and DNA modifications (Bracken)
12	Tue 11th Nov Blackboard	Prerecorded lectures *** Proteomics: Identify/characterise/quantify; Mass Spec and other technologies (Mok) Quantitative proteomics; clinical proteomics (Mok)

13	Mon 17th Nov 17:00-18:00	Using genomic information for the development of cancer therapies (Bracken)
13	Tue 18th Nov 17:00-18:00	Interaction/affinity proteomics; metabolomics introduction (Mok)
14	Mon 24th Nov 17:00-18:00	Methods to analyse the epigenome; the ENCODE project (Bracken)
15	Mon 1st Dec 17:00-18:00	Cancer profiling and classification of tumour types (Bracken)
15	Tue 2nd Dec 16:00-17:00	Metabolomics technologies (Mok)
15	Tue 2nd Dec 17:00-18:00	*Revision of material, discussion and answering student questions (all lecturing)*
16		**Revision Week**
17		**Assessment Week**

NOTE: Venue LTEE3

8. Learning Outcomes: Upon successful completion of this module, students will be able to describe experimental approaches used in the fields of genomics, proteomics and metabolomics. They will understand how to leverage these methods to analyze complex biological systems and questions. Students will be able to evaluate the applications of these techniques in biological sciences and discuss case studies involving specific diseases and disorders. Finally, they will be able to differentiate between systems biology and traditional reductionist approaches in biology.

9. Recommended Reading List: none

10. Assessment Details: One 1.5-hour exam paper at the end of semester 1

11. Module Coordinator Mike Dolan MJDOLAN@tcd.ie

4.2.6 BIU33150 Biochemistry for Biosciences

Last year schedule and module descriptor. New timetable and details will be provided on Blackboard. Please use this information as a guide

1. Module Code BIU33150 (Open Module)

2. Module Name Biochemistry for Biosciences

3. Semester taught Semester 1

4. Contact Hours 20 hours lectures online (each ~ 50 mins in total), plus 2 in person tutorial sessions

5. Module Personnel Amir Khan (AK), K.H. Mok (KHM), Vincent kelly (VK), Martin Caffrey (MC), Andrei Budanov (AB), Derek Nolan (DN), Emma Creagh (EC), Aisling Dunne (AD), Daniela Zisterer (DZ).

6. Learning Aims This module follows on from the biochemistry/cell biology component of the "Molecules to Cells" BIU22201 module of year 2. The aim is to provide Junior Sophister students of other disciplines with the grounding in biochemistry necessary to (i) understand biology at a molecular level, (ii) form a mechanistic view of biological processes and (iii) appreciate the pathobiochemical basis of disease. The module covers four major themes in biochemistry: Proteins and Nucleic Acids , Membranes, Cytoskeleton and Signalling. The module will be assessed through a combination of in course assessment and an individual end of term exam.

7. Module content: Programme of lectures

Lecture	**Lecture Topic & Lecturer**
	Part A - Proteins and Nucleic Acids
1	Amino acids and peptide bond (AK)
2	Structures , motifs and folds (AK)
3	Structure and mechanism: serine proteases (AK)
4	Spetrophotometry of biomolecules (KHM)
5	Protein folding and pathologies (KHM)
6	The proteome (KHM)
7	DNA, chromatin & the nucleus (VK)
8	RNA structure, folds & function (VK)
	Part B – Membranes
9	An introduction to cellular and model membranes (MC)
10	Membrane composition and therapeutic approaches (MC)
11	The Synthetic & Assembly Mechanisms for Membrane Proteins that Form Specific Topologies (DN)
12	Membrane transport of small molecules, specificity, mechanisms, energy Coupling (DN)
	Part C – Cytoskeleton
13	Structure of tubulin and microtubules and the Assembly / Disassembly of Microtubular Structures (EC)
14	Microtubular motors, types, mechanism of movement, regulation, physiological roles (EC)
15	Introduction to actin and the actin cytoskeleton (DN)
16	F-actin nucleation & pathologies associated with actin cytoskeleton (DN)
	Part D – Signalling
17	Introduction to cell signalling & GPCRs (EC)
18	G-Protein coupled Receptor (GPCR) regulation (EC)
19	Receptor tyrosine kinases (RTKs)-PDGF and EGF (DZ/AD)
20	RTK signalling – PKB and PDK1 (DZ/AD)

Lectures schedule and time table

All lectures will be delivered online as follows with the accompanying lecture notes on blackboard : Module BIU33150. Lectures will be released 2 per week starting on week 1 of the teaching term (Monday 9th Sept). Subsequent lectures will be released 2 per week each following Monday. Lectures are usually subdivided into part A , C etc on BB. These can vary in length but combined will give 50 min overall for the lecture topic. So these are not multiple lectures, they are smaller parts of the same lectures.

Sampel MCQs and exam Qs are available on line in BB.

Date of lects (on BB)	**Lect No**	**Staff**	**Upload to BB by**
1 Mon 11/09	1-2	AK	11/09
2 Mon 18/9	3-4	AK/KHM	18/09
3 Mon 25/9	5-6	KHM	25/09
4 Mon 2/10	7-8	VK	2/10
5 Mon 9/10	9-10	MC	9/10
6 Mon 16/10	11-12	DN	16/10
7 Reading week			
8 Mon 30/10	13-14	EC	30/10
9 Mon 6/11	15-16	DN	6/11
10 Mon 13/11	17-18	EC	13/11
11 Mon 20/11	19-20	AD/DZ	20/11

(1-11 week of teaching term)

8. Learning Outcomes: On completion of this module, the student will be able to:

- Recall and comprehend key knowledge and concepts of the hierarchy of polypeptide structure and the forces that stabilize the three-dimensional shape of proteins
- Explain the link between a protein structure and its biological activity, and with appropriate examples, how human diseases arise from a deviation in structure
- Appreciate the principles of spectrophotometry and its applications to biomolecules
- Understand the concept of the proteome and its importance in disease
- Integrate key concepts about nucleic acid structure and function
- Demonstrate an understanding of the biochemical processes of nucleic acids in the cell
- Recall and integrate key knowledge and concepts concerning the role of lipids in membrane structure and function
- Describe how model membranes are formed and their applications
- Describe how an understanding of membrane composition and structure can be used in the design of vaccines, antibiotics and beta-blockers.
- Demonstrate a knowledge of the biosynthesis of membrane proteins, including the mechanisms of insertion and transport to their various locations.
- Explain the types of membrane transport and how this process is coupled to energy and assayed.
- Describe the structure of microtublules, their assembly and disassembly and their polarity.
- Describe the structure of microtublule motors and the processes of directed vesicle transport and cytoplasmic streaming.
- Describe the structure of monmeric actin and how it is assembled into filaments
- Explain how actin nucleation is linked to pathological states.

- Describe the general principles of G-protein coupled receptor (GPCR) signalling and its regulation, the initial discovery of G-proteins linked to cyclase, the functional effects of cAMP and the activation of GPCR-linked signal-activated phospholipases.
- Discuss Receptor Tyrosine Kinase (RTK) signalling and details of MAP kinase cascades, using PDGF and EGF as examples. Explain RTK and PI3K pathways in the context of PKB (Akt) and PDK1 signalling.
- Describe the principles of steroid hormone receptor signalling mechanisms.

9. Recommended Reading List: A reading list will be given out by lecturers during the module.

10. Assessment Details: 60% End of year examination, 40% in course assessed.
In course assessment: Two online MCQ assessemnts.
The MCQs will be structured as follows:
There will be two MCQs per lecture, giving 40 MCQs for the course.
The first MCQ will be after reading week and will cover the first 12 lectures (so 24 MCQs) representing 24% of the marks for the module.
The second MCQ will be in week 12, i.e. the last week of the term and will cover the material contained in the eight lectures after reading week. There will be 16 MCQs representing 16% of the marks for the course.

11. Module Coordinator: Dr D Nolan denolan@tcd.ie

4.3 Semester 2 Modules

4.3.1 GEU33100 Field Trip

1. Module Code GEU3100
2. Module Name Field Trip
3. Semester taught 2
4. Contact Hours 18
5. Module Personnel Adrian Bracken, Dan Bradley, Matthew Campbell, Lara Cassidy, Mike Dolan, Jane Farrar, Seamus Martin, Kevin Mitchell, Juan Pablo Labrador, Aoife Mc Lysaght, Russell McLaughlin, Mani Ramaswami, Frank Wellmer.
6. Learning Objectives: The field trip takes place over two days on the week 27 (26th – 27th Feb 2026). Hilary Term). It is a great opportunity for staff and students to meet scientifically and socially in an informal setting. Each student is expected to present a short (10- minute) presentation on the topic of their allocated Literature Review.
7. Module content:

Week		Lecture Topic & Lecturer
26	Mon 9th Feb 10:00-11:00	Field trip tutorial (Labrador) **LTEE3**
27	Thurs 26th Feb 10:00-18:30	Student presentations
27	Fri 27th Feb 10:00-15:00	Student presentations

8. Learning Outcomes: At the end of this module, students should be able to deliver a professional presentation on a scientific subject.
9. Recommended Reading List: Individually suggested by supervisors and student personal research.
10. Assessment Details: 10 min presentation on week 27 (26th – 27th Feb 2026). Attendance and presentation are **compulsory.**
11. Module Coordinators: Juan Pablo Labrador labradoj@tcd.ie

4.3.2 GEU33303 Molecular genetics II - Genome structure and dynamics

1. Module Code GEU33303
2. Module Name Molecular Genetics II
3. Semester taught 2
4. Contact Hours 23 (5 ECTS)
5. Module Personnel Prof. Frank Wellmer, Prof Matthew Dorman
6. Learning Aims The aim of this module is to introduce students to fundamental concepts in Molecular Genetics. By focusing on plant and microbial genetics, we want to highlight the overlap between these seemingly disparate biological systems. The microbial genetics component will focus on critical regulatory aspects of the gene expression machinery (transcription and translation), and genome replication (DNA replication, homologous recombination, mutagenesis and DNA repair). In relation to plant genetics, students will be introduced to major topics such as the structure and evolution of the nuclear genome, the importance of model plants, including Arabidopsis thaliana, light-regulated gene expression, hormone receptors and signal transduction systems. The evolutionary origins of plant cell organelles (chloroplasts and mitochondria) via endosymbiosis involving ancestral microbes will also be explored as will be the many facets of plant-microbe interactions including plant immunity and symbiosis.
7. Module content:

Week	Date & Time	Lecture Topic & Lecturer
22	Tue 20th Jan 11:00-12:00	DNA replication I: Linear and circular genomes; replication strategies; origins of replication (Dorman)
22	Tue 20th Jan 14:00-15:00	DNA replication II: regulation of initiation at oriC; role of DnaA and hemimethylation (Dorman)
22	Thurs 22nd Jan 15:00-16:00	Homologous recombination I: Holliday, Meselson-Radding and Szostak models (Dorman)
23	Tue 27th Jan 14:00-15:00	Homologous recombination II: RecA, SSB, RecBCD, RuvA, B, C; Horizontal gene transfer (Dorman)
23	Thurs 29th Jan 15:00-16:00	DNA Mutagenesis: chemical, deamination, base-analogues, chromosomal integration through homologous DNA, transposons (Dorman)
24	Tue 3rd Feb 11:00-12:00	DNA Repair systems: Mismatch base repair; Base excision repair; nucleotide excision repair; SOS response; Non-homologous end-joining; Error Prone DNA Polymerases (Dorman)
24	Tue 3rd Feb 14:00-15:00	*Tutorial*: revision of material, discussion and answering student questions (Dorman)
24	Thurs 5th Feb 15:00-16:00	Introduction: why plant research is important (Wellmer)
25	Tue 10th Feb 11:00-12:00	Models for plant research and nuclear genome structure (Wellmer)
25	Thurs 12th Feb 15:00-16:00	Evolution of the nuclear genome and sex determination in plants (Wellmer)
26	Thurs 19th Feb 15:00-16:00	Discovery and mutagenic potential of transposable elements (Wellmer)
28		Review Week
29	Wed 11th Mar 16:00-17:00	Regulation of transposon activity (Wellmer)
29	Thurs 12th Mar 14:00-15:00	The plastid genome and plastid evolution (Wellmer)
30	Wed 18th Mar 16:00-17:00	The genetic toolbox for analyzing plant biology: the making of transgenic plants (Wellmer)
30	Thurs 19th Mar 14:00-15:00	*Tutorial*: revision of material, discussion and answering student questions (Wellmer)
30	Thurs 19th Mar	The genetic toolbox for analyzing plant biology: genetic screens (Wellmer)

	15:00-16:00	
31	Wed 25th Mar 16:00-17:00	The genetic toolbox for analyzing plant biology: mutant analyses (Wellmer)
31	Thurs 26th Mar 14:00-15:00	Understanding signal transduction in plants (Wellmer)
31	Thurs 26th Mar 15:00-16:00	Understanding the response pathway for light (Wellmer)
32	Wed 1st Apr 16:00-17:00	Understanding the response pathway for the hormone ethylene (Wellmer)
32	Thurs 2nd Apr 14:00-15:00	Plant-microbe interactions (Wellmer)
32	Thurs 2nd Apr 15:00-16:00	Plant-pathogen interactions: an evolutionary arms race (Wellmer)
33	Thurs 9th Apr 14:00-15:00	*Tutorial*: revision of material, discussion and answering student questions (Wellmer)

8. Learning Outcomes: Upon successful completion of this module, students will be able to describe the critical regulatory features of the gene expression systems in prokaryotic microbes and eukaryotic cell organelles (chloroplasts and mitochondria). They will understand how DNA is replicated, how it can be recombined via homologous recombination, altered by mutagenic processes, and repaired. Students will also have acquired knowledge of key topics in plant genetics, such as light-regulated gene expression, hormone receptors and signal transduction, and the genetic basis of plant immunity.

