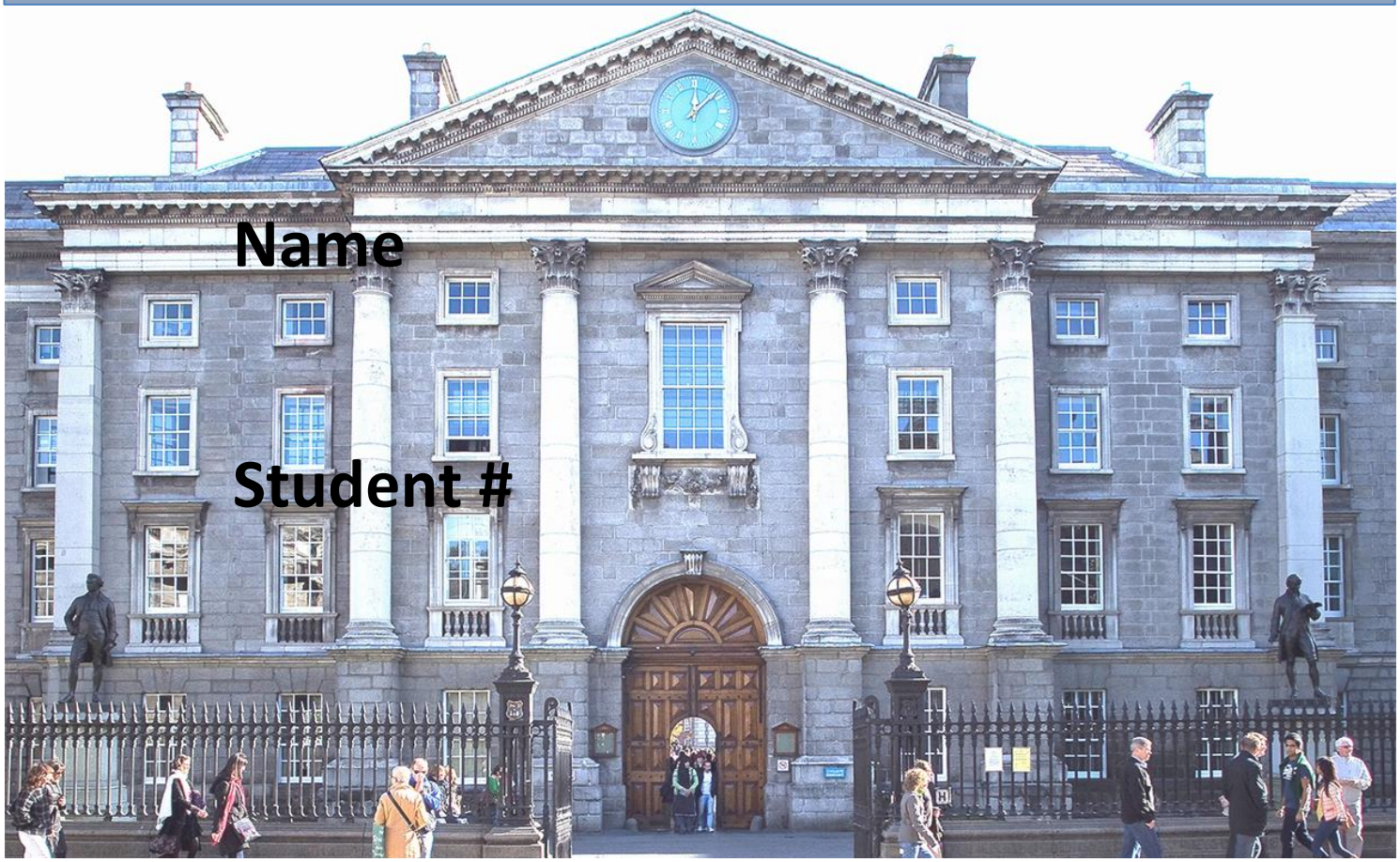
Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Neuroscience

Senior Sophister Course Handbook

2023–2024



Name

Student #

TRINITY COLLEGE
Institute of Neuroscience
from molecules to mind

Contents

Foreword

This Handbook has been prepared as a guide to the Senior Sophister year, and contains information regarding the course content, course assessment, timetables, attendance, reading lists, guidance about conducting and writing up your final year project and also material on plagiarism and viva voce exams. It is essential that you read the information contained in this handbook and it is your responsibility to make yourself aware of your obligations on these modules and on the final year of the moderatorship as a whole.

