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

Neuroscience Moderatorship

Junior Sophister Handbook

2024–2025

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

Table of Contents:

INTRODUCTION

Welcome to the Neuroscience Program at Trinity College. Neuroscience is a discipline that is devoted to the scientific study of the nervous system and is at the interface between biology and psychology. It includes study of the nature and functioning of the nervous system at all levels, from the molecules that make up individual nerve cells, to the complexities of how behaviour, thoughts and emotions are produced. Neuroscience is unique in that it makes use of a variety of methods and investigations from a wide range of traditional disciplines. Understanding the functioning of the nervous system requires an integrated knowledge of anatomy, physiology, biochemistry, molecular biology, pharmacology, and psychology. Consequently, although the degree is housed within the School of Biochemistry and Immunology, the Sophister Neuroscience program is comprised of courses from all these disciplines and is the only degree in Trinity to be taught by lecturers from all three faculties.

In the Junior Sophister year, our aim is to lay a solid foundation in the various disciplines that make up Neuroscience but will also begin to really delve into the integration of circuits in the brain and to examine how the brain generates behaviour. In addition, the Junior Sophister year will give you experience in data handling, biostatistics, experimental design, computing, written and oral communication skills, and interpretation and critical analysis of scientific research papers. The 'open modules' in *Cell Physiology and Pharmacology*, in *Biochemistry for Biosciences* and in *Human Neuropsychology* are essential underpinning for the core Neuroscience curriculum and these three are strongly recommended. Thus, you will be well prepared for the Senior Sophister year. **It is also important to remember that your Junior Sophister marks contribute 30% to your final degree.** The Senior Sophister year will take you deeper into some of the areas you explored in the Junior Sophister year, but also will take on new areas like glial biology, neuroimmunology and neurodegenerative & neuropsychiatric conditions, as well as undertaking a major capstone project in one of the many research labs that make up the neuroscience community in Trinity.

This *Handbook* has been prepared as a guide to the Junior Sophister year, and contains information regarding the course content, course assessment, reading lists, plagiarism and basic laboratory information. Due to the multidisciplinary nature of Neuroscience, the Junior Sophister year will be demanding and will require you to be committed to your course. Students are expected to work hard and to take responsibility for their learning. However, you should always feel free to seek advice and guidance from members of teaching staff, who may be contacted in their respective departments, or in the TCIN building.

In addition to learning within the context of formal lecture and practical sessions, I encourage co-operation with your fellow students so as you can learn from each other along the way. You should not consider helping one of your classmates as a waste of your time, but rather as revision for yourself!

I wish you every success over the next two years.

Dr Roisin McMackin

Who should I contact if I have a question/problem?

The following is a guide of who to contact for various issues. If you send an e-mail outside of working hours, even if urgent, do not expect it to be seen until working time commences.

A typical response time is ~5 working days (i.e. excluding weekends, evenings and bank holidays) and follow up emails in the absence of a response should not be sent within this period unless urgent.

Your college tutor (differs for each student) – If you are struggling to keep up with your coursework, need to seek permission to defer an end of term exam or have other personal issues during your academic work.

Module coordinator (specific to each module, see modules in this handbook) – If you have a query about the content, deadlines, exam format or anything else pertaining to an individual module/set of lectures.

Course administrator (Gabrielle McCabe, gamccabe@tcd.ie) – If you are having issues accessing/viewing your timetable or exam results (such as on my.tcd.ie), wish to request transcripts of results, or view your exam script after marks have been released.

Academic registry (academic.registry@tcd.ie, https://www.tcd.ie/academicregistry/) – If you are having issues with fee payment, course registration, student ID cards or other matters regarding your status as a student at TCD.

Student counselling service (student-counselling@tcd.ie) – If you are personally struggling or need help with your mental health.

College health ((01) 896 1999 or (01) 896 1317) – If you need a medical certificate or need a (free) GP/nurse appointment.

JS course coordinator, Dr Roisin McMackin (mcmackro@tcd.ie) - If you have queries about the overall course, such as the term/year structure or the course contents.

SS course coordinator, Dr Colm Cunningham (cunninco@tcd.ie) - If you have queries about the SS year, such as queries about next year's term/year structure or the course contents.

REQUESTING ACADEMIC REFERENCES

If a student would like to request a reference, they should send an email to make the request and provide the staff member with the following:

- details of the course, job, internship, PhD/MSc application etc.
- details of the type of reference (letter, completion of section on application form etc) required and the mode of submission (upload to website, email etc).
- a copy of their current *Curriculum Vitae.*
- a copy of their personal statement or application letter where appropriate
- a minimum of **2 week's notice** for provision of the reference.

Need support? Reach out to Student Counselling Service

What does SCS actually do? SCS offer free, confidential and non-judgmental support to registered students of Trinity who are experiencing personal and/or academic concerns. The SCS team of qualified counsellors and learning strategists are committed to promoting and protecting wellbeing and success throughout a diverse student body. No matter who you are, no matter what your situation is, the Student Counselling Service is here to support you through your difficulties.

All students at TCD are entitled to (a limited number of) free one-to-one counselling sessions every year. These sessions can be extremely helpful and supportive during your studies, even if you are not feeling acutely burdened or overwhelmed. However, due to the demand for these sessions, there can be delays of several weeks to several months in waiting times for first appointments. These waiting times are at their lowest during summertime and early in the academic year.

Need Urgent Support?
In the event of an emergency that cannot wait, the Student Counselling Service has emergency appointments available every weekday. Email at student-counselling@tcd.ie to book in with the duty counsellor.

You can also reach ***Niteline***, which is run by students at:

https://www.tcd.ie/Student_Counselling/support-services/niteline/

Additional off-campus support is available at Samaritans (www.dublinsamaritans.ie) and Pieta House (http://www.pieta.ie/).

As a reminder, you can always contact your **College Tutor** for personal and academic guidance. However, your Tutor is an academic, and therefore will not be qualified to provide professional mental health support.