9. Recommended Reading List: Anthony J.F. Griffiths et al. Introduction To Genetic Analysis. 12th edition. New York, NY :W.H. Freeman & Company, 2020.

Further reading on specialist topics will be provided during the presentation of the module.

10. Assessment Details: One 1.5-hour exam paper at the end of semester 2

11. Module Coordinators: Frank Wellmer (wellmerf@tcd.ie)
Matthew Dorman (dormanmj@tcd.ie)

4.3.3 GEU33301 Bioinformatics

1. Module Code GEU33301
2. Module Name Bioinformatics
3. Semester taught Semester 2
4. Contact Hours 39 Hours
5. Module Personnel Dr Karsten Hokamp (KH), Dr Carsten Kröger (CK), Dr Máire Ní Leathlobhair (MNL), Dr Fiona Roche (FR)
6. Learning Aims This module is taught in combination with the Microbiology department and covers web-based bioinformatics, Python programming and a data handling component. Lectures will be held in computer labs to enable a hands-on approach. The bioinformatics component provides a practical introduction to the use of commonly used bioinformatic databases and tools with a focus on web-based applications. Students will become familiar with accessing biological sequence databases and exploring various sequence analysis tools to understand evolutionary relationships and how this can help to draw protein functional and structural inferences. The Python programming component introduces students to computer programming in Python using bioinformatics-related examples and exercises. It will be carried out within an internal JupyterLab environment. The data handling part contains a biolab component in which samples will be prepared for whole-genome sequencing (WGS). The combined lectures and practicals cover basic techniques for processing next-generation sequencing data and working with the statistical software R.
This module runs for 14 x 2 hours (combined lecture and practical sessions) plus a 5-hour lab practical and 3 x 2-hour in-class assessments in Semester 2.
Students are required to bring their own laptop for the practical sessions.

As learning aims of this module students will

- learn how to search a range of biological databases
- understand how proteins are annotated and classified
- get to know which tools can be used to explore unknown sequences of interest
- master the concept of sequence alignment and homology searching
- understand the process of programming
- acquire basic Python programming skills
- gain a thorough understanding of next-generation sequencing data
- be familiar with the steps and tools required to process, map and visualise NGS data
- become familiar with the specifics of NGS data analysis
- understand how to enhance NGS results with annotation data
- isolate genomic DNA from *E. coli* bacteria
- prepare a DNA library for Nanopore sequencing
- carry out WGS analysis of a bacterial genome

7. Module content: Programme of lectures and practicals

Week	Day & Time	Lecture Topic & Lecturer
22	**Mon 19th Jan 14:00-16:00**	Bioinformatics 1 – Biological Databases (FR, 2 hours)
22	**Fri 23rd Jan 11:00-13:00**	Bioinformatics 2 – Protein Resources & Function Prediction (FR, 2 hours)
23	**Mon 26th Jan 14:00-16:00**	Bioinformatics 3 – Pairwise and Multiple Sequence Alignments (FR, 2 hours)
23	**Fri 30th Jan 14:00-16:00**	Bioinformatics 4 – Homology Searching using BLAST (FR, 2 hours)
24	**Fri 6th Feb 14:00-16:00**	Programming 1 – Variables and Loops (KH, 2 hours)
25	**Mon 9th Feb 14:00-16:00**	Programming 2 – Input/Output, Branching (KH, 2 hours)
25	**Fri 13th Feb 14:00-16:00**	Programming 3 – Lists, Tuples, Sets (KH, 2 hours)
26	**Mon 16th Feb 11:00-13:00**	Bioinformatics Assessment (FR, 2 hours)
26	**Mon 16th Feb 14:00-16:00**	Programming 4 – Dictionaries (KH, 2 hours)
26	**Fri 20th Feb 11:00-13:00**	Programming 5 – Functions, System Commands (KH, 2 hours)
	Review week	
29	**Tue 10th Mar 11:00-12:00 & 14:00-18:00**	Biolab Practical (CK, 5 hours) **
29	**Thu 12th Mar 10:00-12:00**	Programming Assessment (KH, 2 hours)
29	**Fri 14th Mar 11:00-13:00**	NGS Data Analysis 1 – Using R for bioinformatics: Part I (MNL, 2 hours)
30	**Thu 19th Mar 11:00-13:00**	NGS Data Analysis 2 – Using R for bioinformatics: Part II (MNL, 2 hours)
30	**Fri 20st Mar 11:00-13:00**	NGS Data Analysis 3 – Graphs & Data Visualization in R (MNL, 2 hours)
31	**Thu 26th Mar 11:00-13:00**	NGS Data Analysis 4 – Markdown Notebooks in R (MNL, 2 hours)
32	**Thu 2nd Apr 11:00-13:00**	NGS Data Analysis 5 – Introduction to Machine Learning in R (MNL, 2 hours)
33	**Thu 9th Apr 11:00-13:00**	R Assessment (MNL, 2 hours)

NOTE: Venue LTEE3 and MAC Lab.
**Biolab 1 Carsten Kroger session on Tue 10th March.

Description of each Lecture:
Bioinformatics 1 - Biological Databases (FR, 2 hours) This lecture covers how bioinformatics data are stored and organised with a focus on resources provided at NCBI and EBI. Students will learn about the different types of data and tools found within these resources, specifically the retrieval of gene/transcript information and approaches to interactively explore biological data in the context of the genome.
Bioinformatics 2 - Protein Resources and Function Prediction (FR, 2 hours) This lecture describes how protein sequence data are stored, annotated and classified. Students will learn about computational methods used for predicting protein function and be introduced to protein resources, such as

UniProt and InterPro.

Bioinformatics 3 - Pairwise and Multiple Sequence Alignment (FR, 2 hour) This lecture introduces the concept of sequence alignment, the process of comparing two sequences to determine if they are evolutionarily related to one another. Students will gain an understanding of both pairwise and multiple sequence alignment and learn of its many applications including its role in inferring function and structure and the identification of genetic variants from sequence comparison.

Bioinformatics 4 - Homology Searching using BLAST (FR, 2 hours) This lecture will explore the concept of homology searching using the BLAST algorithm, which compares single sequences against a database of sequences to search for significantly similar sequences. PSI-BLAST will also be introduced for the identification of more distant homologs.

Programming 1 – Variables and Loops (KH, 2 hours) This lecture covers string variables, string formatting, as well as built-in functions and methods for strings. This is followed by the use of 'while' and 'for' loops for repeated application of programming steps.

Programming 2 – Input/Output, Branching (KH, 2 hours) This lecture deals with ways of reading experimental data from files into a Python script and how to store results generated by a script in a file. It also introduces ways of making decisions in a Python script through branching. With this additional skill set students will be able to write more elaborate scripts and tackle processing of sequence data in Fasta format.

Programming 3 – Lists, Tuples, Sets (KH, 2 hours) Lists are a very common feature in data science. They are represented in Python through various types of iterable variables, which are covered in this lecture together with their built-in functions and methods.

Programming 4 – Dictionaries (KH, 2 hours) This lecture is dedicated to dictionaries, a collection of key-value pairs, which enables students to implement a DNA translation script.

Programming 5 – Functions, System Commands (KH, 2 hours) With the introduction of functions, the repertoire of programming skills is expanded so that scripts can be written more efficiently. System commands will enable the execution of external programs from within script.

Practical – Isolation of gDNA and Nanopore Sequencing (CK, 5 hours) In this practical, the students will learn how to isolate genomic DNA from Escherichia coli bacteria and how to quality-control the DNA integrity to be suitable for whole genome sequencing. One DNA library will be prepared for Oxford Nanopore sequencing.

NGS Data Analysis 1 – Using R for Bioinformatics (MNL, 2 hours) The last part of the module deals with the analysis of Next-Generation Sequencing (NGS) data. This lecture will introduce students to how the statistical software R can be used to manipulate and analyse NGS and other data. Students will learn about data structures, data manipulation and subsetting, as well as functions and packages in R.

NGS Data Analysis 2 – Using R for Bioinformatics: Part II (MNL, 2 hours) Building on Part I, this lecture will continue to explore how we can use R for the analysis of NGS data. Students will explore more complex data manipulation methods and learn about specialized bioinformatics packages in R. The session will also cover statistical analysis, enabling students to apply these skills to their own research projects.

NGS Data Analysis 3 - Graphs & Data Visualization in R (MNL, 2 hours) This lecture will cover basic plotting in base R, data visualization with ggplot2 and introductory data visualization theory.

NGS Data Analysis 4 - Working with Notebooks inR (MNL, 2 hours) This lecture covers the use of R Markdown Notebooks as an integrated way to carry out and share data analysis. Students will learn about the structure of R Notebooks, how to use Markdown to format text, and how to create and customize code blocks within Notebooks.

NGS Data Analysis 5 – Introduction to Machine Learning in R (MNL, 2 hours) This lecture will introduce students to the basics of machine learning using R. Students will learn about key machine learning concepts and techniques, including supervised and unsupervised learning.

8. Learning Outcomes: On successful completion of the module students should be able to:

MLO1. Query a range of bioinformatic databases
MLO2. Apply tools to investigate unknown sequences
MLO3. Carry out sequence alignment and homology searching
MLO4. Visualise biological data through a genome browser
MLO5. Approach programming tasks in a structured way
MLO6. Write Python scripts following good coding practice
MLO7. Integrate external programs and use functions within Python scripts
MLO8. Solve entry-level bioinformatics problems using Python scripts
MLO9. Assess the quality of NGS data
ML1O. Apply bioinformatics tools for processing NGS data
ML11. Visualise NGS data through genome browser resources
ML12. Carry out core NGS downstream analyses resulting in genome assemblies
ML13. Integrate external annotation data with analysis results through Python scripts
ML14. Competency to isolate bacterial DNA and to prepare a Nanopore sequencing reaction

9. Recommended Reading List:

The Biostar Handbook, 2ndEdition (https://www.biostarhandbook.com/)
Bioinformatics, 4th Edition, John Wiley and Sons Ltd, by Andreas D. Baxevanis, Gary Bader, David Wishart
Bioinformatics and Functional Genomics, 3rd Edition, 2015, Wiley Blackwell, Jonathan Pevsner
A Critical Guide to BLAST, TK Attwood
https://f1000research.com/documents/7-1435
How to Think Like a Computer Scientist, Learning with Python 3 (RLE), 2012 edition, by Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers
(https://openbookproject.net/thinkcs/python/english3e/)

10. Assessment Details: (1) A bioinformatics exam 33%
(2) a Python programming exam 33%
(3) R homeworks and an R programming exam 34%.
In case of an overall fail mark for this module, the failed components need to be repeated during the reassessment period.

