



Trinity College Dublin

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

Junior Sophister Molecular Medicine 2022-2023

**School of Biochemistry & Immunology
and
School of Medicine**

WELCOME TO JUNIOR SOPHISTER MOLECULAR MEDICINE

Congratulations on obtaining your place in Molecular Medicine!

In the Junior and Senior Fresh years you have essentially been building a scientific foundation that provides you with learning skills, scientific knowledge and even vocabulary for your chosen degree. Those first two years are typified by large classes, busy practical classes and the feeling that you're in a cast of thousands.

That changes now. Welcome to a small, but highly dynamic School where research excellence and international recognition is translated into a degree taught by research leaders who are enthusiastic about their particular areas of research. You are also part of a much smaller class, providing you with much more interactive teaching and learning, so take advantage of that. Ask questions, then ask some more. Your lecturers are your guide. They will navigate you through new material, instruct you on new topics and ideas and support you in your learning when you need it. Above all, your Sophister years should be seen as a terrific opportunity to mature as a scientist and develop the knowledge, skills and experience that you can take with you into your chosen career paths.

In the School, each student is allocated a Tutor who will meet with you regularly in small group format. These provide opportunities for additional learning, skills development and support. Tutorials are flexible in their nature and can be influenced by your requirements that will vary from month to month. There will also be tutorial sessions related to the practical classes, key techniques and skills. The mini-review, the practical write-ups, as well as the essays written as part of tutorials, will help you develop the organisation and style in writing needed to get the most out of your degree. Whatever your future career you will no doubt need to present clear, well-structured reports. Discuss your work and value the comments made by the staff member – they are as important as the mark. Poor exam technique, such as failure to use diagrams and inadequate consideration of essay structure, have to be corrected now. Assessments and exams in this year and next now influence the overall degree award you will obtain. So please start now and work towards developing these skills with the help of your lecturers, tutors and peers.

Finally, we would like to wish you all the very best for the coming year.

September 2022

Dr. K. H. Mok, Associate Professor in Biochemistry

JS Molecular Medicine Course Advisor, 2020 –

Office: TBSI L5.04 | E-mail: mok1@tcd.ie | Landline: 01 896 3190

NOTE: Information in this handbook was compiled as accurately as possible, but errors and omissions may still have occurred. The fluid changes in restrictions during the Covid-19 pandemic will particularly be impactful on various administrative aspects, and we ask in advance for your understanding.

Table of Contents

Course structure3

Lecture timetables4

Module summaries5

Module learning outcomes.....7

College regulations (FEMS) regarding Junior Sophister exams9

Rules regarding attendance and satisfactory completion of course work9

Plagiarism.....11

School policy on absences, late submissions and release of marks11

Course work12

Guidelines for Laboratory Notebooks13

Small group tutorials.....14

Junior Sophister summer awards14

Social events14

Students with disabilities or long-term health Issues14

Contact Information15

Guidelines for requesting an academic reference17

Glossary of scientifically used terms:.....18

Module contents19

Course structure

A Junior Sophister student must complete 60 ECTS credits in the year.

The European Credit Transfer and accumulation System (ECTS) is an academic credit system based on the estimated student workload required to achieve the objectives of a module or programme of study. It is designed to enable academic recognition for periods of study, to facilitate student mobility and credit accumulation and transfer. The ECTS is the recommended credit system for higher education in Ireland and across the European Higher Education Area.

The ECTS weighting for a module is a measure of the student input or workload required for that module, based on factors such as the number of contact hours, the number and length of written or verbally presented assessment exercises, class preparation and private study time, laboratory classes, examinations, clinical attendance, professional training placements, and so on as appropriate. There is no intrinsic relationship between the credit volume of a module and its level of difficulty.

The European norm for full-time study over one academic year is 60 credits. The Trinity academic year is 40 weeks from the start of Michaelmas Term to the end of the annual examination period. 1 ECTS credit represents 20-25 hours estimated student input, so a 10-credit module will be designed to require 200-250 hours of student input including class contact time and assessments.

The 60 ECTS credits translate into 600 marks that are distributed across the course as follows:

1. Four 10 credit modules consisting of lectures and linked practicals. Each of these modules will be assessed by continuous assessment (30% weighting) and by an exam paper at the end of the semester (70% weighting). There will be a separate exam paper for each module. Total marks for this component = 400 marks
2. A 10 credit research skills module covering literature skills (a minireview of a topic proposed by a member of staff), presentation skills (involving a short oral presentation of the minireview topic) and analysis of quantitative data (4 quantitative problem sessions and associated exams). This module will be assessed by continuous assessment across both semesters (100%).
3. The continuous assessment component will be linked to the literature review and an element associated with in-course exams linked to the problem sessions. Total mark for this module = 100 marks.
4. A 5 credit laboratory skills module covering basic biochemical and immunological laboratory skills (practical sessions) and data handling lectures. This module will be entirely in-course assessed in semester 1. Total mark for this component = 50 marks.
5. All JS students are obliged to take a Trinity Elective (5 ECTS) more information is available on the TCD website (<https://www.tcd.ie/trinity-electives/>). Total mark for this component = 50 marks.

In summary; there will be four exam papers in total; Two at the end of Semester 1, two at the end of Semester 2, (2 hours each), which will assess the ten-credit core modules

associated with lectures. You should note that in-course assessment includes a laboratory-based practical exam, MCQs and problem exams, as well as home-work elements (laboratory assessments, mini-review *etc.*).

The Junior and Senior Sophister years are integrated and the **Junior Sophister mark** (including the mark for the Trinity Electives) will contribute **30% to your final degree mark**.