Other support from SCS:

In addition to one-to-one counselling, the SCS provides an array of workshops, online and in person courses and group meetings that cater to an array of mental health, personal development and other issues. For more information see: https://www.tcd.ie/Student_Counselling/counselling/

JS course overview

<table>
<tr><th colspan="2">Neuroscience</th></tr>
<tr><th>Semester 1 (S1)</th><th>Semester 2 (S2)</th></tr>
<tr><th colspan="2">Core Modules</th></tr>
<tr><td>BIU33485 Research Skills (5 credits)</td><td>ANU33001 Neuroanatomy (5 credit s)</td></tr>
<tr><td rowspan="2">BIU33465 Integrative Neuroscience (5 credits)</td><td>BIU33445 Neurochemistry I (5 credits)</td></tr>
<tr><td>GEU33035 Genetic Analysis of the Nervous System (5 credits)</td></tr>
<tr><td rowspan="2">NSU33PH1 General Principles of Pharmacology (5 credits)</td><td>PGU33009: Neurophysiology I (5 credits)</td></tr>
<tr><td>BIU33495 Nucleic Acids & Molecular Biology Techniques
(5 credits)</td></tr>
<tr><th colspan="2">Open Modules Scenario I (recommended)</th></tr>
<tr><td>PGU33905 Cell Physiology and Pharmacology (5 credits)</td><td rowspan="3">Human Neuropsychology * (5 credits)
For 2024-25*
PSU34620 Advanced BioPsychology</td></tr>
<tr><td>BIU33150 Biochemistry for Biosciences (5 credits)</td></tr>
<tr><td>Trinity Elective (5 credits)</td></tr>
<tr><th colspan="2">Open Modules Scenario II</th></tr>
<tr><td>PGU33905 Cell Physiology and Pharmacology (5 credits)</td><td rowspan="3">Trinity Elective (5 credits)</td></tr>
<tr><td>BIU33150 Biochemistry for Biosciences (5 credits)</td></tr>
<tr><td>GEU33045 Genomes and Systems Biology (5 credits)</td></tr>
<tr><th colspan="2">Open Modules Scenario III</th></tr>
<tr><td>PGU33905 Cell Physiology and Pharmacology (5 credits)</td><td rowspan="3">Trinity Elective (5 credits)</td></tr>
<tr><td>BIU33150 Biochemistry for Biosciences (5 credits)</td></tr>
<tr><td>Trinity Elective (5 credits)</td></tr>
</table>

Teaching staff on the Neuroscience Moderatorship

Teaching Staff	Contact details	School
Dr Roisin McMackin	mcmackro@tcd.ie	Medicine
Dr Eva Jimenez-Mateos	jimeneze@tcd.ie	Medicine
Prof. Andrew Harkin	aharkin@tcd.ie	Pharmacy
Dr Pablo Labrador	labradoj@tcd.ie	Genetics and Microbiology
Prof. Kevin Mitchell	kevin.mitchell@tcd.ie	Genetics and Microbiology
Prof. Andrew Bowie	agbowie@tcd.ie	Biochemistry and Immunology
Dr David Loane	loanedj@tcd.ie	Biochemistry and Immunology
Dr Colm Cunningham	colm.cunningham@tcd.ie	Biochemistry and Immunology
Dr Gavin Davey	gavin.davey@tcd.ie	Biochemistry and Immunology
Dr David Finlay	finlayd@tcd.ie	Biochemistry and Immunology
Dr Derek Nolan	denolan@tcd.ie	Biochemistry and Immunology
Dr Tomás Ryan	tomas.ryan@tcd.ie	Biochemistry and Immunology
Dr Daniela Zisterer	dzistrer@tcd.ie	Biochemistry and Immunology
Prof. Fiona Newell	FNEWELL@tcd.ie	Psychology
Dr Daniel Johnston	djohnst@tcd.ie	Anatomy
Dr Fred Sheedy	fsheedy@tcd.ie	Biochemistry and Immunology

Student Feedback

From time to time, you may be asked to evaluate parts of the course. Your comments on all aspects of the Neuroscience program, both positive and negative, **are extremely valuable and will be treated in confidence**. Student feedback is extremely important, particularly in the early years of a new course, as it provides a means for us to assess the course and will enable us to improve aspects of the course in the coming years.

-

Core modules

BIU33485: RESEARCH SKILLS

Module coordinator: Dr Eva Jimenez-Mateos (4 Lectures, 2 Workshop, 4 Tutorials)

MODULE DESCRIPTION

The first part of the module (**data handling, statistics and experimental design**) gives an introduction to experimental design, data handling and statistical analysis of data, data interpretation and presentation. In block I and II, students will use computer software (a) to perform a range of commonly used statistical tests, (b) to graphically represent data and (c) to apply what they have learnt in problem-solving exercises. In block III, Journal Club is designed to provide students with an opportunity to read individual scientific articles and to develop the necessary skills to critically evaluate them.

MODULE DETAILS

Block 1

Lecture 1- Introduction to data representation and Interpretation. Dr Jimenez-Mateos.

Lecture 2- Data representation and Interpretation. Dr Jimenez-Mateos.

3 hours session on Computer lab (PAC room)

Block 2

Lecture 4- Quantitative and computational Neurosciences (MATLAB)- Dr McMackin

Lecture 5- Quantitative and computational Neurosciences (MATLAB)- Dr Nasseroleslami

Workshop- Quantitative and computational Neuroscience.

Block 3

Tutorial 1- Journal Club (2-3hr)- Dr Sarah McComish

Tutorial 2- Journal Club (2-3hr)- Dr Jimenez-Mateos

Tutorial 3- Journal Club (2-3hr)- Dr Jimenez-Mateos

Tutorial 4- Journal Club (2-3h) – Dr Jimenez Mateos

Tutorial 5- Journal Club (2-3hr)- Oral presentation (10%)- Dr Jimenez-Mateos

Reading/Learning Resources:

Primer of Biostatistics. 5th Ed. by S.A. Glantz. McGraw-Hill. ISBN 0-07-024268-2, 1997
Biomedical Research: How to plan, publish and present it. 2nd Ed. by W.F. Whimster. Springer-Verlag Berlin and Heidelberg GmbH & Co. KG. ISBN 3540198768, 1997.
Medical Statistics at a Glance. by A. Petrie and C. Sabin. Blackwell Science, Oxford. ISBN 0632050756, 2000.

LEARNING OUTCOMES

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

- critically read and interpret scientific journal papers.

- critically assess experimental design and interpretation of data.
- evaluate statistical methods.
- present scientific data via PowerPoint to a scientific audience.