11. Module Coordinator: Dr Karsten Hokamp kahokamp@tcd.ie

4.3.4 GEU33035 Genetic Analysis of Nervous Systems

1. Module Code GEU33035
2. Module Name Genetic Analysis of Nervous Systems
3. Semester taught Semester 2
4. Contact Hours 30
5. Module Personnel Juan Pablo Labrador, Mani Ramaswami
6. Learning Aims The module is focused on understanding how experimental genetics are used to manipulate genes in organisms to address problems in biology. Areas covered are 1) Experimental Genetics: structure and conservation of genes, nature of mutations and their effects on protein structure and function, model organisms in genetic research and experimental manipulation of animal genomes. 2) Developmental Neurogenetics: the purpose and design of genetic screens, genetic analysis of neurogenesis and genetic analysis of axon guidance 3) Behavioral Genetics: cell organization and methods of cell biology, cell biology of neurons and synapses, creation and use of molecular reporters of specific gene or cell activity, methods to study nervous systems, sensory circuits, sensation; transduction; perception; coding; behavior, learning and memory, sleep and circadian rhythms.
7. Module content: Program of lectures

Week	Day & Time	Lecture Topic & Lecturer
22	Tue 20th Jan 12:00-13:00	Experimental Genetics - Introduction - Structure and conservation of genes, nature of mutations and their effects on protein structure and function (Labrador)
22	Wed 21st Jan 15:00-16:00	Experimental Genetics - Dominance and germ line transmission (Labrador).
22	Thu 22nd Jan 9:00-10:00	Experimental Genetics - Transgenesis and the Gal 4 system (Labrador). **LTEE1**
22	Thu 23rd Jan 11:00-12:00	Experimental Genetics - Experimental manipulation of animal genomes. (Labrador)
22	Thu 23rd Jan 12:00-13:00	Developmental Genetics - The purpose and design of genetic screens (Labrador)
23	Tue 27th Jan 12:00-13:00	Developmental Genetics – Mapping Genes (Labrador)
23	Wed 28th Jan 15:00-16:00	Developmental Genetics - From phenotypes to genes, midline screen (Labrador)
23	Thu 29th Jan 11:00-12:00	Developmental Genetics - From genes to pathways, modifiers screens (Labrador)
23	Thu 29th Jan 12:00-13:00	Neurogenetics/ Behavioral Genetics Overview (Ramaswami)
24	Tue 3rd Feb 12:00-13:00	Building blocks – 1: Neurons, Ion channels, Synapses (Ramaswami)
24	Wed 4th Feb 15:00-16:00	Building blocks – 2: Neurons, Ion channels, Synapses (Ramaswami)
24	Thu 5th Feb 11:00-12:00	Cells to perception: visual system and some experimental methods (Ramaswami)
24	Thu 5th Feb 12:00-13:00	Genetics and biology of taste and smell (Ramaswami)
25	Tue 10th Feb 12:00-13:00	Cellular Basis for Memory (Ramaswami)
25	Wed 11th Feb 15:00-16:00	Genetic analysis of memory in Drosophila (Ramaswami)
25	Thu 12th Feb 11:00-12:00	Circadian Rhythms (Ramaswami)
25	Thu 12th Feb 12:00-13:00	**TBC**
26	Tue 17th Feb 11:00-13:00	**TBC**

26	Tue 17th Feb 12:00-13:00	**TBC**
26	Wed 18th Feb 15:00-16:00	**TBC**
26	Thu 19th Feb 11:00-12:00	**TBC**
26	Thu 19th Feb 12:00-13:00	**TBC**
27	Tue 24th Feb 11:00-12:00	**TBC**
27	Tue 24th Feb 12:00-13:00	**TBC**
28		**Review week**
29	Mon 9th Mar 15:00-16:00	Final written test
29	Mon 9th Mar 16:00-17:00	**TBC**
31	Mon 23rd Mar 9:00-10:00	**TBC**
31	Mon 23rd Mar 10:00-11:00	**TBC**
31	Mon 23rd Mar 11:00-12:00	**TBC**
31	Mon 23rd Mar 14:00-15:00	**TBC**
31	Mon 23rd Mar 15:00-16:00	**TBC**
32	Mon 30th Mar 9:00-10:00	**TBC**
32	Mon 30th Mar 10:00-11:00	**TBC**
32	Mon 30th Mar 11:00-12:00	**TBC**
32	Mon 30th Mar 14:00-15:00	**TBC**
32	Mon 30th Mar 15:00-16:00	**TBC**
32	Mon 30th Mar 16:00-17:00	**TBC**

NOTE: Venue LTEE3 // **week 22 Thursday 9:00-10:00 LTEE1**

Lecture times are subject to change within the hours reserved for the module on the above timetable.

8. Learning Outcomes: Upon successful completion of this module, students will be able to understand and describe how model organisms are used in genetic research and common technologies and methods employed to genetically modify organisms. Students should also understand the basis of genetic screens and mapping. They will be able to explain epistasis through the analysis of different genetic interactions in neurogenesis and axon guidance. Students will become familiar with the cell biology of neurons and synapse as well as methods to probe synaptic activity. Students will also learn about circuitry underlying perception.

9. Recommended Reading List: Anthony J.F. Griffiths; Susan R. Wessler; Sean B. Carroll; John Doebley. Introduction To Genetic Analysis. New York, NY :W.H. Freeman & Company, 2015

10. Assessment Details: Continuous assessment**:** class participation – Poster presentation (Week 31st) TBC (50%) and test on week 29 TBC (50%)

11. Module Coordinator Juan Pablo Labrador labradoj@tcd.ie

4.3.5 GEU33008 Analytical Genetics Laboratory

1. Module Code GEU33008
2. Module Name Analytical Genetics Laboratory
3. Semester taught Semester 2
4. Contact Hours 5 hours per week
5. Module Personnel Juan Pablo Labrador
6. Learning Aims

This module is a practical module that introduces the fundamentals of genetic analysis and the use of *Drosophila melanogaster* as a genetic model organism. The module will cover different aspects of model organisms handling and segregation. Virtual crosses are employed to understand Mendelian genetics and non-Mendelian inheritance including segregation, recombination, gene mapping, lethal genes and sex-linked inheritance.

7. Module content: Programme of lectures

Week	Day & Time	Lecture Topic & Lecturer
22	Mon 19th Jan 16:00-18:00 Tue 20st Jan 15:00-17:00 Wed 21st Jan 16:00- 18:00	Drosophila husbandry, identification of phenotypes, setting up crosses Mendelian inheritance tutorial. P-elements tutorial Monohybrid, dihybrid crosses (Labrador)
23	Tue 27th Jan 15:00-17:00 Wed 28th Jan 16:00- 18:00	Drosophila husbandry, identification of phenotypes, setting up crosses Non-Mendelian inheritance tutorial, Lethal mutations. (Labrador) Short Quiz 1: Monohybrid/dihybrid crosses
24	Tue 3rd Feb 15:00-17:00 Wed 4th Feb 16:00- 18:00	Segregation in Drosophila, identification of males carrying P-elements Lethal mutations , Sex linked inheritance. (Labrador) Short Quiz 2: Lethal mutations
25	Tue 10th Feb 15:00-17:00 Wed 11th Feb 16:00- 18:00	Segregation in Drosophila - fly husbandry Sex linked inheritance , Linkage, recombination and mapping. Linkage and mapping tutorial (Labrador) Short Quiz 3: Sex linked inheritance
26	Tue 17th Feb 15:00-17:00 Wed 18th Feb 16:00- 18:00	Segregation in Drosophila analysis of crosses Linkage and mapping (Labrador) Short Quiz 4: Linkage, Recombination and mapping
27	Mon 23rd Feb 14:00-17:00 Tue 24th Feb 15:00-17:00 Wed 25th Feb 16:00- 18:00	Fly husbandry -Set up crosses if required Review Mendelian and non-Mendelian inheritance (Labrador) Final Quiz: Mendelian and non-Mendelian inheritance, lethal mutations, linkage and mapping (date TBC)
28		**Reading Week**
30	Mon 16th Mar 14:00-17:00	Segregation in Drosophila – Review of results P-element mapping in Drosophila Tutorial (Labrador) Fly husbandry
31	Tue 24th Mar 15:00-16:00	Analysis and review of P-element results Fly husbandry (Labrador)
32	Wed 1st April 16:00- 18:00	TBC

NOTE: Venue MAC LAB and BIOLAB3 - Experiment weeks may be subject to change as we are working with live animals. An updated experiment, MCQs and lab report timetable will be provided at the start of the module.

8. Learning Outcomes: Upon successful completion of this module, students will be able to understand how model organisms are used in genetic research in a laboratory setting. Students should be able to set-up crosses and plan experiments using *Drosophila melanogaster*. Students will be able to design crosses and analyse ratios in the progeny. Mendelian inheritance ratios through the analysis of monohybrid, dihybrid and trihybrid crosses involving two or 3 chromosomes should be understood. Students will appreciate non-Mendelian inheritance involving sex linked loci or linked loci in autosomes or sex chromosomes.

9. Recommended Reading List:

Anthony J.F. Griffiths; Susan R. Wessler; Sean B. Carroll; John Doebley. Introduction To Genetic Analysis. New York, NY :W.H. Freeman & Company, 2015

Greenspan, R.J. (2004). Fly pushing: the theory and practice of Drosophila genetics, 2nd ed. (Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory Press).

10. Assessment Details: MCQs/Final MCQ 50% Week 27. Lab report 50% submission deadline Friday week 30/31 (TBC) 5pm

11. Module Coordinator Juan Pablo Labrador labradoj@tcd.ie

4.3.6 GEU33055 Developmental Genetics

1. Module Code GEU33055 (Open Module)
2. Module Name Developmental Genetics
3. Semester taught Semester 2
4. Contact Hours 24
5. Module Personnel Prof. Seamus Martin, Prof. Adrian Bracken, Prof. Frank Wellmer
6. Learning Aims This module aims at introducing students to fundamental concepts in developmental genetics and to experimental approaches that are used to study development. To this end, the module takes a comparative approach: the development of different organisms (insects, vertebrates, plants) will be examined to demonstrate differences and commonalities in the genetic mechanisms controlling morphogenesis. Students will be introduced to important developmental control mechanisms, including morphogens, spatial signaling via asymmetric distribution of signaling molecules, signal transduction cascades that culminate in differential gene expression and the activation of homeotic selector genes which dictate the specification of biological structures such as limbs and wings. We will also explore the factors governing cell division, a key biological process that is used to generate huge numbers of new cells during development as well as for tissue turnover and repair, and we will examine how cell division is precisely regulated via the 'cell division cycle'. The module will also introduce students to stem cell biology and will examine how stem cells are programmed to undergo growth and differentiation.

7. Module content:

Week	Day & Time	Lecture Topic & Lecturer
22	Wed 21st Jan 11:00-12:00	Intro to development and developmental genetics-Overview (Martin)
22	Wed 21st Jan 14:00-15:00	Pluripotent Stem Cells (Bracken)
22	Thu 22nd Jan 14:00-15:00	Multipotent Stem Cells 1 (Bracken)
22	Fri 23rd Jan 14:00-15:00	Multipotent Stem Cells 2 (Bracken)
23	Wed 28th Jan 14:00-15:00	Cellular Reprogramming (Bracken)
23	Thu 29th Jan 14:00-15:00	The cell cycle 1 (Martin)
24	Wed 4th Feb 11:00-12:00	The cell cycle 2 (Martin)
24	Wed 4th Feb 14:00-15:00	The cell cycle 3 (Martin)
24	Thu 5th Feb 14:00-15:00	The cell cycle 4 (Martin)
25	Wed 11th Feb 11:00-12:00	Introduction to *Drosophila* development and embryogenesis (Martin)
25	Wed 11th Feb 14:00-15:00	*Drosophila* development: anterior-posterior axis specification (Martin)
25	Thu 12th Feb 14:00-15:00	*Drosophila* development: role of maternal effect genes (Martin)
26	Wed 18th Feb 11:00-12:00	*Drosophila* development: activation and function of gap genes (Martin)
26	Wed 18th Feb 14:00-15:00	*Drosophila* development: activation and function of pair-rule genes (Martin)

26	Thu 19th Feb 14:00-15:00	*Drosophila* development: activation and function of segment polarity genes (Martin)
27	Wed 25th Feb 11:00-12:00	*Drosophila* development: dorso-ventral axis specification (Martin)
27	Wed 25th Feb 12:00-13:00	*Drosophila* development: homeotic selector genes and segment identity (Martin)
27	Wed 25th Feb 14:00-15:00	Tutorial: revision of material, discussion and student questions (Martin, Bracken)
28		**Review week**
29	Wed 11th Mar 11:00-12:00	Organogenesis: genetic control of vertebrate limb development (Wellmer)
29	Wed 11th Mar 14:00-15:00	Organogenesis: genetic control of vertebrate limb development II (Wellmer)
31	Wed 25th Mar 11:00-12:00	Organogenesis: Genetic control of *Drosophila* eye development (Wellmer)
31	Wed 25th Mar 14:00-15:00	Principles of plant development (Wellmer)
32	Wed 1st Apr 11:00-12:00	Stem cells, cell fate determination and organogenesis in plants (Wellmer)
32	Wed 1st Apr 14:00-15:00	Tutorial: revision of material, discussion and student questions (Wellmer)

NOTE: Venue LTEE3

8. Learning Outcomes: Upon successful completion of this module, students will be able to describe fundamental mechanisms underlying the control of development in animals and plants. They will understand how cell division is tightly regulated in higher organisms via a dedicated set of enzymes (called the cyclins and cyclin-dependent kinases) and how deregulated cell division can lead to cancer. They will have acquired knowledge to outline key events during development including embryogenesis and the formation of organs and will be able to describe how these events are regulated at a molecular level. Students will be familiar with the biology of stem cells and how these cells are programmed to undergo growth and differentiation. They will be able to describe experimental approaches that are used by researchers to dissect developmental processes and mechanisms.