Importantly, the pass-mark for Junior Sophister Molecular Medicine is 40% but to progress to Senior Sophister year, students must obtain a minimum grade of 45% in JS year.

The Junior Sophister Molecular Medicine course content, module-by-module with associated mark weightings and methods of assessment are outlined in the following pages. Further information on course content and learning objectives is provided in the final "Teaching & Learning" section.

ECTS credits are awarded to a student only upon successful completion of the course year. Progression from one year to the next is determined by the course regulations. Students who fail a year of their course will not obtain credit for that year even if they have passed certain component courses. *Exceptions to this rule are one-year and part-year visiting students, who are awarded credit for individual modules successfully completed.*

Lecture timetables

Lecture timetables are published in My.TCD.ie. Hard copies are not provided. We will endeavor to notify you by email if there are any amendments to the scheduled timetables.

Module summaries**Semester 1:**

MODULE	CODE	TOPIC	LECTURER(S)	ASSESSMENT		MARKS	
BIU33370 PROTEIN To CELLS (10 ECTS) (100 marks)	Lectures	Protein Structure & Function	Dr A Khan	Semester 1 Paper 1 (Proteins to Cells)	(1 of 2 questions) X 3	60	
	Lectures	Protein Activity & Regulation	Drs D Finlay, J Murray, D Nolan and A Budanov				
	Lectures	Membranes and Trafficking	Dr J Murray				
	Lectures	The Cytoskeleton	Drs D Nolan, HP Voorheis and E Creagh				
		General module material, including practicals			Semester 1 Paper 1	Short questions	10
	Practicals	Various	Various	Assignments and Write-ups		15	
	Lab MCQ	Material from practical classes	Various	In-class MCQ		15	
BIU33380 CELL BIOLOGY (10 ECTS) (100 marks)	Lectures	Cell Signalling	Drs E Creagh and D Zisterer	Semester 1 Paper 2 (Disease Mechanisms and Drug Discovery)	(1 of 2 questions) X 3	60	
	Lectures	Drug Design	Drs KH Mok and J Murray				
	Lectures	Cancer	Drs T McElligot, Gately, M Barr and J Murray				
	Lectures	Clinical Aspects of Inflammation	Prof P Fallon				
	Lectures	Integration of Metabolism	Dr R Porter				
	Lectures	Metabolic Disease	Dr F Sheedy and C Cunningham				
		General module material, including practicals			Semester 1 Paper 2	Short questions	10
	Practicals	Various	Various	Assignments and Write-ups		15	
Lab MCQ	Material from practical classes	Various	In-class MCQ		15		

- Along with the above, you will complete two 5 ECTS Modules (either Approved Open or Trinity Elective; 50 marks each)
(Approved Open Module: Genomics and Systems Biology)

Semester 2:

MODULE	CODE	TOPIC	LECTURER	ASSESSMENT		MARKS	
BIU33390 NUCLEIC ACIDS (Molecular Medicine) (10 ECTS) (100 marks)	Lectures	Nucleic acid chemistry	TBC	Semester 2 Paper 1 (Nucleic Acids)	(1 of 2 questions) X 3	60	
	Lectures	DNA structure	Prof A Bowie				
	Lectures	Replication	Dr D Zisterer				
	Lectures	Gene transcription	Prof A Bowie				
	Lectures	mRNA translation	Dr D Zisterer				
	Lectures	Molecular Biology techniques	TBC				
	Lectures	Transcription and Translation: a molecular perspective	Dr V Kelly				
	Lectures	DNA repair mechanisms	Dr D Finlay				
	General module material, including practicals				Semester 2 Paper 1	Short questions	10
	Practicals	Various	Various	Assignments and Write-up		15	
Lab MCQ	Material from practical classes	Various	In-class MCQ		15		
BIU33360 RESEARCH SKILLS in MOLECULAR MEDICINE (10 ECTS) (100 marks)	Literature Review	Assigned	Assigned Mentor	Mini-review submission		40	
	Presentation	Literature Review Presentation	Dr. K.H. Mok and others	In-class presentation		10	
	Practicals	Assignments from practical classes	Various	Write-up		15	
	Lab MCQ	Material from practical classes	Various	In-class MCQ		25	
	Quantitative Problems	Quantitative Problems	Various	In-class exam		20	

- Along with the above, you will complete two 5 ECTS Modules (either Approved Open or Trinity Elective; 50 marks each)
(Approved Open Module: Immunology and Immunometabolism)

Module learning outcomes

Semester 1

BIU33370 – Proteins To Cells

- 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
- Organize enzymes into various classes and demonstrate the ability to critically develop an assay of biological activity
- Define the mechanism of enzyme inhibitors and propose how this can be exploited for drug therapy
- Describe the complex kinetics of multi-substrate catalytic reactions and identify and compare the assays utilized to study the mechanisms
- Recognize the functional groups of proteins and explain how the chemistry is linked to biological function.
- Be able to discuss in detail the essential function of biological membranes, their composition how they are organised and involved in membrane trafficking.
- Understand the significance of membrane trafficking to and from the plasma membrane to the lysosome and the similarities and differences between endosomal and autophagy pathways.
- Define signal sequences of membrane-associated proteins and how membrane proteins function, including pumps and ion channels, to maintain a membrane potential.
- Can describe how cells maintain structure through their actin and microtubule networks, how they are assembled, linked and the signalling involved in their control.