ASSESSMENT: All assessment for this module is in-course. **Block I** – MCQ, 30%. **Block II** – ICA, 20%. **Block III** - Oral presentation, 10%. Written exam critical analysis of scientific text, 40% (Take home exam, 24hr)

BIU33465: INTEGRATIVE NEUROSCIENCE

Module coordinator: Dr Tomás Ryan (14 lectures and 6 tutorials)

MODULE DESCRIPTION

The intention of this course is firstly to provide students with a firm grounding in the sub-fields of neuroscience that are conventionally referred to as systems neuroscience, cognitive neuroscience, and behavioural neuroscience; and secondly to introduce students to integrative frameworks for synthesizing existing neuroscience literature from different fields and for orientating to hypothesis driven and explanatory research. Students will learn how to approach any brain function (e.g. learning and memory) from a functional and evolutionary standpoint and will apply heuristic conceptual and computational approaches for developing frameworks within which hypotheses can be developed. They will learn how such hypotheses can be tested through multi-disciplinary research projects that combine behavioural, cognitive, physiological, and molecular investigations of brain function using cutting edge experimental methods. They will learn how to assess the validity and quality of such research with the utmost scepticism. They will learn how outcomes of progressive experimental investigations can develop and refine theories that aim to explain the brain and behaviour. This Junior Sophister module is designed to be comprehensive, in order to provide all students with a firm and holistic platform that can be applied to students' interpretation of other courses and/or of their own independent reading and research.

LEARNING OUTCOMES

- understand the historical origins of the scientific study of behaviour in ethology and experimental psychology.
- appreciate different cognitive and computational frameworks in which to explain behaviour.
- develop a working knowledge of neural circuit organization and function.
- understand the methodology and interpretation of data from widely used technology and methods of modern neuroscience research.
- understand core concepts and current topics in the neuroscience of movement.
- understand core concepts and current topics in the neuroscience of perception.
- understand core concepts and current topics in the neuroscience of emotion and motivation.
- understand core concepts and current topics in the neuroscience of learning and memory.
- understand core concepts and current topics in the neuroscience of decision making.
- understand core concepts and current topics in the neuroscience of organismic homeostasis.
- appreciate different empirical approaches to the neuroscience of consciousness.
- appreciate the role of evolutionary biology in explaining neuroscience and behaviour and have knowledge of evolutionary neuroscience and psychology.

At the end of the problem-based learning element of the course the student will:

- have developed a theory-orientated perspective for understanding cognitive and behavioural functions at multiple levels.
- be able to critically assess and integrate multiple sources from different fields and develop and synthetic framework for describing current knowledge of any neuroscience topic.

- be able to identify and articulate novel scientific questions at the frontier of systems, cognitive, and behavioural neuroscience.
- have demonstrated the ability to community the above outcomes through an extensive written essay.
- have demonstrated the ability to community the above outcomes through oral presentations.
- have demonstrated the ability to work in a team.

ASSESSMENT: All assessment of this module is in-course. In-course assessment comprises of oral presentation following group work, essay, and examination.

NSU33PH1: GENERAL PRINCIPLES OF PHARMACOLOGY

Module coordinator: Prof. Andrew Harkin

Module content: 26 Lectures; 5 Practicals; 1 revision class

MODULE DESCRIPTION

Targets of drug action; receptor pharmacology and cell signalling; pharmacodynamics (drug action, agonism and antagonism; specificity and side-effects); Dose-response; basic pharmacokinetics (drug absorption, distribution, metabolism and excretion); general ANS pharmacology - sympathetic and para-sympathetic nervous transmission; cholinergic drugs, anticholinesterases; direct and indirect acting sympathomimetics; non-adrenergic and non-cholinergic transmitters; neuromuscular transmission and neuromuscular blocking agents; central neurotransmission and the biochemical basis of neuropharmacology; excitatory and inhibitory transmitters; neuromodulatory transmitters: biogenic amines and acetylcholine; application of basic principles in selected examples of drug use; overview of drug development and testing. ***Practical classes include***: 1 Drug targets and receptor transduction - computer simulated programme with assignment, 2. Dose response in the Guinea Pig Ileum preparation: agonists - computer simulated experiments and data analysis with assignment , 3. Water Maze – computer simulated programme with data analysis and assignment, 4. Basic Pharmacokinetics, computer simulated programme with data analysis and assignment, 5. Drug development and testing – clinical trials; computer simulated programme with assignment.

LEARNING OUTCOMES

On completion of this course the student will be able to:

- state the variety of targets to which drugs bind in the body and illustrate their transduction and cell signalling mechanisms.
- define agonist (full, partial and inverse), antagonist (competitive and non-competitive) and recall selected examples of each.
- describe receptor binding experiments and define the receptor binding parameters B_{MAX} and K_D.
- to construct dose response curves and calculate drug potency of both agonists and antagonists.
- to illustrate the principles of drug absorption, distribution, metabolism and excretion and define the terms, pKa, bioavailability, volume of distribution, clearance, half-life and Kel.
- to illustrate the organisation and mode of neurotransmission within the sympathetic, para sympathetic, enteric and somatic nervous systems.
- to recall the mechanisms of action and clinical uses of cholinergic and adrenergic drugs within the peripheral nervous system.
- to define the key steps associated with excitatory and inhibitory neurotransmission in the brain and provide selected examples of drugs which influence these steps.
- to report on the various stages of drug discovery, development and the clinical trials process.

ASSESSMENT: Examination (60%) & in-course assessment (40%).

Reading/Learning Resources:

Rang and Dale's Pharmacology (9th Ed.) by James Ritter Rod Flower Graeme Henderson Yoon Kong Loke David MacEwan Humphrey Rang. Elsevier (2020)

Brody's Human Pharmacology. Mechanism-Based Therapeutics (6th Ed.) by Lynn Wecker Elsevier (2018)
The Biochemical Basis of Neuropharmacology. (8th Ed) by J.R. Cooper, F.E. Bloom and R.H. Roth. (2003) Oxford University Press. ISBN 0-19-514008-7.

PGU33009: NEUROPHYSIOLOGY I

Module coordinator: Dr Eva Jimenez-Mateos (23 lectures; 4 Practicals)

MODULE DESCRIPTION

The lectures in this module focus on how the nervous system works. Lectures will describe the structure and function of neurons, how they communicate and how they are arranged to form the nervous system. Topics include electrical properties of neurons, properties and physiological functions of ion channels, synaptic excitability, transmission and plasticity and the delivery and interpretation of sensory information into the central nervous system. Part of the course is also devoted to describing methods to record both cellular and brain activity. Practical classes focus on computer-simulated recordings of individual nerves to understand features of neuronal activity, recording brain function via electroencephalogram and sensory-evoked potentials. This module is designed to provide understanding of how the brain functions at a cellular and systems level.