9. Recommended Reading List:

Anthony J.F. Griffiths; Susan R. Wessler; Sean B. Carroll; John Doebley. Introduction To Genetic Analysis. New York, NY :W.H. Freeman & Company, 2015.

10. Assessment Details: One 1.5-hour exam paper at the end of semester 2

11. Module Coordinator Prof. Seamus Martin Email: MARTINSJ@tcd.ie

4.3.7 GEU33215 Medical Genetics

1. Module Code GEU33215 (Open Module)
2. Module Name Medical Genetics
3. Semester taught Semester 2
4. Contact Hours 18
5. Module Personnel Jane Farrar, Russell McLaughlin,
6. Learning Objectives The module provides an introduction to core concepts in medical genetics highlighting the importance and power of genetic information in the era of genomic medicine and the impact of such information for all of us. Learning objectives include: (1) discussion of the genetic basis of single gene disorders (Mendelian) and complex disorders; (2) overview of the history of medical genetics; (3) insights into key developments in medical genetics up to 2025 including state-of-art technologies and novel innovative therapies; (4) discussion of the key technologies and methodologies currently used to elucidate the genetic basis of human traits; (5) discussion of the individualisation of medicine and the important roles of genetic information in disease diagnosis, prognosis and the design and choice of therapy. In summary, the module provides an introduction to:

- The genetic basis of mendelian & complex disorders
- Genetic technologies & methodologies used to elucidate the genetic basis of human traits
- The exploitation of genomic data in diagnosis, prognosis & treatment of disease
- The individualization of medicine using genetic information

7. Module content: Programme of lectures

Week	Day & Time	Lecture Topic & Lecturer
29	Mon 9th Mar 17:00-18:00	Importance of medical genetics and history of developments in the field. (Jane Farrar)
29	Wed 11th Mar 17:00-18:00	Introduction to complex traits. (Russell McLaughlin)
29	Fri 13th 16:00-17:00	Quantitative traits and complex disorders. (Russell McLaughlin)
29	Fri 13th 17:00-18:00	Variance components and heritability (Russell McLaughlin)
30	Mon 16th Mar 17:00-18:00	Overview of spectrum of Mendelian and multifactorial disorders. (Jane Farrar)
30	Wed 18th Mar 17:00-18:00	Dominance, additivity and interaction. (Russell McLaughlin)
30	Fri 20th Mar 16:00-17:00	Identification of disease genes and disease mutations. (Jane Farrar)
30	Fri 20th Mar 17:00-18:00	Variant interpretation and ACMG guidelines. (Jane Farrar)
31	Mon 23rd Mar 17:00-18:00	New trends in medical genetics. (Jane Farrar)
31	Tue 24th Mar 17:00-18:00	Introduction to pharmacogenomics. (Jane Farrar)
31	Fri 27th Mar 16:00-17:00	Selection on complex traits and the liability scale for complex disorders. (Russell McLaughlin)
31	Fri 27th Mar 17:00-18:00	Selection on complex traits and the liability scale for complex disorders. (Russell McLaughlin)
32	Mon 30th Mar 17:00-18:00	Genetic variation in cytochrome P450s and influence on drug response. (Jane Farrar)
32	Tue 31st Mar 17:00-18:00	Tracking on polygenic pharmacogenetic traits - GWAS, high throughput analysis. Actionable pharmacogenetic traits in clinical practice (Jane Farrar)
32	Wed 1st Apr 17:00-18:00	Mapping complex disease genes I: GWAS and polygenic risk. (Russell McLaughlin)

33	Tue 7th Apr 17:00-18:00	Mapping complex disease genes II: missing heritability and rare variants (Russell McLaughlin)
33	Wed 8th Apr 17:00-18:00	Tutorial (Russell McLaughlin)
33	Fri 10th Apr 16:00-17:00	Tutorial (Jane Farrar)
33	Fri 10th Apr 17:00-18:00	TBC

NOTE: Venue LTEE3.

Description of Lectures:

Jane Farrar

History and importance of medical genetics: Topics include disease prevalence (congenital, Mendelian and multifactorial disorders including cancer), the practical value of genetic information *inter alia* the role of genetic counseling and potential of emerging new therapeutics based on knowledge of disease etiology.

Overview of spectrum of Mendelian and multifactorial disorders: Topics include phenotypes associated with autosomal dominant, recessive and X-linked disorders, emphasising the clinical significance of many of these inherited disorders with many being distressing, serious and life-threatening. The genetics underpinning multifactorial disorders and methodologies utilised to elucidate these genetic factors is also discussed.

Identification of disease genes and disease mutations. An overview of the development and utilisation of methodologies to identify disease causing genes and mutations. Application of genome sequencing in the era of genomic medicine.

New trends in medical genetics: In the era of whole genome sequencing (WGS) interpretation of novel genetic variants is key; innovative methods for interpretation are discussed. Use of the American College of Medical Genetics (ACMG) guidelines in clinical genetics. Targeted therapies directed by genetic information – current status for gene therapy, gene editing etc.

Introduction to pharmacogenomics. Genetic variation between individuals greatly influences drug response, drug efficacy and / or drug toxicity and indeed is relevant to all of us - on average every human carries a number of actionable pharmacogenetic variants. Such genetic information is leading to the individualisation of medicine and has enormous ramifications for medicine and drug development. An introduction to methods used to identify genetic variants for monogenic and polygenic pharmacogenetic traits will be discussed. Genes encoding drug metabolising enzymes (DMEs) will be introduced including Phase I and Phase II DMEs. For example, the significant effects of genetic variants in the thiopurine methyltransferase (TPMT) gene (a Phase II DME) on response to major chemotherapeutic and immunosuppressant drugs will be outlined.

Genetic variation in cytochrome P450s and drug response: The family of genes encoding cytochrome P450 enzymes (Phase I DMEs) will be introduced including CYP2C9 and CYP2D6, among others. Genetic variants in these DME genes influence metabolism of drugs, including commonly used medications such as warfarin and codeine, among others. A summary of the studies underpinning the now actionable pharmacogenomic outcomes associated with warfarin and codeine therapies will be provided. Genetic information can be utilised to target the optimal therapy at the right dose to the correct patient.

Tracking on polygenic pharmacogenetic traits - GWAS, high throughput analysis. **Actionable pharmacogenetic traits in clinical practice.** Methods used to identify genetic factors that influence risk of an adverse drug response between individuals will be reviewed. Parallels between pharmacogenomic studies and use of GWAS, WGS to decipher genetic determinants of complex disorders will be highlighted. While pharmacogenetic traits underpin much of the variance between

individuals in response to medications, genetic variants in pharmacogenes can also influence disease risk. Many DMEs metabolise not only exogenous compounds (therapeutics) but also endogenous compounds, and therefore it is not surprising that genetic variants in these genes can contribute to disease risk - mounting evidence that genetic variants in pharmacogenes can impact disease risk will be outlined. Genetic variants that can cause catastrophic drug responses will be discussed, as will how these are becoming actionable in clinical practice. An overview will be provided of pharmacogenetic traits that have obtained FDA/EMA backing with actionable outcomes in clinical practice. The barriers that have hindered translation of pharmacogenetic information from the laboratory into clinical practice will be discussed.

Russell McLaughlin

Introduction to complex traits: In this lecture we define the concept of complex traits, framed against classical Mendelian genetics and alternative models of genetic architecture. This lecture also explores the problem of defining phenotypes in the presence of clinical and genetic heterogeneity.

Quantitative traits and complex disorders: This lecture sets the statistical framework for following lectures, defining basic population parameters including mean, variance and distribution, using a worked example of human height. The liability scale is introduced as a prototype for modelling complex disorders as quantitative traits.

Variance components and heritability: Here we demonstrate how phenotypic variance can be decomposed into genetic and non-genetic components, allowing the estimation of heritability (the fraction of phenotypic variance due to genetic variance). Methods for estimating heritability are discussed, including worked examples with inbred plant lines and monozygotic twins.

Dominance, additivity and interaction: Our genetic model for complex traits is further decomposed to explicitly define variance conferred by dominance effects, gene-gene and gene-environment interactions and additive effects of trait-increasing alleles. Methods for heritability estimation using non-twin pedigree data are defined.

Selection on complex traits and the liability scale for complex disorders: This lecture discusses the practical application of statistical models for complex traits, explaining models of variance components established in previous lectures through the lens of plant and animal breeding. The equivalence between this and the liability scale for complex disease is delineated.

Mapping complex disease genes I: GWAS and polygenic risk: Having established the overall model for complex diseases, this lecture now lays out a key method used to understand the genetics of complex disease: the genome-wide association study (GWAS). We also describe and explain how GWAS data can be used to understand the genetic architecture of complex diseases (e.g., polygenic/non-polygenic) and to estimate the fraction of overall heritability explained by common variants.

Mapping complex disease genes II: missing heritability and rare variants: This lecture defines the missing heritability problem along with explanations and solutions for understanding the genetic architecture of disease in the post-GWAS era, specifically in the context of rare variants.

We shift our focus from GWAS and rare single-nucleotide variants to some other types of genetic variation that are likely to play a major role in the aetiology of complex diseases. The lecture takes a dive into a worked example of the role of repeat expansions in the neurodegenerative disease amyotrophic lateral sclerosis.

8. Learning Outcomes:

On completion of the module students will:

- Have gained an overview of the history of medical genetics and understand the current state-of-the art in this rapidly changing and exciting field
- Have knowledge regarding the genetic basis of mendelian and complex disease

- Have gained insights into methods of analyses used in medical genetics; linkage studies, genome-wide association studies (GWAS), next generation sequencing (NGS), data analyses tools etc
- Understand the genetics of polygenic traits, the concept of heritability and methods to estimate it
- Have insights into emerging themes in personalized medicine that influence drug design, drug choice and drug response and the importance of genetic information for medicine and drug development
- Understand the relevance of medical genetics to diagnosis, prognosis and treatment of disease

9. Recommended Reading List:

'Genetic and Genomics and Medicine', (Garland Science) - Tom Strachan, Judith Goodship and Patrick Chinnery

'Introduction to Genetic Analysis' (Macmillan Education) Griffiths, Wessler, Carroll & Doebly

Primary references will be provided in lecture materials

10. Assessment Details: One 1.5-hour exam paper at the end of semester 2

11. Module Coordinator Jane Farrar gjfarrar@tcd.ie

4.3.8 BIU33250 Introduction to Immunology & Immunometabolism

Last year schedule and module descriptor. New timetable and details will be provided on Blackboard. Please use this information as a guide

1. Module Code BIU33250 (Open Module)
2. Module Name Introduction to Immunology & Immunometabolism
3. Semester taught Semester 2
4. Contact Hours 22
5. Module Personnel Cliona O'Farrelly (COF), Frederick Sheedy (FS), Jean Fletcher (JF), Richard Porter (RP), Luke O'Neill (LON),
6. Learning Aims This module introduces to the basic components and function of the immune system – the molecules, cells, tissues and organs that make up the immune system. It will illustrate the immune responses to infection. Additionally, it will introduce students to the importance of central energy and intermediary metabolic pathways before considering how they are dysregulated in diseases like cancer and also how we can harness this knowledge for new immunotherapies

7. Module content: Provisional for semester 2

Lecture #	Lecture Topic
23	Introduction – The Immune System (COF)
23	Innate Immunity 1 – Innate Defences (FS)
23	Innate Immunity 2 – Cellular Response to infection (FS)
23	Innate Immunity 3 – PRR Signalling (FS)
24	Innate Immunity 4 – Cytokines (FS)
24	T-cells 1 – DCs & Antigen Presentation (JF)
24	T-cells 2 – T-cell Receptor (JF)
24	T-cells 3 – T-cell Signalling (JF)
25	T-cells 4 – Effector T-cells (JF)
25	B-cells 1 – B-lymphocytes & Plasma Cells (COF)
25	B-cells 2 – Antibodies (COF)
25	B-cells 3 – Disorders of the immune system (COF)
26	Advanced Metabolism 1 – Central Energy Metabolism (RKP)
26	Advanced Metabolism 2 – Intermediary Metabolism (RKP)
26	Advanced Metabolism 2 – Intermediary Metabolism (RKP)
26	Advanced Metabolism 4 – Nucleotide Metabolism (RKP)
27	Advanced Metabolism 5 – Cancer Cell Metabolism (RKP)
27	Advanced Metabolism 6 – Immune Cell Metabolism (RKP)
27	Immunometabolism 1 (LON)
27	Immunometabolism 2 (LON)
28	In-class MCQ

Lecture schedule will be confirmed before start of semester 2.