BIU33380 – Disease Mechanisms and Drug Discovery

- Obtain a broad knowledge of cell signalling, from cell surface receptors through to the effects their activation of various signalling pathways, including the PI3K and Ras pathways, and the how these control gene transcription and normal cellular functions.
- Define the causes and epidemiology of cancer and the methods used in its diagnosis and treatment.
- Define the clinical features of inflammation and how the inflammatory process modulates response to pathogens.
- Discuss how animal models of the inflammatory process have contributed to a greater understanding of human disease.
- Identify cells, receptors and soluble components of the adaptive immune system and how they function to eliminate pathogens.
- Define the processes of drug target identification, validation and development
- Demonstrate and understanding of the chemical structure and interactions among molecular components of the cell
- Define the sites of drug action in DNA/RNA, enzymes and receptors and the procedures used in developing of new drug entities

Semester 2

BIU33390 – Nucleic acids (Molecular Medicine)

- Recall and integrate key knowledge and concepts about DNA structure and function and process and assess the importance of DNA replication and DNA repair.
- Describe the molecular and structural features of transcription initiation, transfer RNA charging and ribosomal translation.
- Recognize the functional groups of nucleic acids and relate how the chemistry is linked to biological function.
- Recall and integrate key knowledge and concepts about how gene expression is regulated and demonstrate an understanding of the processes and importance of transcription and translation.
- Relate the theory behind techniques used in recombinant DNA technology and evaluate how these techniques can be applied to biological problems.

BIU33360 – Research Skills in Molecular Disease

- Become confident in conducting a literature-based research project and the writing of a review paper that demonstrates criticality of thought and unbiased assimilation and presentation of peer-reviewed research on a specific topic.
- Gain the skill in using Endnote, or similar reference managing software for use in writing.
- Ability to interpret a quantitative experimental problem, analyse the data and provide a critical analysis of the data after it has been computationally analysed.
- Obtain experience in discussing a research topic in a group context and learning how scientific research is presented to a peer audience.

College regulations (FEMS) regarding Junior Sophister exams

Timetables for Sophister examinations are published in advance of the dates of the examinations, and available on-line. The onus lies on each student to find out the dates of examinations by consulting these timetables. No timetables or reminders will be sent to any individual student. Junior Sophister students must, in the first instance, sit the annual examination and meet the requirements of the course.

The Junior Sophister Annual Examination has a two-fold purpose. It is (a) the final examination for the Ordinary BA degree and (b) a qualifying examination to proceed to the Senior Sophister year as a Moderatorship candidate. A student who rises to, and completes, the Senior Sophister year, but fails the Moderatorship examination, is still qualified for the award of an Ordinary BA degree on the basis of a successful performance in the Junior Sophister examination. Students who pass the Junior Sophister examination can have the Ordinary BA degree conferred if they do not choose or are not qualified to proceed to Moderatorship. Except by special permission of the University Council, on the recommendation of the Course Director, the ordinary degree of BA may be conferred only on candidates who have spent at least three years in the course.

To pass the Junior Sophister examination, students must achieve a mark of 40% or higher in each of their modules or pass by compensation or aggregation.

To compensate/aggregate students must;

- (i) obtain an overall mark of 40% or higher and

EITHER (compensate)

- (ii) obtain individual marks of 40% or higher in modules to the value of 40 credits with a minimum mark of 30% in the each of the failed modules up to a maximum of 20 credits.

OR (aggregate)

- (iii) obtain individual marks of 40% or higher in modules to the value of 40 credits with a minimum mark of 30% in additional modules of at least 10 credits.

NOTE: the pass-mark for Junior Sophister Immunology is 40% but to progress to Senior Sophister year, students must obtain a minimum grade of 45% in JS year.

Rules regarding attendance and satisfactory completion of course work

Attendance: The college regulations regarding attendance, as laid out in 'General regulations and information' in Part 1 of the College Calendar (<http://www.tcd.ie/about/calendar/part1/index.php>), will apply. For your information, relevant extracts are reprinted here.

'All students should enter into residence in or near Dublin and must begin attendance at the College not later than the first day of teaching term, and may not go out of residence before the last day of teaching term, unless they have previously obtained

permission from the Senior Lecturer through their tutor. Students must attend College during the teaching term. They must take part fully in the academic work of their class throughout the period of their course. Lecture timetables are published on College and school or department notice-boards before the beginning of Michaelmas lecture term. The onus lies on students to inform themselves of the dates, times and venues of their lectures and other forms of teaching by consulting these timetables.'

'In special circumstances exemption from attendance at lectures for one or more terms may be granted by the Senior Lecturer; application for such exemption must be made in advance through the tutor. Students thus exempted must perform such exercises as the Senior Lecturer may require.'

'Students who in any term have been unable, through illness or other unavoidable cause, to attend the prescribed lectures satisfactorily, may be granted credit for the term by the Senior Lecturer but must perform such supplementary exercises as the Senior Lecturer may require. The onus for informing the Senior Lecturer of illness rests with individual students who should make themselves familiar with the general and more detailed school or course regulations regarding absence from lectures or examinations through illness. In addition, issues with students may arise from time to time, which in the opinion of the Senior Lecturer affect a student's ability or suitability to participate in his or her course. If requested by the Senior Lecturer, students will be required to undergo a medical examination or assessment by a doctor or specialist nominated by the Senior Lecturer at the expense of the College for the purpose of obtaining an opinion as to the student's medical fitness to continue with his/her studies or as to his/her ability or suitability to participate in his/her course to the standards required by the College.'

'Students who find themselves incapacitated by illness from attending lectures (or other forms of teaching) should immediately see their medical adviser and request a medical certificate for an appropriate period. Such medical certificates should be copied to the faculty, school or department office, as appropriate, by the student's tutor.'