DETAILS OF THE MODULE

Semester 1

Lectures:
Membrane excitability
Neurophysiology I
Neurophysiology II
Somatic Sense Organs
Proprioception, Taste and Olfaction
Hearing and Equilibrium

Practicals:
Nerve stimulation
Electroencephalogram
Visual Evoked Potentials
Receptor modulation

Semester 2

Lectures:
1. Neurotransmitters, ion channels and synaptic transmission
2. Neurotransmitters, ion channels and synaptic transmission II
3. Neurotransmitters, ion channels and synaptic transmission III
4. Magnetic resonance Imaging
5. Electroencephalogram
6. Neurophysiology of Sleep
7. Somatosensation
8. Nociception
9. Visual System I
10. Visual System II
11. Visual System III
12. Motor System – primary motor areas
13. Motor System – Basal ganglia
14. Motor System – cerebellum
15. Electrophysiological techniques
16. Learning and memory
17. Reward circuits and addiction

LEARNING OUTCOMES

On completion of this module, the student will be able to:

- describe the neurophysiological activity of peripheral and central neurons involved in sensory information processing.
- define the physiological roles of the brain regions and pathways involved in the planning, initiation and control of movement.
- identify the brain activity patterns associated with distinct sleep states and describe the neurophysiological basis of sleep and wakefulness.
- relate cellular and synaptic neuronal activity to the coordinated brain oscillations recorded by electroencephalography (EEG).

- interpret neurophysiological activity recorded using in vitro and in vivo electrophysiological techniques and recognise the clinical uses of neurophysiological recordings including EEG and sensory-evoked potentials.
- relate how synaptic plasticity at cellular and network levels underlies long-term alterations in behaviour associated with learning and memory, addiction.

ASSESSMENT: Laboratory reports & in-class test (30%) and Examination (70%).

ANU33001: NEUROANATOMY

Module coordinator: Dr Daniel Johnston

Module contents: 8 Lectures; 1 Lab. introduction; 7 practical sessions

LEARNING OUTCOMES

Neuroanatomy is the anatomic study of the CNS and PNS, with emphasis on pathways and nuclei associated with sensory input integration and motor output. This module will combine theoretical learning with cadaveric brain inspection and on successful completion you will be expected to:

- recognize and describe the major subdivisions and anatomic features of the central nervous system (CNS), including the cerebral hemispheres, brainstem, cerebellum, and spinal cord.
- describe the ventricular system and the production, circulation, absorption, and function of the cerebrospinal fluid.
- name the major vessels visible and outline the blood supply of the CNS.
- identify CNS structures associated with major sensory and motor systems, their connections, and outline their pathways outside the CNS.
- locate and functionally describe the nuclei and pathways associated with the special senses.
- name and classify the cranial nerves and list their major connections.
- list the deeper cortical nuclei associated with the limbic system and basal ganglia and their function where known.
- apply anatomical knowledge to explain the normal function of CNS regions in activities of daily life.
- use anatomical knowledge to explain the pathogenesis and natural history of common clinical disorders of the CNS.

ASSESSMENT: Examination (50% multiple choice questions) AND Practical Examination, comprising 40%, end of module, and 10%, in course continuous assessment, (after practical 3) (totally 50%).

Please note that the neuroanatomy practical examination is usually held outside of Hilary term prior to the annual examination period.

Reading/Learning Resources:

Clinical Neuroanatomy and related Neuroscience: FitzGerald and Folan-Curran: W B Saunders
Very detailed and integrates neuroanatomy, neurophysiology, neuropharmacology and clinical considerations.

Grays anatomy for students. Drake, Vogel, Mitchel.
Excellent textbook with detailed schematic and clear explanatory text.

Blackboard
This contains all announcements relating to curricular content, explanatory videos, sample questions, lectures slides and practical manuals and the Wiegert's presentation.

BIU33495: NUCLEIC ACIDS & MOLECULAR BIOLOGY TECHNIQUES

Module coordinator: Daniela Zisterer

Module content: 17 Lectures and 5 practicals

MODULE DESCRIPTOR

This module covers the structure and function of nucleic acids in a eukaryotic context. The basis of gene transcriptional regulation and mRNA translation are described at a mechanistic and structural level in addition to the processes involved in DNA replication and repair. The lectures of this module (17h) are accompanied by a set of practical sessions (15 contact hours) that include (i) pKA and preparation of buffers and (ii) analysis of plasmid DNA, digestion and cloning, transformation and selection of bacteria; laboratory and tutorial sessions.

Learning Outcomes:

On completion of this module, the student will be able to:

- Recall and integrate key knowledge and concepts about DNA structure, function and process and assess the importance of DNA replication.
- Describe the molecular and structural features of transcription initiation, transfer RNA charging and ribosomal translation.
- 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.
- Understand the different types of DNA damage, how they occur and implications for genome stability.
- Exhibit knowledge of the signal transduction pathways that sense DNA damage and the different repair pathways that exist to deal with the range of types of DNA damage.

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

Assessment Details:

80% End of year examination, 20% in-course assessed.

In course assessment: Pre- and post-practical homework assignments (20% of course)

BIU33445: NEUROCHEMISTRY I

Module coordinator: Prof. Gavin Davey

Module contents: 12 Lectures; 6 practical sessions

MODULE DESCRIPTOR

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. Practical classes are devoted to the following topics: subcellular fractionation of brain tissue, assessment of protein expression in brain tissue, assessment of enzyme markers, measurement of neurotransmitters, analysis of brain lipids, neurotransmitter receptor binding.

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 brain disorders
- Set up and manage standard laboratory equipment correctly, safely and in the appropriate context.
- Outline the theory behind the techniques used in practical classes.
- Construct a clear scientific record of experiments and the data generated in experiments in a laboratory notebook and critically assess the data.
- Explain the importance of experimental controls and multiple determinations.
- Work independently and in a team and exercise initiative and personal responsibility.
- Participate in group discussions with peers and with teachers. Select and apply appropriate statistical tests to their own experimental data and evaluate the results of these tests.

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

Assessment Details: Examination (100%).

GEU33035: GENETIC ANALYSIS OF THE NERVOUS SYSTEM

Module coordinator: Dr Juan Pablo Labrador

Module contents: 19 Lectures; 3 tutorials

MODULE DESCRIPTOR

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) Behavioural 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; behaviour, learning and memory, sleep and circadian rhythms.

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.

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

Assessment Details: Final exam/or assignment

Open Modules

The below open modules are those which may be chosen (as outlined on page 4, under “Course Structure”) to fulfil the required credits of the JS Neuroscience Year. Most of these modules are delivered to a number of different moderatorships within the Biological and Biomedical Sciences course, and therefore it is often not be possible to schedule lectures at a time where all students are available to attend in person. As a result, lectures often need to be provided as online recordings. The module coordinator will outline if/when this is the case at the beginning of the module.