8. Learning Outcomes:

On successful completion of this module students will be able to:

• Identify cells, receptors and soluble component of the innate immune system and how they function to eliminate pathogen.

• Define how an adaptive immune response is initiated and how different types of adaptive immune responses are used to eliminate particular pathogens.

• Identify how the immune system can cause disease and how it can be exploited therapeutically

• Recall key central energy and intermediary metabolic pathways and appreciate their importance in cellular function
• Apply knowledge on cellular metabolism to diseases including cancer and inflammation

9. Recommended Reading List:

The recommended text for this module is Janeway's Immunobiology published by Norton's Books, currently in its 10th Edition. Further reading will be given out by lecturers during the module.

10. Delivery

This Open module consists of 16 scheduled lectures (plus 2 tutorials) which will be delivered either online through Panopto (pre-recorded) or face to face. Any recordings will be released online in Blackboard and students will be notified beforehand. The in-class MCQ will be made available on the Blackboard after Reading/revision Week 1 at a flexible slot. The end of Semester exam will be an in-person, written exam paper.

11. Assessment Details:

60% End of year examination, 40% in course assessed.
In course assessment: In-class end of module MCQ exam covering lecture material

12. Module Coordinator Dr Aisling Dunne aidunne@tcd.ie

4.3.9 BIU33475 Basics of Neurobiology

Last year schedule and module descriptor. New timetable and details will be provided on Blackboard. Please use this information as a guide

1. Module Code BIU33475 (Open Module) Module)
2. Module Name Basics of Neurobiology
3. Semester taught Semester 2
4. Contact Hours 16 hours (16 Lectures)
5. Module Personnel Gavin Davey & David Loane
6. Learning Aims: This module focuses on chemical transmission between neurons, how neurotransmitters are classified and identified and describes typical and atypical neurotransmitters and their functions in the brain. It considers mechanisms in which abnormal neurotransmission gives rise to common neurological & psychiatric disorders.
7. Module content: Programme of lectures and practicals –

Week	Lecture Topic & Lecturer
Semester	
22	Intro: cell types in the brain and their functions; NT types; NT criteria (GD)
22	Techniques for studying neurotransmission (GD)
22	Acetylcholine release & exocytosis (GD)
23	Biogenic Amines I (GD)
23	Biogenic Amines II & brain disorders (GD)
23	Glutamatergic neurotransmission systems
24	GABAergic neurotransmission systems (GD)
24	Atypical Neurotransmitters I (GD)
24	Atypical Neurotransmitters II (GD)
25	Brain lipids, gangliosides & lipid mediators (GD)
25	Intracellular trafficking & signalling (GD)
25	Inborn metabolic diseases of the brain (GD)
26	Inborn metabolic diseases of the brain (DL)
26	Neurobiology of schizophrenia & autism (DL)
27	Neurobiology of mood and anxiety disorders (DL)
27	Neurobiology of addiction (DL)

8. Learning Outcomes:
On completion of this module, the student will be able to:

- Describe the cell types in the brain and common techniques that enable chemicals with neurotransmitter-like properties to be identified
- Understand the criteria that need to be satisfied in order for a chemical to be classified as a neurotransmitter
- Develop a knowledge of the biogenic amines (acetylcholine, dopamine, noradrenaline, adrenaline, serotonin) and the properties that allow them to be classified as neurotransmitters
- Develop a knowledge of glutamate and GABA and the properties that allow them to be classified as neurotransmitters
- Develop a knowledge of atypical neurotransmitters (NO, CO, D-serine, neuropeptides, purines) and the properties that allow them to be classified as neurotransmitters
- Develop a knowledge of how dysfunctional neurotransmitter systems give rise to common neurological & psychiatric disorders

9. Recommended Reading List:
Basic Neurochemistry (Siegal, Albers, Brady, Price) Academic Press, 7th Edition. (6th Edition is online free at https://www.ncbi.nlm.nih.gov/books/NBK20385/?term=basic%20neurochemistry)
Principles of Neural Science by Eric Kandel , James Schwartz , Thomas Jessell , Steven Siegelbaum , A.J. Hudspeth
10. Assessment Details: Examination (70% written examinations; 30% continual assessment).
11. Module Coordinator: Dr Gavin Davey gdavey@tcd.ie

4.4 Marking Scale

Note that these guidelines are for use as a general reference. Differences may occur between disciplines.

	Mark Range	Criteria
I	90-100	IDEAL ANSWER; showing insight and originality and wide knowledge. Logical, accurate and concise presentation. Evidence of reading and thought beyond course content. Contains particularly apt examples. Links materials from lectures, practicals and seminars where appropriate.
	80-89	OUTSTANDING ANSWER; falls short of the 'ideal' answer either on aspects of presentation or on evidence of reading and thought beyond the course. Examples, layout and details are all sound.
	70-79	MAINLY OUTSTANDING ANSWER; falls short on presentation and reading or thought beyond the course, but retains insight and originality typical of first class work.
II-1	65-69	VERY COMPREHENSIVE ANSWER; good understanding of concepts supported by broad knowledge of subject. Notable for synthesis of information rather than originality. Sometimes with evidence of outside reading. Mostly accurate and logical with appropriate examples. Occasionally a lapse in detail.
	60-64	LESS COMPREHENSIVE ANSWER; mostly confined to good recall of coursework. Some synthesis of information or ideas. Accurate and logical within a limited scope. Some lapses in detail tolerated.
II-2	55-59	SOUND BUT INCOMPLETE ANSWER; based on coursework alone but suffers from a significant omission, error or misunderstanding. Usually lacks synthesis of information or ideas. Mainly logical and accurate within its limited scope and with lapses in detail.
	50-54	INCOMPLETE ANSWER; suffers from significant omissions, errors and misunderstandings, but still with understanding of main concepts and showing sound knowledge. Several lapses in detail.
III	45-49	WEAK ANSWER; limited understanding and knowledge of subject. Serious omissions, errors and misunderstandings, so that answer is no more than adequate.
	40-44	VERY WEAK ANSWER; a poor answer, lacking substance but giving some relevant information. Information given may not be in context or well explained, but will contain passages and words, which indicate a marginally adequate understanding.
F-1	35-39	MARGINAL FAIL; inadequate answer, with no substance or understanding, but with a vague knowledge relevant to the question.
	30-34	CLEAR FAILURE; some attempt made to write something relevant to the question. Errors serious but not absurd. Could also be a sound answer to the misinterpretation of a question.
F-2	0-29	UTTER FAILURE; with little hint of knowledge. Errors serious and absurd. Could also be a trivial response to the misinterpretation of a question.
U.G		Ungraded

Faculty of Engineering, Mathematics and Science - Guidelines on Marking, last modified 2007.

4.4 Attendance Requirements

Students must attend all practical and tutorial modules GEU33085, GEU33007, GEU33008, GEU33301 And are strongly advised to attend all lectures on the remaining modules. Failure to attend one third of the scheduled contact hours may deem the student non-satisfactory.

Our aim during the Junior Sophister year is to provide you with a thorough grounding in the fundamentals of modern Genetics so that you will be well prepared for the challenges of the Senior Sophister year. We therefore expect you to attend all lectures and in addition, some modules have strict attendance policy with direct consequences as a student may be deemed non-satisfactory.

It is necessary to constantly be aware that timetable may be subject to change if external conditions and circumstances demand this. Please be advised that the schedule might slightly vary subject to Lecturers availability. Any changes will be communicated via Blackboard announcement/email.

Attendance at seminars

In addition to the lecture courses there are weekly departmental seminars scheduled for 1 p.m. on Fridays in the atrium (these will be announced a few days ahead of time). Whilst it is not compulsory to attend these seminars you are strongly recommended to do so.

Communication

Announcements will be made by emailing you at your **tcd.ie email address**. You must read this mailbox regularly or set it up to forward to an account that you do read. Your primary contact for each module is the module coordinator and for general queries the Course Coordinator.

4.5 Non-submission of coursework and absence form Examinations

Students are required to complete the assessment components for each module as prescribed by the programme regulations.

Students must complete and submit the assessment components specified for each module that constitute their programme of study. Completion includes the submission of continuous assessment and attendance at examinations and other tests.

Students who are experiencing difficulties that are affecting their ability to complete their assessment components should contact their Tutor at the earliest opportunity to discuss the nature of the difficulties and the possible options available in Trinity. Depending on the specific details of a case, options can range from a request for a short extension from a module coordinator to a formal request for a deferral made to the Senior Lecturer/Dean of Undergraduate Studies.

Where the difficulties are serious, a student may need to make a Student Case, through their Tutor, to the the Senior Lecturer/Dean of Undergraduate Studies.

Where a student does not complete specified assessment component(s), the relevant Court of Examiners has the authority to make one of the following determinations:
i. Permission to defer to the reassessment session
ii. Re-assess in relation to the missed component(s) for the reassessment session, subject to capping the associated reassessment(s) at the pass mark

iii. Repeat year

Calendar Part II, B: General Regulations and Information, 'Absence'
Academic Policies

4.6 Progression Regulation

It is important that you aim to achieve high grades in your continuous assessments and exams because 30% of the marks obtained in the JS year will contribute directly to your Senior Sophister BA Moderatorship grade. Also, when **project and review topics for Senior Sophister year** are assigned next year, students with higher marks in JS year will tend to get their higher preference choices of topic.

The current regulations are included below (calendar 2024-25). Please check the most recent version of the calendar for any updates (TCD Calendar):

Progression regulations: Bachelor programmes

59 *Some programmes with professional accreditation have received a derogation from specific regulations on progression by the University Council. The relevant programme entry provides these details. See www.tcd.ie/teaching-learning/academic-affairs/ug-prog-award-regs/derogations /by-school.php. In order to rise with their class, students must obtain credit for the academic year by satisfactory attendance at lectures and tutorials and by carrying out, submitting and sitting the required assessment components. In addition, students must pass the year by achieving, at a minimum, an overall credit-weighted average pass mark for the year (40 per cent or 50 per cent, as per programme regulations) and either: (a) accumulate 60 credits by achieving at least the pass mark in all modules or (b) pass by compensation. All modules and components within modules are compensatable (except in particular professional programmes where compensation does not apply). To pass a year by compensation, in programmes that locate the pass mark at 40 per cent, a student must achieve the pass mark in modules carrying a minimum of 50 credits and obtain a module mark of at least 35 per cent in any remaining module(s). A student may accumulate a maximum of 10 credits at qualified pass where the mark lies between 35-39 per cent. To pass a year by compensation, in programmes that locate the pass mark at 50 per cent, a student must achieve the pass mark in modules carrying a minimum of 50 credits and obtain a module mark of at least 45 per cent in any remaining module(s). A student may accumulate a maximum of 10 credits at qualified pass where the mark lies between 45-49 per cent.*

60 *Progression is on an annual basis. Within a year students may carry failed modules from one semester to the next but not from one academic year to another; that is, they will not be able to rise to the next year of their programme until they have successfully completed the preceding year(s). Students who have not passed their year are required to present for reassessment when: (a) they obtain in excess of 10 credits at qualified pass (i.e. marks between 35-39 per cent where the pass mark is 40 per cent; or 45-49 per cent where the pass mark is 50 per cent); (b) they fail any module (i.e. achieving marks below 35 per cent where the pass mark is 40 per cent; or below 45 per cent where the pass mark is 50 per cent); (c)*

they do not obtain an overall pass mark for the year; (d) any combination of (a) - (c) occurs.