Additional requirements of the School of Biochemistry and Immunology: With regard to attendance are that students are required to attend, and actively participate in, all lectures, pre-practical talks, practicals, small group tutorials and problem sessions that have been organized for them. Students must sit all of the annual examination papers.

Requirements of the School of Biochemistry and Immunology with regard to the satisfactory performance of course work: In accordance with Calendar directives, namely:

'Students may be deemed non-satisfactory if they miss more than a third of their course of study or fail to submit a third of the required course work in any term. At the end of the teaching term, students who have not satisfied the school or department requirement, may be reported as non-satisfactory for that term. Students reported as non-satisfactory for the Michaelmas and Hilary terms of a given year may be refused permission to take their annual examinations and may be required by the Senior Lecturer to repeat their year.'

In addition, the School of Biochemistry and Immunology requires that Junior Sophister students should complete and submit all practical assessments, problems, a minireview, a data handling project and any work set by their tutor.

Plagiarism

The College Calendar defines plagiarism, describes the levels of plagiarism and the sanctions. All students are required to complete the online tutorial 'Ready, Steady, Write'. It is located at <http://tcd-ie.libguides.com/plagiarism>.

When you submit coursework, you will have signed a declaration to the effect that you have read and understood the plagiarism provisions of the College. Therefore, all cases of matching text will be treated as Level 3 offences, see <http://tcd-ie.libguides.com/plagiarism/levels-and-consequences>, zero marks will be assigned to all plagiarised text and there will be no option to resubmit.

Where an assignment (or part assignment) cross matches with text in the assignment of another student both students and their tutors will be notified by email and invited to explain the match. As both students will have signed a declaration that they have read and understood the plagiarism provisions of the College all cases of matching text will be treated as Level 3 offences by both students, zero marks will be assigned to the two texts and there will be no option to resubmit. Level 3 applies even if a student was given permission to use another student's work.

School policy on absences, late submissions and release of marks

All cases will be considered on their individual merits but the following general rules will apply;

- (1) For missing any practical sessions or problem exams, a medical cert/DUCAC letter must be provided to the course co-ordinator *via* the School office in consultation with your College Tutor. This is compulsory for all cases, including self-certification.
- (2) Where a student misses a complete practical, a *pro-rata* mark will be awarded for the missed practical. This applies to a maximum of two missed practicals and is dependent upon production of a valid cert/DUCAC letter. Any subsequent missed practicals will be awarded a maximum of 40 %.
- (3) For multi-session practicals, for each lab session missed, there will be a 20% deduction from the lab assignment for that practical.
- (4) A student will be returned as non-satisfactory if they fail to attend more than a third of the practical sessions associated with the module, or if they fail to submit more than one third of the practical assessments associated with the module.
- (5) Late submission of any continual assessment activity will result in an automatic and immediate deduction of 10%. A further 10% will be deducted for each week an assignment is late.
- (6) Mark deductions will be made by the School office at the end of the year.
- (7) In the case of missing a Practical Exam or Problem Exam session, a Supplemental Exam will be scheduled where possible (assuming proper paperwork is submitted by the student).

(8) All assignments are returned to students with the grade achieved written on the assignment (or entered in My Grades in Blackboard). Practical exam marks will be displayed in Blackboard. Running totals will not be provided by the office.

Course work

Practical assignments, lecture resource materials, and end-of-module practical MCQ exams are supplied through the relevant module in Blackboard (mymodule.tcd.ie). Check that you can see all six of your BI3*** modules. If a module is not visible to you send an email to bblearn@tcd.ie giving the module code and your college username. If the issue is not resolved contact, please contact either the JS Course Coordinator, or Dr. Audrey Carroll (aucarrol@tcd.ie).

Laboratory notebooks: We will provide you with a hardbound laboratory notebook. All records of your practical work must be kept in the book provided and not on rough sheets of paper or on laptop computers. Advice on keeping a good lab notebook is given in the front of the Practical Manual and listed below. Students will meet with their course organiser (see Practical timetable) where your lab book will be examined and discussed.

Laboratory assessments: All practicals will be assessed and graded. The assignment for each practical will be posted under the relevant module in Blackboard. The submission process will vary, some assignments are submitted to Blackboard, some are submitted by hard copy to the School Office, the process will be specified on the assignment. All assignments have cut-off times and dates, the penalties relating to late submission are given in the front of the Semester 1 Practical Manual.

Blackboard: All course work, assignments, lecture resource materials and MCQ exams are supplied through the relevant module in Blackboard (mymodule.tcd.ie). CHECK that you can see all six of your BI3 modules. If a module is not visible to you send an email to bblearn@tcd.ie giving the module code and your college user name. If the issue is not resolved contact robinsog@tcd.ie.

Laboratory multiple choice exam: At the end of each semester you will sit a 45-minute multiple choice exam (MCQ) where you will be required to answer 15 questions (approx. 3 minutes per question). These questions will be directly related to the material that you have covered in the practicals. Sample exam questions will be provided.

Mini-Review and Presentation: Students will be required to carry out a literature search and write an extended essay consisting of diagrams plus 6,000-8,000 words in the text. The ability of a student to survey and evaluate the literature and produce an organised, cogent synthesis will be taken into account. Guidelines on writing a review and a sample review are available in BI3020 on BlackBoard VLE. Mini-Reviews have been assigned randomly. In preparation for the review you could look at some review articles in *Current Opinion in Cell Biology* or *Current Opinion in Structural biology*. All reviews must be typed in 12-point font and spacing must be at least 1.5 point. Recommended margins are minimally 1.5 cm all around. Students are required to sign a declaration to the effect that the mini-review is entirely their own (refer to plagiarism rules and guidelines). Completed mini-reviews are due to be handed in by 5 pm on the Friday the 14th of January.