There is one open module that is only available to Neuroscience students (see ADVANCED BIOPSYCHOLOGY, below). Although it is an open module it is strongly recommended that Neuroscience students take this module since it provides a human neuropsychology perspective on behaviour that is not available elsewhere in the moderatorship.

PGU33905: CELL PHYSIOLOGY AND PHARMACOLOGY I

Module coordinator: Dr Roisin McMackin

Contact Hours: 25

This module has two sections. The first half of the module covers lectures focused on (i) membrane structure, proteins and properties; (ii) receptors and neurotransmitters, (iii) the principles of drug action, drug development and drug targets. These lectures are designed to consider the structure of the membrane, the changes that occur in the membrane under different biological circumstances using age as an example, and role of membrane proteins. Cell functions, for example, the control of intracellular calcium by cells and transmitter release will be considered in the context of the membrane proteins that impact on these functions. The second half of the module covers lectures focused on (i) a general introduction to pharmacokinetics and pharmacodynamics, (ii) pharmacology of the autonomic nervous system, (iii) therapeutic targets in neurodegenerative and affective disorders and (iv) drug treatments for cardiovascular disease.

Learning Aims:

This module has two sections. The first half of the module covers lectures focused on (i) membrane structure, proteins and properties; (ii) receptors and neurotransmitters, (iii) the principles of drug action, drug development and drug targets. These lectures are designed to consider the structure of the membrane, the changes that occur in the membrane under different biological circumstances using age as an example, and role of membrane proteins. Cell functions, for example, the control of intracellular calcium by cells and transmitter release will be considered in the context of the membrane proteins that impact on these functions. The second half of the module covers lectures focused on (i) a general introduction to pharmacokinetics and pharmacodynamics, (ii) pharmacology of the autonomic nervous system, (iii)

therapeutic targets in neurodegenerative and affective disorders and (iv) drug treatments for cardiovascular disease.

Learning Outcomes:

- Appreciate the role lipids play in the composition and function of plasma membranes.

- Be aware of the role that fatty acids and lipids in cell function, and the impact of ageing on membrane lipids and consequently on cell function.

- Be in a position to describe how accumulation of reactive oxygen species impacts on membrane lipids and to appreciate how these changes contribute to diseases.

- Appreciate the importance of controlling intracellular calcium concentration.

- Be able to characterize the steps leading to transmitter release.

- Be in a position to describe the techniques used to analyse lipids, intracellular calcium concentration and neurotransmitter release.

- Demonstrate an understanding of the physiology and associated pathophysiology of the key systems discussed.

- Explain key measurements used to understand the pharmacokinetic and pharmacodynamic properties of a drug.

- Describe how drugs produce their therapeutic and side effects on the body.

- Describe the neurotransmitter systems and neural networks involved in autonomic nervous system and how they can be targeted to treat given ailments, including explaining the mechanism(s) of action of selected drugs (giving examples) and their indications and contraindications.

- Be able to explain control of normal heart rate, rhythm and force of contraction and explain how systems which regulate these functions can be targeted to treat given ailments, including explaining the mechanism(s) of action of selected drugs (giving examples) and their indications and contraindications.

- Be able to explain examples of known/hypothesised mechanisms which are disrupted in neurodegenerative diseases, and how they can be targeted to treat these diseases, including explaining the mechanism(s) of action of selected drugs (giving examples) and their indications and contraindications.

Recommended Reading List:

Alberts, Bruce, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell. 5th Edition. New York: Garland Science. ISBN 978-0-8153-4111-6

Rang and Dale’s Pharmacology, Elsevier, ISBN: 9780702053634. − Medical Pharmacology at a Glance, 8th Edition, Michael J. Neal, John Wiley & Sons, ISBN: 9781118902400

Assessment Details:

The module is assessed by a combination of an in course MCQ exam (30% of overall grade), following the initial cell physiology portion of the module, followed by an end of term exam (70% of overall grade) which involves answering one question of a choice of two, on cell physiology, and one question, of a choice of two, on pharmacology.

BIU33150: BIOCHEMISTRY FOR BIOSCIENCES

Semester taught - Semester 1

Contact Hours - 20 hours

Module Coordinator - Derek Nolan

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.

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 microtubules, their assembly and disassembly and their polarity.

- Describe the structure of microtubule motors and the processes of directed vesicle transport and cytoplasmic streaming. Describe the structure of monomeric 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.

Assessment

60% end of year examination, 40% continuous assessment

In course assessment: Two online MCQ assessments.

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 MCQ representing 16% of the marks for the course.

Complete details of the assessments, MCQs and end of term exam, will be posted separately on BB in BIU33150.

Sample MCQs and a sample paper will be available online.

PSU34620: ADVANCED BIOPSYCHOLOGY

Module coordinator: Prof Fiona Newell

Contact hours: 11

Biopsychology is the study of the biological basis of behaviour. In this course, students discover connections among psychology and biology, neuroscience, pharmacology, and endocrinology. Lectures cover the structure, function, and development of the human nervous system and how this system can give rise to basic sensory, motor, cognitive, and regulatory processes that characterize human behaviour. The content will also include discussions on the role of hormones and microbiome on brain function and behaviour. This course will refer to examples of the effects of brain damage and nervous system disorders to provide insight into how pathological thoughts and behaviours are rooted in physiological causes.

Additionally, students develop a basic understanding of the methods used in biopsychology and evaluate the contributions as well as limitations of these approaches. Students can expect the following content across the lectures in this module:

1. Neuroanatomy and neurophysiological processes in the brain
2. Neurotransmitters and drugs
3. The evolution of the brain and behaviour
4. The development of the brain
5. Hormones and the brain
6. Homeostasis: brain mechanisms and regulatory behaviour
7. Biological rhythms and sleep
8. Principles of sensory processing in the brain
9. Brain basis of major sensory systems and their interactions
10. The gut and brain function
11. Psychopathology and mental disorders

Learning outcomes:

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

LO1. Demonstrate a broad understanding of how the brain gives rise to behaviour.
LO2. Demonstrate understanding of important concepts, perspectives, and empirical findings linking brain and behaviour.
LO3. Explain the neuroanatomy and development of human brain structures across the lifespan.
LO4. Outline the steps involved in neural signalling including neurochemistry and effect of drugs on the brain.
LO5. Demonstrate understanding of sensation, action, motivated behaviour, and cognition - within the context of neuroscience and behaviour.
LO6. Use research to evaluate recent evidence linking microbiome to brain and behaviour.
LO7. Demonstrate understanding of the biological basis of regulatory behaviour.