***61** If a student has achieved both fail and qualified pass grades at the first sitting or has exceeded the 10 credit limit allowed for compensation and is not*

permitted to rise with their year, they must present for reassessment in all modules for which they obtained a fail and/or a qualified pass.

***62** Different modalities of assessment to the first sitting are permitted in the reassessment session, as determined by the programme.*

***63** The same progression and compensation regulations as outlined above apply at the reassessment session. The overall credit-*

There is one reassessment session which is held at the beginning of Michaelmas term. Students are assessed in all failed modules from both semesters during the reassessment session. Students are not permitted to repeat successfully completed assessments or examinations in order to improve their performance. In exceptional circumstances such as illness, if a student does not attempt exams at the end semester, they can defer until the reassessment examining period.

weighted average for the academic year will be calculated using the most recent marks achieved.

***64** Students who fail to satisfy the requirements of their year at the reassessment session are required to repeat the year in full (i.e. all modules and all assessment components).*

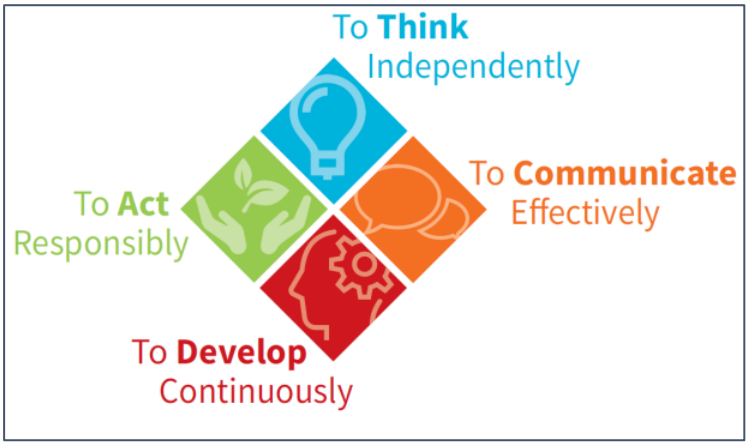
***65** Students are permitted to repeat any year of an undergraduate programme subject to not repeating the same year more than once and not repeating more than two academic years within a degree course, except by special permission of the University Council.*

***66** The maximum number of years to complete an undergraduate degree is six years for a standard four-year programme and seven years for a five-year programme.*
Applications to defer exams should be made to the Senior Lecturer's Office via your tutor.

You are strongly advised to submit all the lab reports during the year, and not to miss the continuous assessment tests, because if you obtain a mark of < 35% in 3 or more modules you will be unable to progress to the Senior Sophister year (you'll have to repeat the JS year or leave College). If you fail to submit coursework on time, you will get a mark of zero for it.

4.7 Graduate Attributes

The Trinity Graduate Attributes represent the qualities, skills and behaviours that you will have the opportunity to develop as a Trinity student over your entire university experience, in other words, not only in the classroom, but also through engagement in co- and extra-curricular activities (such as summer work placements, internships, or volunteering).



The four Trinity Graduate Attributes are:

- To Think Independently
- To Act Responsibly
- To Develop Continuously
- To Communicate Effectively

Why are the Graduate Attributes important?

The Trinity Graduate Attributes will enhance your personal, professional and intellectual development. They will also help to prepare you for lifelong learning and for the challenges of living and working in an increasingly complex and changing world.

The Graduate Attributes will enhance your employability. Whilst your degree remains fundamental, also being able to demonstrate these Graduate Attributes will help you to differentiate yourself as they encapsulate the kinds of transversal skills and abilities, which employers are looking for.

How will I develop these Graduate Attributes?

Many of the Graduate Attributes are 'slow learned', in other words, you will develop them over the four or five years of your programme of study.

They are embedded in the curriculum and in assessments, for example, through undertaking independent research for your final year project, giving presentations and engaging in group work. You will also develop them through the co-curricular and extra-curricular activities. If you help to run a club or society you will be improving your leadership skills, or if you play a sport you are building your communication and team-work skills.

4.8 Student Feedback Evaluation

Statement on College requirements for evaluation and feedback.

References/Sources:

Student Evaluation and Feedback

Student Partnership Policy

Procedure for the Conduct of Focus Groups for Student Feedback on Modules and Programmes

5. Literature Review Instructions

Please note: due to the length and number of reviews to be assessed, we may not be able to return marks to you before the annual exams in May.

Format

Your review must not exceed 4,000 words. What is included in this limit? All text except:
Title page, index page/table of contents, references section, appendixes and academic integrity page, page numbers, page header or footer.
What is included? All the rest including text in figure legends or within tables

Word limit is strictly enforced. However, a margin of 10% above the limit is allowed and there is no penalty below. Shorter, concise sentences are encouraged. Limit may not apply for some LENS students.

It must be typed in Times New Roman 12 point font, with a line spacing of 1.5. It must be submitted not later than Monday January 5th, 2026), with the word count verified and included in the submitted version (see appendix n IV).

- The work should be divided into: Title page; Abstract; Introduction; Main text to be organized in subsections with headings, according to topic; Conclusion and discussion; References. It may also contain an index/table of contents (encouraged)
- Pages must be numbered.
- Figures and Tables: If figures and tables are included, they must be numbered (Figure 1, etc.).
- Each Figure must be accompanied by an explanatory legend (text attached to the Figure that explains what it shows). If you have included a figure or table that you did not draw yourself, you must write your own legend and cite the source in the legend, e.g. “figure from (Jones et al 2018)”. If you used a published figure and modified it cite the as “adapted from …
- Each Figure/Table must be referred to from a sentence in the main text, to direct the reader to them when relevant.
- Citations: When the text refers to a published paper, the citations in the text must use a format like these examples (using EndNote APA 7th format should take care of everything):
    - XYZ was observed (Behan, 2011). For papers with 1 author.
    - XYZ was observed (Behan and Murphy, 2011). For papers with 2 authors.
    - XYZ was observed (Behan et al., 2011). For papers with 3 or more authors.
    - Most references are cited at the ends of sentences like this (Behan et al., 2011). However, it is sometimes more useful to write something like Behan et al. (2011) found that XYZ was not true.
    - Do not use a citation system based on numbers.
    - Do not include the initials of the authors in the citations in the main text.
- References section: The references section (also called the bibliography) is the list of papers that have been cited in the text. It appears at the end of the review. It gives more details of the papers that have been cited: complete list of authors (initials and surname); year of publication; title of the article; journal name; volume number; page numbers (first and last). Please use APA 7th format with EndNote as it will take care of all the formatting automatically. PLEASE DO NOT INCUDE NUMBERS Example:
    - Behan M, Cahill S, Murphy C (2011) The plastid genome of higher plants. Nature Reviews Genetics 103: 56-58.

- References to websites should not be used as a substitute for the primary published literature in the field under review and should only be cited if there is no published paper as an alternative. If you need to cite a website, put the address (URL) directly in the text of as a footnote, not in the references section.
- The review's title and your name should be on the front cover.
- Make sure you are aware of College policies regarding academic misconduct (Appendix I, II and III) and complete the 'Ready, Steady, Write' online tutorial.
- Review submission is online and you must upload an electronic copy of your review to *Blackboard* before the deadline.

Other Review requirements:

WARNING: Your review must not contain material produced via a process of "copying" or "cutting and pasting" of text from any source: this is plagiarism. Also, the "paraphrasing" of text (i.e. changing few words in a sentence or paragraph) constitutes plagiarism. It can be readily detected by computer- based searches of your submitted work. For more information on plagiarism please see the appendix.

Plagiarism or use of AI where not authorized is a serious offence. Any submitted work (e.g. your Review) that contains content not adhering to College's academic integrity policy will be marked punitively and may even be awarded a mark of 0%.

Note that your supervisor will be able to gauge your level of understanding of the subject matter in your meetings with them, and this may be taken into account in their assessment of the final review. In addition, students may be invited to present their review and questioned on its content

Declaration information

Please include the declaration statement (Appendix n IV) on your review. Statement should be signed (electronic signature will suffice) and dated.

The review must be your own work. Note that your supervisor will be able to gauge your level of understanding of the subject matter in your meetings with them, and this may be taken into account in their assessment of the final review.

Review Assessment

The review will be assessed taking into account the following criteria:

- Difficulty of topic
- Scientific content
- Clarity of thinking / Comprehension of the subject
- Ability to write scientifically
- Structure of the review
- Awareness of the recent literature on this subject
- Presentation

6. Assessments guidelines:

The overall Junior Sophister results will represent 30% of your final moderatorship grade. Modules are assessed by continuous assessment and/or by examination. The distribution scheme of marks between papers continuous assessment and practical work varies with each module and it is specified within its

description. Specific exam dates as well as submission deadlines are also specified for each module and it is vital that you submit on time.

- Word limit: Word limit is strictly enforced. However, a margin of 10% above the limit is allowed and there is no penalty below. **Shorter, concise answers are encouraged**. Limit may not apply for some LENS students.

- Time: The allocated time includes submission of the answers. A 5-10min lateness will be allowed without penalty. Some LENS students are allowed extra time and, although module coordinator will be aware, the student should make sure required accommodations are taken into account.

- Submission: Blackboard is the preferred submission platform. Submissions are allowed in the system past the deadline (they are flagged in red as late in Blackboard).

Penalties are applied when time or length are exceeded, and it only applies to the time or length beyond the allowed margin.

- Exceeding the word limit: Marker will consider when grading the ability of the student to adhere to the specified limit.

- Exceeding the time limit: Open book exams, 5% grade reduction/15min.
  Assignments, review 5% grade reduction/day.

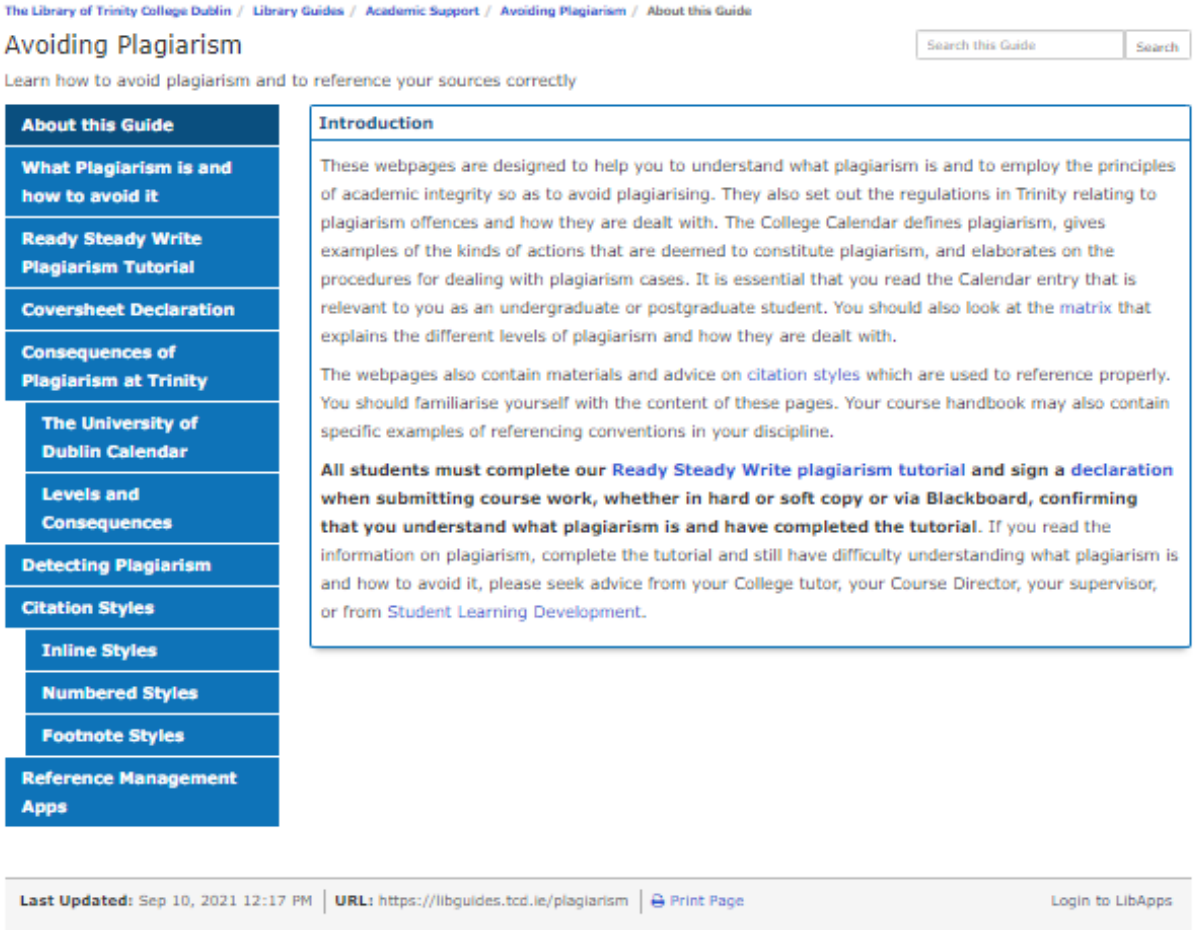
No penalties will apply if there are mitigating circumstances or the student has been allowed to exceed the limits. The onus is on the student to provide evidence of mitigating conditions. These incidences should be approved on a case-by-case basis by the Course Coordinator for consistency.