Quantitative Problems: All students will be assessed on a total of four problem sets. There are three time-tabled sessions for each problem set. In session 1 the theoretical background

to the problem set will be explained and a problem will be assigned to you. In session 2 the solution to the problem will be explained and you will have an opportunity to discuss the solution with the member of staff in charge. Session 3 will take the form of a practice exam in which you will be given a second, similar problem, which you will solve under exam conditions (50 minutes). Each problem exam will be worth 10 marks.

There is a Problem Paper in the Senior Sophister year (that JS problems may appear on). All problems tend to have an influence in determining the final degree grade and failure to hand in problems simply throws away precious marks that are very difficult to earn elsewhere.

Guidelines for Laboratory Notebooks

- It is the quality of record keeping that is assessed. There is no connection between practical assignments and inspection of lab books. You do not need your practical assignments returned to you before the lab book inspection.
- Background text from your laboratory manual should not be repeated in your laboratory note book.
- Prepare for a lab session by writing the title of the experiment on a new numbered and dated page, writing a short summary of the principle aim(s) of the practical, performing necessary calculations and laying out tables for data collection.
- All rough work, the details of how you prepared your solutions (how many g, what volume, dilution factors, *etc* should be recorded in the notebook while you are in the laboratory. Do not worry if your notes appear messy or contain corrections or modifications. What is important is that your lab book contains the information/data that will allow you and others to follow what you actually did in the lab.
- All calculations and results, both primary data (recorder traces, printouts, photographs) and final tables and graphs MUST be recorded in your laboratory note book. It is NOT acceptable to say, 'my results are in the post-practical assignment form and I did not receive it back yet'.
- In the event of two people working together but only one recorder-trace being available, or the trace being submitted as an assignment, you must make a neat and legible photocopy or scan (high quality smartphone photo may be acceptable) of the data for inclusion in your notebook.
- DO NOT USE PENCIL, use a pen. Pencil is not acceptable because: pencil can be difficult to read; pencil fades and can be altered and is therefore not a permanent record;
- Where possible, data should be plotted on graph paper as you go along, thus enabling you to spot technical errors. All graphs should have titles and the axes should be labelled with the appropriate units.
- We expect your notebook to be a little messy and stained. Pristine clean notebooks have clearly been written up after the event, and this is noted.

You must keep in mind the purpose of the lab book: it is your record of what you did in the laboratory; your proof that the data you obtained is real and the only way you can convince others that you did the experiment and obtained the results you claim to have. It is vital that you pay attention to your record keeping: this skill will be essential during your research project in final year but even more importantly in the real world as an employee or a researcher.

Small group tutorials

Each student meets regularly with a tutor, in groups of 2-3 students. Your tutors will be the academics whom you have decided to write your respective Mini Reviews, giving you further incentive to have stimulated discussions throughout the academic year. Please contact your tutor during the first week of Semester 1 to arrange a meeting. There will be 6-10 tutorials per year. These will include exercises covering course material, training in getting the most out of research papers, and giving presentations on topics chosen by the tutor. These tutorials are useful times to discuss lecture courses and practicals, and the various exercises set should help you in your development as a scientist, and in examinations. Attendance at these tutorials and completion of any exercises set is MANDATORY. Students who fail to comply will be returned as 'non-satisfactory'.

Junior Sophister Summer Awards

The School may award 1 funded laboratory internship at the end of Junior Sophister Year to a Molecular Medicine student. The awards will take the form of a six-week stipend to work in one of the research laboratories in the School of Biochemistry and Immunology. The awards will be offered to the student who obtain the highest total mark. Details of how to apply will be circulated in the Hilary Semester. Please note that students who spend any time in a research lab during the summer (whether paid or unpaid) cannot do their SS project in that lab.

Social events

There are a number of social events throughout the year that provide an opportunity for students and staff to meet in an informal setting. These include poster day, when the Senior Sophister students present the results of their research projects; this is followed by an informal reception for students and staff. After the end of year exams, there will a reception "*The Bruno Bash*" to accompany the presentation of the Margaret Ciotti Medal for the best Senior Sophister student. Dates and times will be announced throughout the year and you are strongly encouraged to attend as an integral member of our School.

Students with disabilities or long-term health Issues

The Schools Academic Liaison Officer is Ms Martha Motherway-Gildea (motherm@tcd.ie), based in the Preparation Room, Biochemistry Teaching Laboratory. Please notify Ms Motherway-Gildea, in confidence, if you have any disabilities or health issues that might affect your ability to complete your practicals or the associated assignments. Large print manuals can be provided to students with a visual impairment.

Students are encouraged to register with the disability officer, Mr Declan Reilly (reillyde@tcd.ie). It is particularly important to do this well before the examination period. It may be helpful to discuss any disability or health issues with your College Tutor as well.

Contact Information

School Office: Room 3.09: Stairs to Level 3, turn right, right again and left at fire point.