LO8. Report on observations of biorhythms and implement knowledge to provide theoretical insights into behaviour.
LO9. Evaluate role of physiological basis of brain disorders and trauma on behaviour

Recommended reading:

Core textbook: Behavioural Neuroscience (10th edition) by Breedlove & Watson, 2023, Sinauer (Oxford University Press), (ISBN: 9780197616857)

Other primary source materials (e.g. review articles) will be announced in class and will be available as pdfs on the course website. Other materials such as videos or demos will be made available on Blackboard for each week. Links for further (optional) readings may also be provided on lecture slides.

Assessment:

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Quiz	Four short quizzes (take-home, mcq) will be administered during the course (5% each). Each quiz will be timed and open-book.	LO1-5	20%	3, 5, 7, 9
Coursework	A single homework assignment based on circadian rhythms.	LO1, 2, 5	20%	6
Exam	Knowledge of the content of the course, including conceptual and theoretical approaches, will be assessed by an in-person, written (closed-book) exam. This exam will be 2-hours, taken during exam week.	LO1-5	60%	TBC

GEU33045: GENOMICS AND SYSTEMS BIOLOGY

Semester taught 1

Contact Hours 24

Module Personnel Mike Dolan, Adrian Bracken, Carsten Kröger, Kenneth Mok

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.

Module content:

Week	Day & Time	Lecture Topic & Lecturer
3	Tue 10th Sept 17:00-18:00	Introduction to Genomics and Systems Biology (Dolan)
3	Wed 11th Sept 17:00-18:00	History of DNA Sequencing I (Dolan)
4	Mon 16th Sept 17:00-18:00	History of DNA Sequencing II: The Human Genome Project (Dolan)
4	Tue 17th Sept 17:00-18:00	Modern Day DNA sequencing I: 2nd Generation Sequencing Technologies (Dolan)
5	Mon 23rd Sept 17:00-18:00	Modern Day DNA sequencing II: 3rd Generation Sequencing Technologies (Dolan)
5	Tue 24th Sept 17:00-18:00	Structural and Comparative Genomics (Dolan)
6	Mon 30th Sept 17:00-18:00	Genomic Architecture of Schizophrenia (Dolan)
6	Tue 1st Oct 17:00-18:00	Transcriptomics: Revealing Gene Expression (Dolan)
7	Mon 7th Oct 17:00-18:00	Profiling RNA expression in the Schizophrenic Brain (Dolan)
7	Tue 8th Oct 17:00-18:00	Regulation of Gene Expression (Dolan)
7	Wed 9th Oct	Single-cell and spatial Transcriptomics (Dolan)

	17:00-18:00	
8	Mon 14th Oct 17:00-18:00	Single-cell dissection of the human brain in health and disease (Dolan)
8	Tue 15th Oct 17:00-18:00	*Revision of material, discussion and answering student questions (Dolan) - tutorial*
9		**Study/Review week**
10	Tue 29th Oct 17:00-18:00	Bacterial genomes and comparative genomics (Kröger)
11	Mon 4th Nov 17:00-18:00	Functional genomics in bacteria (Kröger)
11	Tue 5th Nov 16:00-17:00	Introduction into the epigenome: histone and DNA modifications (Bracken)
11	Tue 5th Nov 17:00-18:00	Methods to analyse the epigenome; the ENCODE project (Bracken)
12	Mon 11th Nov 17:00-18:00	Cancer profiling and classification of tumour types (Bracken)
12	Tue 12th Nov 17:00-18:00	Using genomic information for the development of cancer therapies (Bracken)
13	Mon 18th Nov 17:00-18:00	Proteomics: Identify/characterise/quantify; Mass Spec and other technologies (Mok)
13	Tue 19th Nov 17:00-18:00	Quantitative proteomics; clinical proteomics (Mok)
14	Mon 25th Nov 17:00-18:00	Interaction/affinity proteomics; metabolomics introduction (Mok)
14	Tue 26th Nov 16:00-17:00	Metabolomics technologies (Mok)
14	Tue 26th Nov 17:00-18:00	*Revision of material, discussion and answering student questions (all lecturing)*
15		**Revision Week**
16		**Assessment Week**

NOTE: Venue LTEE3

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.

Recommended Reading List: none

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

Module Coordinator Mike Dolan MJDOLAN@tcd.ie

ELECTIVES

It is part of College's education strategy that all students should be given the opportunity to experience knowledge and ideas outside their main subject area as Group III courses. Elective courses consist of 5 ECT credits spread over Semester 1 or 2. Details of the Elective courses, including timetables can be found at https://www.tcd.ie/trinity-electives/electives/

Uniquely, Neuroscience students have the option to choose just one (as opposed to two) Trinity Elective since they also are offered an open module in Psychology, which is not available to any other moderatorship within TR060. Students may choose to take 1 elective in each semester, but we do recommend the Psychology module that is offered in semester 2, in lieu of a second elective.

Elective courses are assessed as Group III courses, i.e. they count towards the overall JS mark.

Academic Matters

1. Attendance

All students are expected to attend lectures, workshops, practical classes, in-course assessments and examinations. Scheduled classes play an important role in supporting progress through the academic year in particular course assignment work. Students are therefore expected to keep up a consistent rate of good attendance so that performance later in the year will not be adversely affected. Medical certificates are required if the absence means a deadline, laboratory practical, assessment or other mandatory course component will be missed. **In the event of not being able to attend such components due to illness, please inform the coordinator for that module.** Students who miss classes are responsible for updating themselves on any information provided during those classes.

The Department operates the College procedure in relation to 'Non-satisfactory attendance and course work' (Calendar). **That is, any student who misses more than a third of a course in any term or fails to complete assignments may be declared 'non-satisfactory'. Non-satisfactory returns are made to the Senior Lecturer; such students may be refused permission to take the annual examination and may be required by the Senior Lecturer to repeat the year.**

2. Credits

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.

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.

3. Assessment and examinations

Courses are assessed by in-course assessment and/or by examination. Your grade at the end of the Junior Sophister year is compiled from the results of annual examinations and continuous assessment marks for the year. Ten marks are allocated per ECTS credit, towards the possible 600 marks for Junior Sophister year. Please note that, as per College Calendar, **student attendance at all examinations is mandatory**. Should a student miss an exam (without medical cert or appropriate supporting documentation submitted to College Tutor and Student Cases) they will be returned as '*ABSENT NO PERMISSION*' which results in automatic exclusion from college. Please see https://www.tcd.ie/Senior_Tutor/faq/ for further information regarding college regulations.