Mitigating circumstances are well documented technical problems. LENS students' particular circumstances or sickness properly justified.

Appendices

I. Online central repository

All students are required to access the **online central repository** in which all information and resources on plagiarism have been consolidated. This facility explains what plagiarism is, and how it can be avoided. The central repository is being hosted by the Library and is located at http://tcd-ie.libguides.com/plagiarism



- Plagiarism Policy - https://www.tcd.ie/teaching-learning/academic-policies/assets/plagiarism-mar2020.pdf
- Calendar, Part III, General Regulations & Information, Section I 'Plagiarism' https://www.tcd.ie/calendar/graduate-studies-higher-degrees/complete-part-III.pdf

II. Ready Steady Write Plagiarism Tutorial

All students are required to complete the **Ready Steady Write plagiarism tutorial**, a resource developed by the Centre for Academic Practice and eLearning (CAPSL) at Trinity College Dublin, to help you understand and avoid plagiarism and develop your academic writing skills and academic integrity. www.tcd.ie/Library/support/plagiarism/story.html

Plagiarism can occur in many forms, for example copying another student's work, or quoting directly from published sources without acknowledgement, or using as your own slightly modified versions of the published work of others. Thus, in writing essays or other project work you are warned against copying verbatim, or copying and making minor modifications to, phrases, sentences, paragraphs, sections or illustrations from other published work.

Students and staff have access to Turnitin computer software (see Appendix IV) that can readily detect plagiarism. The Department will use this sensitive anti-plagiarism tool to screen essays and other forms of formal assessed work and Turnitin reports can be used as evidence if plagiarism is suspected. **Accordingly, you are strongly recommended to synthesize your own language at all times**. A full statement of the College's position on plagiarism can be found in the College Calendar

III. Turnitin – Blackboard

Turnitin is an online software program that aids plagiarism prevention. It allows students and lecturers to check students' work for academic integrity by searching for text that is improperly cited or potentially plagiarised. Once uploaded to Turnitin, assignments are compared to millions of books, journal articles, web pages and student papers, identifying any unoriginal material within the essay. The software then creates an Originality Report which highlights and quantifies unoriginal content.

For more information, see http://tcd-ie.libguides.com/plagiarism/detecting-plagiarism and to access the student training tutorial, see http://www.turnitin.com/en_us/training/student-training

IV. Declaration to be included on literature review

TRINITY COLLEGE DUBLIN THE UNIVERSITY OF DUBLIN

SCHOOL OF GENETICS AND MICROBIOLOGY

SMURFIT INSTITUTE OF GENETICS

DECLARATION FOR REVIEW

I have read and I understand the academic integrity provisions in the General Regulations of the University Calendar for the current year, found at http://www.tcd.ie/calendar.

I have also completed the Online Tutorial 'Ready Steady Write', located at https://libguides.tcd.ie/academic-integrity/ready-steady-write

I declare that this assignment fully complies with College's academic integrity provisions.

Signed.....

Dated .....

The **word count** of this document (with the exception of the References section is: ☐

Signed.....

Dated .....

V. Academic year structure 2025/26

Trinity College Dublin — The University of Dublin

Academic Year Calendar
2025/26

Academic Calendar Week	Week beginning	2025/26 Academic Year Calendar		Term / Semester
		UG continuing years / PG all years	**UG new first years**	
1	25-Aug-25	Reassessment 2024/25- Semesters 1 & 2		←Michaelmas Term begins/Semester 1 begins
2	01-Sep-25	Marking/Results		
3	08-Sep-25	Marking/Results and Orientation (PG, Visiting, Erasmus)		
4	15-Sep-25	Teaching and Learning	Orientation (JF UG)	←Michaelmas teaching term begins
5	22-Sep-25	Teaching and Learning	Teaching and Learning	
6	29-Sep-25	Teaching and Learning	Teaching and Learning	
7	06-Oct-25	Teaching and Learning	Teaching and Learning	
8	13-Oct-25	Teaching and Learning	Teaching and Learning	
9	20-Oct-25	Teaching and Learning	Teaching and Learning	
10	27-Oct-25	Study/Review (Monday, Public Holiday)	Study/Review (Monday, Public Holiday)	
11	03-Nov-25	Teaching and Learning	Teaching and Learning	
12	10-Nov-25	Teaching and Learning	Teaching and Learning	
13	17-Nov-25	Teaching and Learning	Teaching and Learning	
14	24-Nov-25	Teaching and Learning	Teaching and Learning	
15	01-Dec-25	Teaching and Learning	Teaching and Learning	
16	08-Dec-25	Revision / Assessment*	Revision / Assessment*	←Michaelmas Term ends Sunday 14 December 2025/Semester 1 ends
17	15-Dec-25	Assessment*	Assessment*	
18	22-Dec-25	Assessment* / Christmas	Assessment* / Christmas	
19	29-Dec-25	Christmas Period - College closed 24 December 2025 to 1 January 2026 inclusive	Christmas Period - College closed 24 December 2025 to 1 January 2026 inclusive	
20	05-Jan-26	Foundation Scholarship Examinations	Foundation Scholarship Examinations	
21	12-Jan-26	Marking***	Marking***	←Hilary Term begins/Semester 2 begins
22	19-Jan-26	Teaching and Learning	Teaching and Learning	←Hilary teaching term begins
23	26-Jan-26	Teaching and Learning	Teaching and Learning	
24	02-Feb-26	Teaching and Learning (Monday, Public Holiday)	Teaching and Learning (Monday, Public Holiday)	
25	09-Feb-26	Teaching and Learning	Teaching and Learning	
26	16-Feb-26	Teaching and Learning	Teaching and Learning	
27	23-Feb-26	Teaching and Learning	Teaching and Learning	
28	02-Mar-26	Study/Review	Study/Review	
29	09-Mar-26	Teaching and Learning	Teaching and Learning	
30	16-Mar-26	Teaching and Learning (Tuesday, Public Holiday)	Teaching and Learning (Tuesday, Public Holiday)	
31	23-Mar-26	Teaching and Learning	Teaching and Learning	
32	30-Mar-26	Teaching and Learning (Friday, Good Friday)	Teaching and Learning (Friday, Good Friday)	
33	06-Apr-26	Teaching and Learning (Monday, Easter Monday)	Teaching and Learning (Monday, Easter Monday)	
34	13-Apr-26	Revision	Revision	←Hilary Term ends Sunday 19 April 2026
35	20-Apr-26	Trinity Week (Monday, Trinity Monday) / Assessment**	Trinity Week (Monday, Trinity Monday) / Assessment**	←Trinity Term begins
36	27-Apr-26	Assessment**	Assessment**	
37	04-May-26	Marking/Results (Monday, Public Holiday)	Marking/Results (Monday, Public Holiday)	
38	11-May-26	Marking/Results	Marking/Results	
39	18-May-26	Marking/Results	Marking/Results	
40	25-May-26	Research	Research	←Trinity Term ends Sunday 31 May 2026/Semester 2 ends
41	01-Jun-26	Research (Monday, Public Holiday)	Research (Monday, Public Holiday)	
42	08-Jun-26	Research	Research	
43	15-Jun-26	Research	Research	
44	22-Jun-26	Research	Research	
45	29-Jun-26	Research	Research	
46	06-Jul-26	Research	Research	
47	13-Jul-26	Research	Research	
48	20-Jul-26	Research	Research	
49	27-Jul-26	Research	Research	
50	03-Aug-26	Research (Monday, Public Holiday)	Research (Monday, Public Holiday)	
51	10-Aug-26	Research	Research	
52	17-Aug-26	Research	Research	
53	24-Aug-26	Reassessment 2025/26 - Semesters 1 & 2	Reassessment 2025/26 - Semesters 1 & 2	

* Semester 1 assessment session: December 11 to 22, 2025 inclusive (No assessment after Dec 22nd)
** Semester 2 assessment session: April 21 to May 1, 2026 inclusive
*** Marking of Semester 1 assessments will continue into January and early February. Provisional Semester 1 results will be made available to students during the week commencing February 9, 2026

CTU — Page 1 of 1 — Last updated: 07.04.2025

https://www.tcd.ie/calendar/academic-year-structure/2025-26/academic-year-structure.pdf

VI. Study Abroad declaration

Personal Declaration for Study Abroad School of Genetics and Microbiology

Please read this declaration carefully, in full, before signing and submitting your application

Study abroad does not suit everyone. Before applying, students should reflect carefully on their individual academic goals, learning styles, personal circumstances etc.

1. **You should have confidence in answering 'YES' to the following statements:**

    - I am aware of the academic and personal challenges that can arise during study abroad.
    - I am not aware of any specific issue(s) or factor(s) that would adversely affect my ability to adapt to a different learning environment or to integrate smoothly into a different cultural environment.
    - (where applicable) I realise that I will have to adapt to a different linguistic environment and am confident in my language abilities.

2. **Respect for host University:**

    Exchange students must follow the rules of their host university, particularly with regard to subject assessment and examinations, and accept that conditions may differ from those in Trinity.
    I understand that:
    - it is my responsibility to inform the host University of any needs I may have.
    - the School of Genetics and Microbiology in Trinity College Dublin cannot guarantee accommodations abroad.
    - the School of Genetics and Microbiology in Trinity College Dublin cannot review the decisions of partner universities.

3. **Compliance with institutional, national, EU and international regulations:**

    - College-Wide exchanges: I understand that my exchange is governed by the International Admissions and Study Abroad Office, while I am subject to School of Genetics and Microbiology rules, I am aware that my point of contact is the International Admissions and Study Abroad Office and that the School of Genetics and Microbiology merely facilitates this process.
    - European exchanges: I understand and accept that study abroad is governed by regulations and procedures set out in ERASMUS and other relevant literature published by the EU, the Higher Education Authority (Ireland) and other relevant national and supranational bodies.

4. Conversion of Marks

I understand that the School of Genetics and Microbiology converts grades in the fairest way possible, with great concern for its student's grades and future prospects. I accept that conditions in my host university may differ from those in Trinity and realise that this may have an effect on my results.

Please note that the School of Genetics and Microbiology does its utmost to ensure that the translation of results from your host university to Trinity's marking system is fair and reflects your achievements abroad. The Court of Examiners cannot, however, guarantee that the process of translation of marks will equal out all differences between the marking structures in different countries and amongst the host universities. The School of Genetics and Microbiology International Committee bases its conversions on conversion tables but retains a discretion to ensure broad equivalence. Trinity's conversion tables are attached to this document.

Individual marks are also carefully reviewed prior to sending them to the Court of Examiners. The distribution of grades in the host and home university may also be taken into account (i.e. your relative position in the class may also be considered), as well as the course load taken.

5. Meeting degree programme requirements

Prior to leaving for exchange, I have conducted extensive research on the institutions I have selected.

- I am aware of my course requirements in terms of credits and have discussed the same with the exchange coordinator(s) for all of my subjects.

Within two weeks of arriving at my host University I will:

- Email a scanned copy of my Learning Agreement, signed by my TCD coordinator(s) and host University to my programme administrator.

While on exchange I will:

- Obtain the permission of my coordinator(s) for any changes I am proposing to my learning agreement while away and resubmit my signed learning agreement to my programme administrator
- Inform my coordinators immediately on any difficulties, including failing modules, that may impact on my ability to progress

Prior to submitting this application, I have conducted extensive research on the institutions I have selected.

- I am aware of all of the information and course requirements which are highlighted in the Erasmus and Exchange Rules 2024/25.
- I understand that I am going abroad as a Trinity student. I therefore understand that I am an ambassador for the College and for the School of Genetics and Microbiology. I will bear this in mind in all my conduct abroad, both academic and personal.
- I am aware I must obtain not less than 25 ECTS credits, or equivalent, from the host university while studying abroad during semester two.
- I confirm that I have read and accept in full the content of this declaration and I confirm that the information provided by me in the application form for study abroad is correct.