JS Executive Officer : Ms Una Murphy, Room 3.07, murphyu1@tcd.ie

Director of Undergraduate Teaching and Learning:

Dr. Vincent Kelly

e-mail: kellyvp@tcd.ie

Junior Sophister Course Advisors:

- | | | | |
|----------------------|----------------------|---------|--|
| - Molecular Medicine | Dr. K. H. Mok | Rm 5.04 | mok1@tcd.ie |
| - Biochemistry | Dr. Derek Nolan | Rm 5.06 | denolan@tcd.ie |
| - Immunology | Dr. Frederick Sheedy | Rm 5.50 | fsheedy@tcd.ie |

Junior Sophister Practical Coordinator:

Dr. Audrey Carroll Room 3.25 (within Teaching Lab, 3.22) e-mail: aucarrol@tcd.ie

Erasmus/International Student Coordinator:

Dr. Andrei Budanov

Room 5.50

e-mail: budanova@tcd.ie

Sr Sophister Molecular Medicine Course Advisor:

Dr. Gareth Brady

e-mail: bradyg1@tcd.ie

Location and venues for classes

TCD now runs on a Two-Semester academic year (<https://www.tcd.ie/calendar/academic-year-structure/academic-year-structure.pdf>). The important aspect of this is that it involves 2 end-of-term examination periods. There will be increased assessment throughout the year through various forms, so students are advised to keep on top of their workload and revise accordingly.

There will be more opportunities for feedback and in most cases, modules formally taught in each semester must be examined in the corresponding exam period. This will mean 2 exam papers at the end of Semester 1 (December 2019) & another 2 at the end of Semester 2 (April/May 2020).

The official College system for student timetables is CMIS, which students can access via mytcd system (https://my.tcd.ie/urd/sits.urd/run/siw_lgn). For major changes, students will be emailed directly while nominating one class representative is a good idea for disseminating changes.

Campus address	Building	Room number/ identification	Description
Pearse Street	Trinity Biomedical Sciences institute (TBSI)	B2.50	Seminar room
		B2.72-B2.74	Tutorial room
		FRED (L5.16)	Seminar room
		L3.22	Practical lab
		L6.07	Tutorial room
		Tercentenary Hall (L2.15)	Large Lecture Theatre
		Stanley Quek Theatre (B1.15)	Large Lecture Theatre
Main Campus	Hamilton Building	LTEE1	Large Lecture Theatre
		LTEE2	Large Lecture Theatre
		LTEE3	Large Lecture Theatre
		MacNeill 3	Large Lecture Theatre
		Maxwell 5	Large Lecture Theatre
		Salmon 1	Large Lecture Theatre
		Joly 4	Large Lecture Theatre
		EEMAC – EE4	Macintosh computer room
		EETC1 – EE4	Windows PC room
	Chemistry Building	CHLLT	Large Lecture Theatre
	Lloyd Building	LB11	Large Lecture Theatre
	Moyne Building	MOYN LT	Large Lecture Theatre
	St. James's Hospital	TCJ1	Various locations

MyCareer from Careers Advisory Service

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




mycareerconnect.tcd.ie

MyCareer:  TCD.Careers.Service



TCDCareers



Careers/students/postgraduate/
www.tcd.ie/
 @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

Guidelines for requesting an academic reference

Students applying for Summer Internships abroad require an academic reference To assist us in processing the many requests that we receive *please provide the following:*

- Title of project and nature of project/internship (a paragraph description or link to the advertisement).
- Identify where you are going, why are you going there, what do you hope to achieve?
- Describe in one paragraph how the internship/summer project will contribute to your professional development.
- Obtain a transcript from Science Course Office with first and second year results.
- If possible, obtain a copy of your JS course work marks to date from the School office. It must be stamped with the School stamp and provided to staff as a hard copy.

Allow a minimum of two weeks for your letter of reference to be prepared.

Glossary of scientifically used terms:

- Analyse:** Interpret data to reach stated conclusions.
- Annotate:** Add brief notes to a diagram, drawing or graph.
- Apply:** Use an idea, equation, principle, theory or law in a new situation.
- Calculate:** Find an answer using mathematical methods. *Show the working unless instructed not to do so.*
- Compare:** Give an account of similarities and differences between two or more items, items referring to both (or all) of them throughout. *Comparisons can be given using a table.*
- Construct:** Represent or develop in graphical form.
- Contrast:** Show differences. See in opposition.
- Deduce:** Reach a conclusion from information given.
- Define:** Give the precise meaning of a word or phrase as concisely as possible.
- Derive:** Manipulate a mathematical equation to give a new equation or result.
- Describe:** Give an account, including all the relevant information
- Design:** Produce a plan, object, simulation or model.
- Determine:** Find the only possible answer.
- Discuss:** Give an account including where possible a range of arguments, assessments of the relative importance of various factors or comparison of alternative hypotheses.
- Distinguish:** Give the difference(s) between two or more different items.
- Draw:** Represent by means of pencil lines. *Add labels unless told not to do so.*
- Estimate:** Find an approximate value for an unknown quantity, based on the information provided and application of scientific knowledge.
- Evaluate:** Assess the implications and limitations.
- Explain:** Give a clear account including causes, reasons, or mechanisms.
- Identify:** Find an answer from a number of possibilities.
- Illustrate:** Give concrete examples. *Explain clearly by using comparisons or examples.*
- Interpret:** Comment upon, give examples, describe relationships. *Describe then evaluate.*
- List:** Give a sequence of names or other brief answers with no elaboration. *Each one should be clearly distinguishable from the others.*
- Measure:** Find a value for a quantity.
- Outline:** Give a brief account or summary. *Include essential information only.*
- Predict:** Give an expected result.
- Solve:** Obtain an answer using algebraic and/or numerical methods.
- State:** Give a specific name, value, or other answer. *No supporting argument or calculation is necessary.*
- Suggest:** Propose a hypothesis or other possible explanation.
- Summarise:** Give a brief, condensed account. *Include conclusions and avoid unnecessary details.*

Module contents

(Due to timetabling difficulties, please note that the sequence of topics within each module may change.)