Please note that examination timetables are compiled by Academic Registry/Exams Office and all examination information is made available to students via **my.tcd.ie**. Course advisors and administrative staff **cannot** provide details of examination dates and venues.

In-Course Assessment

The nature of the assessments will vary from one course to another. Individual members of teaching staff will give more details of assessment procedures at the beginning of each module. Students are encouraged to develop their word-processing skills and computer skills in general in the Junior Sophister year.

Submission deadlines

For each item of course work there will be a submission deadline. Meeting deadlines is regarded as an important part of the course and are valued by employers. Apart from maintaining equity between students, deadlines enable students to demonstrate their ability to schedule their work properly. Students are expected to meet all deadlines. **A case for special circumstances may be made via the College Tutor. Extension of deadlines will only be given in exceptional circumstances.**

Word limitations

All course assessments must comply with the stated word limit (+ 10%). Students are required to write the number of words at the end of the assessment. Students may exceed the word limit only by 10% e.g. if the word limit is 2,500 words, a word count of 2,750 will be accepted.

Class Descriptors: These Science Faculty Descriptors are given as a guide to the qualities that assessors are seeking in relation to the grades usually awarded. A grade is the anticipated degree class based on consistent performance at the level indicated by an individual answer. In addition to the criteria, listed the Department's examiners will also give credit for evidence of critical discussion of facts or evidence.

Guidelines on Grades for Sophisters' Essays and Examination Answers

Class	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.
F-2	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-3	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.

4. Plagiarism

Each student is responsible for ensuring that their work is actually the result of his/her own efforts, skills and knowledge, and has not been produced by means that will give an unfair advantage over other students.

Plagiarism is considered as **academically fraudulent**, and an offence against University discipline. The University considers plagiarism to be a major offence, and subject to the disciplinary procedures of the University.

All students should undertake the "Ready Steady Write" tutorial at: https://libguides.tcd.ie/academic-integrity/ready-steady-write to ensure you understand what constitutes plagiarism and the consequences of plagiarism. **It is the responsibility of the author of any work to ensure that they do not commit plagiarism. Such offences will not be overlooked based on claims that the student was not aware/was not made aware of what constitutes plagiarism.**

The risk of inadvertent plagiarism is greater in Sophister years because of the increasing use of primary sources (research papers). It is therefore essential to develop good practice immediately.

Plagiarism is interpreted by the University as the act of presenting the work of others as one's own work, without acknowledgement.

Plagiarism can arise from deliberate actions and also through careless thinking and/or methodology. The offence lies not in the attitude or intention of the perpetrator, but in the action and in its consequences.

Plagiarism can arise from actions such as:

(a) copying another student's work;

(b) enlisting another person or persons to complete an assignment on the student's behalf.

(c) quoting directly, without acknowledgement, from books, articles or other sources, either in printed, recorded or electronic format;

(d) paraphrasing, without acknowledgement, the writings of other authors.

Examples (c) and (d) in particular can arise through careless thinking and/or methodology where students:

(i) fail to distinguish between their own ideas and those of others.

(ii) fail to take proper notes during preliminary research and therefore lose track of the sources from which the notes were drawn;

(iii) fail to distinguish between information which needs no acknowledgement because it is firmly in the public domain, and information which might be widely known, but which nevertheless requires some sort of acknowledgement;

(iv) come across a distinctive methodology or idea and fail to record its source.

All the above serve only as examples and are not exhaustive.

Students should submit work done in co-operation with other students only when it is done with the full knowledge and permission of the lecturer concerned. Without this, work submitted which is the product of collusion with other students may be considered to be plagiarism.

It is clearly understood that all members of the academic community use and build on the work of others. It is commonly accepted also, however, that we build on the work of others in an open and explicit manner, and with due acknowledgement. Many cases of plagiarism that arise could be avoided by following some simple guidelines:

(i) Any material used in a piece of work, of any form, that is not the original thought of the author should be fully referenced in the work and attributed to its source. The material should either be quoted directly or paraphrased. Either way, an explicit citation of the work referred to should be provided, in the text, in a footnote, or both. Not to do so is to commit plagiarism.

(ii) When taking notes from any source it is very important to record the precise words or ideas that are being used and their precise sources.

(iii) While the Internet often offers a wider range of possibilities for researching particular themes, it also requires particular attention to be paid to the distinction between one's own work and the work of others. Particular care should be taken to keep track of the source of the electronic information obtained from the Internet or other electronic sources and ensure that it is explicitly and correctly acknowledged.

If plagiarism is suspected, the Head of Department will arrange an informal meeting with the student, the student's tutor*, and the lecturer concerned, to put their suspicions to the student and give the student the opportunity to respond.

If the Head of Department forms the view that plagiarism has taken place, he/she must notify the Senior Lecturer in writing of the facts of the case and suggested remedies, who will then advise the Junior Dean. The Junior Dean will interview the student if the facts of the case are in dispute. Whether or not the facts of the case are in dispute, the Junior Dean may implement the procedures set out in Conduct and College Regulations

*As an alternative, students nominate a representative from the Students' Union to accompany them to the meeting.

Gaining summer research experience

You may wish to gain experience in a research lab during the summer of your 3rd and 4th years of the degree. It is important to plan ahead if you wish to gain such experience, as most lecturers/Principal Investigators will decide which students, if any, they are willing to mentor between September and November of the previous year (i.e. during your first semester of JS Neuroscience). This is because there are a number of grants you and a supervisor can apply to in order to obtain funding to support you during your time in the lab. Typically, these stipends, which are not taxed, provide approximately 50-75 euro per day to the student, and are paid fortnightly over a period of a 2–3-month project. Due to the cost of living and renting accommodation in Dublin, some lecturers/Principal Investigators may refuse to take on a summer research student if there is no such stipend in place.

Obtaining such summer research experience, having experience writing a grant application and being awarded a research grant is an attractive addition to the CV of anyone who wishes to work in research after completing their degree. Some examples of such grants are:

The HRB Summer Student Scholarship:

https://www.hrb.ie/funding/funding-schemes/all-funding-schemes/grant/summer-student-scholarships-ss-2024-next-call-envisaged-to-launch-in-october-2024/

Application deadline – 14th December 2024

The Wellcome Trust Summer Internship Programme (for work experience in a lab in London):

https://wellcome.org/jobs/summer-internship-programme

Other grants are available depending on the specific field of research and location of the lab work. If looking up such grants, make sure to check out the “Eligibility Criteria” to see if they are suitable.