(Please type your name below if you are submitting the document electronically)

Name: _____ Date: _____

VII. Table conversion

European Erasmus Conversion Table for Trinity Students Returning from Study Abroad

IRELAND Trinity College	**F 0 – 39**	**III 40 – 49**	**II.2 50 – 59**	**II.1 60 – 69**	**I 70 +**
ECTS	**Fail**	**E-D**	**D-C**	**B**	**A**
AUSTRIA	5 Nicht genügend	4 Genügend	3 Befriedigend	2 Gut	1 Sehr Gut
BELGIUM	0 – 9	10 – 11	12 – 13	14 – 15	16+
CZECH REPUBLIC*	4	3**	3**	2	1
DENMARK	-3 – 0	02	4	7	10 – 12
FINLAND (2 scales)	0	1 – 2 1 – 1.5	2 – 3 2	3 – 4 2.5	4 – 5 3
FRANCE	0 – 7	8 – 9	10 – 12	13 – 15	16+
GERMANY	6.0 – 4.7	Noch ausreichend – Noch Befriedigend 4.5 – 3.7	Befriedigend to Noch Gut 3.5 – 2.7	Gut to Sehr Gut 2.5 – 1.7	Sehr Gut to Ausgezeichnet 1.5 – 1.0
GREECE	0 – 5	5 – 5.9	6 – 6.9	7 – 8.4	8.5+
ICELAND (ECCITS & Flexi Scale)	0-4.99 0-4.99	5.00-5.99 5.00-6.00	6.00-7.24 6.00-7.5	7.25-8.99 7.5-8.5	9.00-10.00 8.5-10.00
ITALY	0 – 17	18 – 22	23 – 26	27 – 29	30 – 30 e lode
MALTA	F 0 – 44	D – D+ 45 – 54	C – C+ 55 – 69	B – B+ 70 – 79	A – A+ 80+
NETHERLANDS	0 – 5.4	5.5 – 6.4	6.5 – 7.0	7.1 – 7.9	8.0+
POLAND	0 – 2	3 – 3.5	4	4.5	5 – 5!
PORTUGAL	0 – 9	10 – 11	12 – 13	14 – 15	16+
SPAIN	Suspenso 0 – 4.9	Aprobado 5 – 5.9	6 – 6.9	Notable 7 – 8.9	Sobresaliente 9 Sobresaliente 10 Matricula de honor (80+)

SWEDEN	U 0 – 49	G** 50 – 55	G** 56 – 70	VG** 71 – 90	V G * * 9 0 +
SWITZERLAND	0 – 2.75	3 – 3.5	3.75 – 4.25	4.5 – 5.5	5.75 – 6
TURKEY	0 – 49	50 – 64	65 – 74	75 – 84	85+
UK (England, Northern Ireland & Wales)	F 0 – 39	D- – D+ 40 – 49	C- – C+ 50 – 59	B- – B+ 60 – 69	A - –
					A + 7 0 +
UK (Scotland) **UK (St Andrews, Scotland)**	0 – 8 0 – 6	9 – 11 7 – 10	12 – 14 11 – 13	15 – 17 14 – 16	18 – 20 17 – 20
RUSSIA	2	3	4	5 (Excellent)**	5 (Excellent)**

Important:

1. The aim of the conversion table is to ensure that all results are treated equally by all disciplines.
2. If for exceptional reasons a discipline deviates from the table, they must inform the International Admissions and Study Abroad Office in writing, stating the reasons for the deviation. Approved deviations include the School of Business (for Business Schools in France only) and the School of Law which uses more refined university by university grades conversion tables in line with the above grade categories.
3. Official transcripts issued by the host institution supersede any unofficial grades supplied by students.

Footnotes:

***** Charles University in Prague might provide more detailed results on request. Students should take a copy of the Trinity grading scheme with them and present it to individual lecturers on arrival as agreed with the International Office in Prague.

****** Where a mark spans two Trinity grades the higher grade may be awarded where supporting documentation is received.

VIII. Prizes and other awards

RONALD A. FISHER PRIZE IN GENETICS The Ronald A. Fisher prize in genetics is awarded annually to a Sophister student who has excelled in oral presentation of a topic of his/her own choice within the field of genetics. The prize was established by a gift from George Dawson who founded the Department of Genetics in 1958 and led it until 1987. Sir Ronald Fisher, Baldwin Professor of Genetics at Cambridge (1943-57), was acknowledged as a leading authority on genetical theories of natural selection and statistics and was a major influence on George Dawson, a student at Cambridge. The prize will be awarded on the advice of the Head of the Department of Genetics.
Value, **€191**

DAWSON PRIZE IN GENETICS This prize was founded in 1990 by colleagues and friends of George Dawson, member of staff (1950-87) and Professor of Genetics (1967-87). He founded the department in 1959 and started a programme of summer research for rising Senior Sophisters. The prize will be awarded, on the advice of the Professor of Genetics, to the student of genetics who has distinguished himself/herself in the Junior Sophister examinations.
Value, **€316**

A.W.B. VINCENT SCHOLARSHIPS IN GENETICS AND HUMAN GENETICS These scholarships are awarded to students in genetics and human genetics, selected by competition, to facilitate research internships at institutions for two to three months in the summer of their Junior Sophister year. William Vincent, LL.D. (h.c.), (1919-2012) established these scholarships in 1975 and funded them for 40 years. His family and friends contributed to ensure they would continue after his death. Dr Vincent was president of the American Irish Foundation from 1972 to 1987 when it merged with the American Ireland Fund of which he became vicechairman. He was a generous supporter of many charitable projects in Ireland.
Value, **€1500**

Larry O'Hara More info will be provided.

IX. Safety statement

To ensure the health and safety of everyone in the Genetics department, we will share with you the departmental Safety Statement. **We ask you to read and abide by the rules given in the Safety Statement.** Please note that failure to comply with the procedures outlined in the departmental Safety Statement may result in disciplinary action. The information provided below is for convenience only; it does not substitute for the departmental Safety Statement.

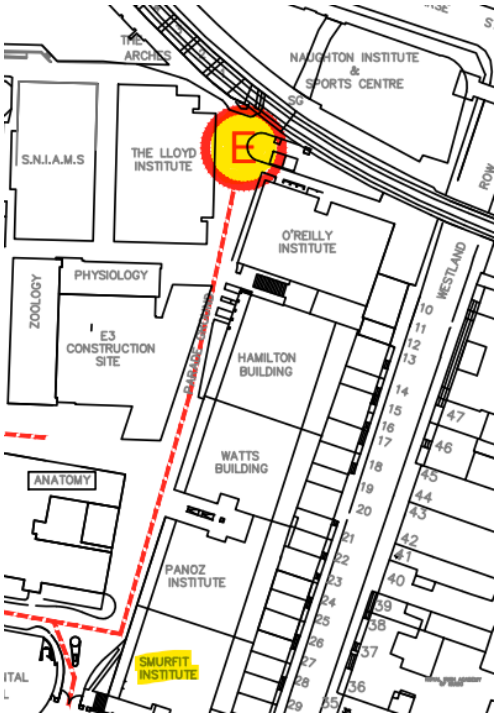
Here we highlight the most relevant safety rules concerning undergraduate students who enter laboratories and lecture theatres. These rules must be followed at all times.

General

- Students are not allowed to enter laboratories unless they are authorized to do so.
- Students are not permitted to work in laboratories unsupervised.
- Students must follow the instructions of laboratory supervisors at all times.
- Eating and drinking is prohibited in laboratories and lecture theatres.
- Smoking is strictly prohibited in all campus buildings.
- Do not leave coats, bags or personal belongings on lab benches or anywhere where they could cause an obstruction.
- Students should not congregate at the entrance to a lab or lecture theatre or at building entrances.

Fire safety

- In the event of a fire alarm, **LEAVE THE BUILDING** immediately using the nearest exit route.
- Report to the Genetics Department Assembly point 'E' shown on the map below, between the O'Reilly / Lloyd buildings.



Laboratory dress code

- Wear long trousers or skirts, and shoes with non-slip soles that fully cover your feet. Shorts, open-toed sandals, flip-flops, high heels, ballet pumps, crocs, and canvas shoes/runners are not permitted.

- Students must wear a suitable laboratory coat while working in a laboratory. “Howie-style” laboratory coats are preferred.
- Safety glasses must be worn when there is access/use of chemicals or potential exposure to biological agents containing aerosols. Those wearing spectacles must wear ‘Pulsafe’ kind which are worn over the normal spectacles. Contact lenses may constitute an additional hazard.
- Long hair must be properly tied back and adequately restrained.
- No loose hanging jewellery, headphones, or earbuds permitted in the laboratory.
- Gloves must be worn and changed as required in all laboratory environments involving the use of chemicals or biological agents.

Laboratory safety

- If any glass apparatus/container/pipette breaks while in use, inform a member of staff immediately.
- Ensure caps are replaced on all containers with chemicals when an experiment is completed.
- If you come into direct contact with chemicals, inform a member of staff immediately.
- Familiarize yourself with the location of first aid kits, safety showers, and eye wash stations in the laboratory you are working in.
- Students must familiarize themselves with the European Standard Chemical hazard symbols shown below.

 Gas under pressure Symbol: gas cylinder	 Explosive Symbol: exploding bomb	 Oxidising Symbol: flame over circle
 Flammable Symbol: flame	 Corrosive Symbol: corrosion	 Acute Health Hazard Symbol: flame over circle
 Acute toxicity Symbol: skull and crossbones	 Serious Health Hazard Symbol: health hazard	 Hazardous to the environment Symbol: environment

If you have any concerns about Health and Safety in the department, please contact the departmental Safety Officer (Sr. Technical Officer - Orla Deevy) or the Head of Department (currently Prof. Matthew Campbell).

For further information on Health and Safety, see the website of the College Safety office at https://www.tcd.ie/safetyoffice/

X. Careers Advisory Service

What do you want to do? How will you get there? We are here to support you in answering these and other questions about your career.

Junior and Senior Fresh Students

Get Involved: Remember that your course of study, extra- curricular activities, voluntary and part-time work all provide opportunities for developing skills and gaining an insight into your career preferences. In your Senior Fresh year, look out for short-term internship opportunities.

MyCareer: Log in to MyCareer to keep abreast of jobs, study and careers events of interest to you.

Junior Sophisters

Attend class seminar: Typically this takes place in Hilary term and includes information on applying for work experience and internships and postgraduate study.

Get work experience: The programme of summer work experience and internships is particularly relevant to Junior Sophisters. Personalise your MyCareer profile to receive email alerts tailored to your preferences.

MyCareer: Log in to MyCareer to keep abreast of jobs, study and careers events of interest to you.

Finalists and Senior Sophisters

Meet Employers and/or Explore Further Study: You may have decided to seek employment directly after graduation and many employers visit Dublin to actively seek out talented graduates. For others, further study may be their preferred option. Your MyCareer dashboard will keep you informed.

Find Jobs: Personalise your MyCareer profile to receive email alerts tailored to your interests.

Attend class seminar: Typically this takes place in Michaelmas term and includes information on applying for postgraduate study and jobs.

GradLink Mentoring: An opportunity to get advice and support from a Trinity graduate.

Drop-In CV / LinkedIn Clinics: We also provide support at a practical level, helping you to improve your applications, which will benefit you in securing your future, whether in employment or further study.

Practice Interviews: A practice interview tailored to the job/ course of your choice with practical feedback.

MyCareer: Log in to MyCareer to keep abreast of jobs, study and careers events of interest to you.

MyCareer

An online service that you can use to:

- Apply for opportunities which match your preferences - vacancies including research options
- Search opportunities- postgraduate courses and funding
- View and book onto employer and CAS events
- Submit your career queries to the CAS team
- Book an appointment with your Careers Consultant

Simply login to MyCareer using your Trinity username and password and personalise your profile.

Careers Advisory Service
Trinity College Dublin, 7-9 South Leinster Street, Dublin 2
01 896 1705/1721 | Submit a career query through MyCareer

MyCareer: mycareerconnect.tcd.ie
TCD.Careers.Service
TCDCareers
www.tcd.ie/Careers/students/postgraduate
@TCDCareers
tinyurl.com/LinkedIn-TCD-Connecting

Opening Hours
During term: 9.30am - 5.00pm, Monday - Friday
Out of Term: 9.30am - 12.30pm & 2.15 - 5.00pm, Monday – Friday