First semester modules:

BIU33370 - Proteins to Cells

Protein Structure & Function (Dr A Khan; 8 lectures)

1. Amino acid chemistry.
2. Conformation and dihedral angles.
3. Secondary structures and motifs.
4. Tertiary and quaternary folding.
5. Principles of protein folding.
6. Diseases of protein conformation.
7. Proteins and proteomics I.
8. Proteins and proteomics II.

Protein activity & regulation

9. Post-Translational modifications I. (Dr D Finlay)
10. Post-Translational modifications II (Dr D Finlay)
11. Enzyme reactions, reaction order, initial rate and linearity. (Dr J Murray)
12. Enzyme kinetics, 2-substrate kinetics & topological reasoning. (Dr J Murray)
13. Enzyme inhibition; reversible and irreversible. (Dr J Murray)
14. Co Factors 1. (Dr A Budanov)
15. Co Factors 2. (Dr A Budanov)
16. Enzyme regulation by macromolecules and irreversible modifications. (Dr D Nolan)
17. Enzyme regulation by Reversible Modification. (Dr D Nolan)
18. Allosteric Regulation. (Dr D Nolan)

Membranes and trafficking (Dr J Murray; 3 lectures)

19. Biological membranes and the secretory pathway.
20. Endocytosis.
21. Endocytic mechanisms

The cytoskeleton

22. Introduction to actin, structure, assembly and polarity of actin filaments. (Dr D Nolan)
23. Structure of filamentous actin. Analysis of F- and G-actin in cells. (Dr D Nolan)
24. Nucleation promoting factors, Wiskott Aldrich syndrome and Hijacking the actin cytoskeleton. (Dr D Nolan)
25. Structure of tubulin and microtubules, tubulin gene families and tubulin expression.
26. Assays of microtubular assembly, disassembly and polarity, drugs affecting microtubules.
27. Mechanism of microtubular assembly, dynamic instability and spindle synthesis.
28. Microtubular motors, types, mechanism of movement, regulation, physiological roles.
29. Intermediate Filament Structure & Function. (Dr E Creagh)

BIU33380 – Disease Mechanisms and Drug Discovery

Cell signalling

1. Introduction to cell signalling and GPCRs. (Dr E Creagh)
2. GPCR signalling (continued). (Dr E Creagh)
3. Receptor tyrosine kinases (RTKs). (Dr D Zisterer)
4. RTK signalling (continued). (Dr D Zisterer)
5. Steroid hormone signalling. (Dr E Creagh)

Drug Design (Dr KH Mok and JT Murray; 4 lectures)

6. What are drugs and ADME(T) (a).
7. What are drugs and ADME(T) (b).
8. Drug classes, their targets and the developmental process (a).
9. Drug classes, their targets and the developmental process (b).

Cancer

10. Overview of Cancer. (Dr T McElligot)
11. Hallmarks of Cancer. (Dr T McElligot)
12. Cancer Biomarkers. (Dr K Gately)
13. Cancer Treatments/Therapeutics. (Dr M Barr)
14. Autophagy and Cancer. (Dr J Murray)

Clinical aspects of inflammation (Prof P Fallon; 4 lectures)

15. Animal models of human inflammatory disease (Introduction).
16. Allergic diseases (i).
17. Allergic diseases (ii).
18. Inflammatory bowel disease.

Integration of metabolism (Dr R Porter; 5 lectures)

19. Recapitulation of relevant intermediary metabolism.
20. Intermediary metabolism in cancer.
21. Oxidative metabolism in cancer.
22. One-carbon metabolism and cancer.
23. Immune cell metabolism.

Metabolic disease

24. Glucose, insulin resistance and diabetes. (Dr F Sheedy)
25. Lipids, hyperlipidaemia and atherosclerosis. (Dr F Sheedy)
26. Therapeutic strategies for metabolic disease. (Dr F Sheedy)
27. Osteoarthritis.
28. Rheumatoid arthritis.

Second semester modules:

BIU33390 - Nucleic acids (Molecular Medicine)

Nucleic acid chemistry (2 Lectures)

Ribose, acetals, phosphate group, heterocyclic bases, tautomeric forms of purine and pyrimidine, glycoside linkage. Formation of esters and phosphate (di)esters, anhydrides of phosphoric acid, diphosphate leaving group. Methylation of DNA, cAMP.

DNA structure (Prof A Bowie; 3 lectures)

- DNA & Gene Structure I: Genome sizes require packing of DNA. Nucleotide structure, base pairing. DNA structure: double-strand helix, A, B, Z forms, nucleosomes, chromatin fibre, chromosomes. Histones, nuclear matrix.
- DNA & Gene Structure II: Chromosome Structure Telomerases induce supercoils. Eu- and hetero-chromatin. Every chromosome needs: telomere, centrosome, origin of replication. Genome complexity
- DNA & Gene Structure III: Gene structure. Gene structure: intron/exon. Regulatory non-coding regions. Gene sizes. Tandem repeats, gene clusters, pseudogenes.

Replication (Dr D Zisterer; 3 Lectures)

- Replication I: Refreshment of previous lectures: General considerations (basic rules in replication, problems associated with replication). Common features of replication conserved in prokaryotes and eukaryotes, differences arising from differences in genome structure and organisation . Enzymes at the replication fork. DNA polymerases.
- Replication II: Mechanism of replication: I) Initiation. Model systems. Replication origins, origin recognition, origin-binding proteins. Initiation of replication. Priming strategies. Regulation of replication initiation.
- Replication III: Mechanism of replication: II) Elongation and termination. Elongation (processivity and fidelity of DNA replication). Termination of replication. Telomeres and telomerases.