As these grant applications can take several weeks to write and require input and support from a specific lecturer/Principal Investigator, make sure to contact the person you wish to supervise you at least 1 month, ideally 2-3 months, prior to the deadline of such grants.

Advice for contacting lecturers/Principal Investigators about a potential summer research position in their lab:

-Do not send a blanket generic email to all lecturers in a department. Lecturers will often ignore non-specific requests for positions which do not display specific interest in their lab’s work.

-Use the TCD website to look into the topics that are researched in TCD/the University you are interested in working in, and research which person/people lead this research

-Email the researcher a brief, polite email, outlining who you are, your reason for contacting them (why you want to work with them specifically, how their field of expertise is relevant to your research interest) and what you are seeking (when/for how long you are looking to perform research). Make sure to also attach your CV outlining relevant academic/research experience to date.

Login. Only two steps - it's easy! Find us on tcd.ie/careers or MyDayApp

STEP 1 Login to MyCareer (using your Trinity username and password)

STEP 2 Update your profile with your email preferences, job and study areas of interest and your career readiness

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

Careers Advisory Service

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

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

Appendices

Appendix 1: Instructions for citing references

The most important thing to remember when citing references is to be consistent. Depending on the module for which you are preparing the written piece, you may be required to use a specific referencing style. If you are unsure, ask the lecturer to set the assignment you are referencing. Below is a general guide to referencing different types of literature.

Referencing a book:

Name of author(s)/editor(s), give surname first followed by initial(s) as given on title page.

Year of publication, this should be placed in brackets.

Title of book this should be underlined or put in brackets.

Edition number, if not first edition.

Publisher

Place of publication.

The standard layout for citation is as follows:

Surname initials (date). Title: subtitle. Edition statement. Place of publication, publisher.

e.g. Leonard, B.E. (1997). Fundamentals of Psychopharmacology, 2nd Ed., pp 110-111, Wiley, Chichester.

Referencing a journal:

Example

Surname initials (date). Article title. Journal title, Volume (part), pages.

e.g. McNair, H. (1980): Basic considerations in HPLC. J. Chromatog. 8: 53-59.

Referencing authors

1. *Single author*

"Recent research (Jones, 1999) has demonstrated that…"

2. *Two authors*

(Connor and Leonard, 1998)

Connor, T.J. and Leonard, B.E. (1998) Depression, stress and immunological activation: the role of cytokines in depressive disorders. Life Sci. 62, 583-606.

3. *Multi-authorship (2 or more authors)*

(Yoo et al., 1995)

Yoo, S.D., Holladay, J.W., Fincher, T.K., and Dewey, M.J. (1995) Rapid microsample analysis of imipramine and desipramine by reversed phase high performance liquid chromatography with ultraviolet detection. J. Chromatog. 668, 338-342.

Dissertation or Thesis

It is necessary to provide details of the level of degree etc. and awarding institution in the full details.

e.g. (Dredge, 1998)

Dredge, K. (1998) A preclinical assessment of the effects of antidepressant drugs on the immune system. Ph.D Thesis, Dept. of Pharmacology, NUI, Galway.

Appendix 2: Useful Neuroscience textbooks

Basic Neurochemistry (8th ed) by G.J. Siegel et al. (2012). Raven Press, New York, ISBN: 039751820X.
A good reference text for neurotransmission and cellular-to-molecular level neurobiology

Neuroscience: Exploring the Brain (Enhanced 4th ed) by M.F. Bear, B.W. Connors, M.A. Paradiso (2020) Lippincott Williams and Wilkins; ISBN: 0781732557.
A good basic text

Neuroscience (6th ed) by D. Purves et al. (2017) Sinauer Associates Incorporated; ISBN: 0878937420.
A good basic text

Principles of Neural Science (6th ed) by E.R. Kandel, J.R. Schwartz & T.M. Jessel (2021) McGraw-Hill; ISBN: 0071120009
A good reference text.

Color Atlas of Neuroscience by B. Greenstein and A. Greenstein (2000) Thieme, Stuttgart. ISBN: 3-13-108171-6.
Contains useful diagrams and will enhance understanding of neuroanatomy and neurophysiology.

The Biochemical Basis of Neuropharmacology. (8th Ed) by J.R. Cooper, F.E. Bloom and R.H. Roth. (2002) Oxford University Press. ISBN 0-19-510399-8.
A useful textbook for basic neurochemistry and neuropharmacology

Analyzing Neural Time Series Data – Theory and Practice. M.X. Cohen. (2014) The MIT Press. ISBN 9780262019873
This book very specifically deals with understanding and processing electrophysiological signals. While this is beyond the scope of the course material, it may help with understanding EEG-based (and other electrophysiological) studies.

Appendix 3: Useful Websites

Pubmed

Pubmed is a database of journals kept in the National Library of Medicine in the USA. It contains journals from the 1960's up to the present day. It gives abstracts for almost all articles, and it also contains links to many full text articles.

http://ncbi.nlm.nih.gov/pubmed/

Science Direct

Science direct is a web-based database of Elsevier Science journals. It contains 1200 scientific journals and access to full-text articles. You can download full text articles from 1995 onwards within TCD, however from outside the college only abstracts are available.

http://sciencedirect.com

The Allen Brain Atlas

Online atlases of the brain for non-human primates, humans and mice.

https://portal.brain-map.org/

Metaneuron

A free computer program that models the basic electrical properties of neurons

https://www.metaneuron.org/

Neuroscience Web Sites

A useful tour of the brain, and a description of brain disorders

http://www.brainexplorer.org

A useful site that deals with neurotransmitter function and drug action within the brain

http://www2.onu.edu/~ksehlhor/drugs.html

Neuroscience for kids, but well worth looking at.

http://faculty.washington.edu/chudler/neurok.html

Brain model tutorial – Useful for Neuroanatomy

http://pegasus.cc.ucf.edu/~Brainmd1/brain.html

Basic Biochemistry of neurotransmitters

http://web.indstate.edu/thcme/mwking/nerves.html

Neuroscience Web Search

http://www.acsiom.org/nsr/neuro.html

Neurological disorders resource - Lots of links to websites dealing with neurological disorders.
http://www.univ.trieste.it/~brain/NeuroBiol/Neuroscienze%20per%20tutti/disorders.html

The whole brain atlas
http://www.med.harvard.edu/AANLIB/home.html