Transcription (Prof A Bowie; 6 Lectures)

- Eukaryotic Transcription I: Introduction. Overall themes of transcription. Overview of the transcription process Identification, structure and function of RNA Pol I, II and III. Promoters, enhancers, and methods to identify them.
- Eukaryotic Transcription II: Transcription Factors – Different classes of TFs. Methods to identify TFs. General properties of TFs with examples. Response elements. DNA binding motifs. Activation domains.
- Eukaryotic Transcription III: RNA Pol II General Transcription Factors and the initiation of transcription. The pre-initiation complex. TFIID (TBP and TAFs), TFIIA, TFIIB, TFIIF, TFIIE, TFIIH.
- Eukaryotic Transcription IV: Regulation of the basal transcription apparatus by TAFs, Cofactors and Mediator. General mechanisms of altering transcription efficiency. The multiple roles of TFIIH. Elongation. Termination. RNA Pol I and III promoters.

- Eukaryotic Transcription V: Regulation of transcription by chromatin remodelling. Role of histones. The SWI/SNF complex. Histone acetylases and histone deacetylases and complexes containing them. The histone code hypothesis.
- Eukaryotic Transcription VI: Signalling pathways converging on transcription. Inducible transcription factors (hormone receptors, CREB, AP1, STATs. Regulation of transcription factors by phosphorylation. NF κ B – history, structure and function, signalling pathways, mechanism of interaction with basal apparatus.

Translation (Dr D Zisterer; 3 Lectures)

- Eukaryotic Translation I (DZ) RNA processing. Acquisition of 5'CAPs and polyadenylate tail to primary RNA transcript. Splicing exons/introns, Splicesomes, Snurps etc. Diseases caused by aberrant splicing. rRNA and tRNA processing. Transport of nuclear mRNA to cytoplasm through nuclear pores.
- Eukaryotic Translation II (DZ) RNA-dependent synthesis of RNA and DNA. Reverse transcriptases and retroviruses. Some retroviruses cause cancer and AIDS. Inhibitors of reverse transcriptases. Self-splicing or catalytic RNA. The genetic code. Wobble hypothesis. The ribosome as a complex supramolecular machine. Amino acid activation. Initiation, elongation and termination of translation. Proof reading on the ribosome. Newly synthesised polypeptide chains undergo folding and processing. Protein synthesis is inhibited by many antibiotics and toxins.
- Eukaryotic Translation III (DZ) Cytoplasmic mechanisms of post-transcriptional control. Micro RNAs repress translation of specific mRNAs. Cytoplasmic polyadenylation promotes translation of some mRNAs. Protein synthesis is globally regulated. The TOR pathway. eIF2 kinases. Sequence specific RNA binding proteins control specific mRNA translation (e.g. iron-dependent regulation of mRNA translation and degradation.)

Genetic techniques (3 Lectures)

The lectures will give an overview on methods that are frequently used in molecular biology. Molecular Cloning: Why and how to clone a gene. Enzymes used in DNA cloning techniques. Recombinant DNA technology. Cloning and expression vectors. Agarose gel electrophoresis. Southern/Northern blotting. DNA libraries. Polymerase chain reaction (PCR). Transformation of *E. coli*, selection, identification, and analysis of DNA clones.

Transcription and translation, a molecular perspective (Dr V. Kelly; 3 Lectures)

- RNA Polymerase II: At the heart of DNA transcription lies and eminently simple machine, the RNA polymerase II enzyme, which provides the mRNA template for protein coding genes. This lecture will consider the results of crystallographic data that provide a structural understanding of how the transcription start site is selected at core promoter elements and the processes that underlying RNA polymerisation during transcription.
- The ribosome & transfer RNA: Solving of the structures of tRNA and the ribosome has provided unprecedented insights of how translation occurs at the molecular level and has clarified the results of many former experiments using site-directed mutagenesis. These lectures will explore translation at the molecular level and examine what is known about the kinetic and structural features of tRNA accommodation and peptide transfer by the ribosome.

DNA repair mechanisms (Dr D Finlay; 5 lectures)

- Introduction. Importance of protecting the genetic code, causes of DNA damage, types of distinct DNA damage lesion and the different specific repair mechanisms, the DNA damage response. Double strand break repair. Homologous recombination, NHEJ (Non-homologous End Joining).
- Excision repair and mismatch repair. Nucleotide excision repair, base excision repair, mismatch repair. DNA damage response. DNA damage response – signal transduction.
- ATM and ATR signalling pathways. Downstream effects of DNA damage response. DNA damage response and human disease. ATM, BRCA1, BRCA2 – cancer, ataxia-telangiectasia. XP syndrome (UV sensitivity) & cancer.
- Mismatch repair defects. Premature aging; Cockayne's syndrome, Werner's syndrome. Fanconi's anaemia syndrome.

BIU33360 – Research Skills in Molecular Disease

This module prepares and trains students for a research career by introducing them to critical analysis and synthesis of the molecular basis of disease literature in the form of a mini-review which will be supervised by an academic staff member with expertise in the topic. They will also present their findings orally. Students will also participate in quantitative problem session where various academic staff members will demonstrate and train students how to handle and present experimental data. Associated practicals' will give students advanced skills in an assortment of biochemistry and molecular biology techniques. A set of talks from experienced staff members will give students skills to build a research profile as they advance their career.