Due to the multidisciplinary nature of Neuroscience, **the Senior 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.

The Junior Sophister year laid solid foundations in various aspects of Neuroscience, as well as conferring transferable skills in areas such as data handling, computing, and written and oral communication skills. Throughout the course of the Senior Sophister year you will gain a more broad-based and in-depth knowledge of Neuroscience from both theoretical and practical standpoints, and further develop your transferable skills. You are expected to supplement your lecture courses with additional reading – your lecturers will recommend key references. In addition, a major part of the Senior Sophister year is an individual research project with literature review that counts for 33% of your Senior Sophister year marks. Research projects will be offered at the beginning of semester 1 and allocated within a few weeks. A major emphasis is placed on the research project and your time spent in the laboratory will help you decide if a career as a research scientist is one that you want or do not want! It is a time to discover if you have a talent for scientific research and you will have ample opportunity to ask advice from your supervisors as well as your laboratory colleagues.

In addition to learning within the context of formal lecture and research sessions, we encourage co-operation with your fellow students so you can learn from each other along the way. It is said that the clearest demonstration of understanding of a concept is the ability to explain this concept to another so peer-to-peer learning helps everyone involved!

We wish you every success over the next year.

Dr Colm Cunningham

SS Neuroscience Coordinator

September 2023

The Neuroscience degree program was funded by the Irish government under the National Development Plan 2007-2013 and aided by the European Social Fund (ESF) under the Human Capital Investment Operational Programme 2007-2013.

COVID-19 Procedures for Students

General Guidance Regarding COVID-19

There are no official measures or restrictions in college at this time. However, COVID-19 does continue to circulate in the population and it remains important that you ***do not attend college if you are experiencing symptoms of COVID-19*** *(*cough, shortness of breath, fever, Loss of smell or taste). You may choose to take a lateral flow COVID test, or you may contact your GP, follow their advice and inform your Course coordinator.

Other requirements and public health restrictions have been removed at this time and **ALL LECTURES and PRACTICAL work will now take place in person**. Wearing of masks in large groups or in small spaces is still advisable.

Lecture recordings **will not be made available** as a matter of course. Students who cannot attend lectures due to COVID19 may request accommodations by sending a photo of a positive COVID test to the relevant lecturer and/or course coordinator.

All of that said, we cannot rule out the possibility that infection levels will escalate and that new restrictions could be put in place. We will deal with this eventuality should it arise.

General good practice is also important.

Wash your hands often with soap and water for at least 20 seconds, especially after going to the bathroom, before eating, and after blowing your nose, coughing, or sneezing. If soap and water are not readily available, use an alcohol-based hand sanitizer.

Other sensible measures include turning your head away from people when you sneeze, using a tissue or your sleeve and disposing of tissues quickly.

Dispensers are provided throughout the campus.

Clear signage is at all entrances to buildings and within buildings of the COVID 19 precautions that apply to everyone: hand hygiene, coughing and sneezing etiquette.

The College website contains a useful COVID FAQ for students: https://www.tcd.ie/about/coronavirus/#student-faq

More information is provided on the HSE website:

https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/

Timetables

We will provide a timetable for Semester 1 in the first instance. However, this is subject to change as circumstances dictate.

The module timetables are available through the TCD portal via ***my.tcd.ie .*** These can be searched for by module code and may be updated from time to time, so please monitor there for any changes.

Despite the minor risk that COVID-19 may still disturb some in-person teaching, **the default position is that lectures will be in person and students should attend lectures. Lecture recordings will not be made available. PowerPoint slides will be available on the modules on blackboard as usual, but it is the students' responsibility to attend lectures if they wish to engage with taught courses. Your choice not to attend does not place any responsibility on lecturers to provide you with recordings.**

Where lectures have to be delivered remotely, recordings will be made available. Where students cannot attend due to COVID infection or exposure, they should contact the lecturer and, if possible, accommodations may be reached. Please check with module coordinator if there are problems or some uncertainty about the arrival, on Blackboard, of course content.

NOTE: *There is now also the* ***"Trinity Live" app,*** *which gives ready access to timetable information. You can download the Trinity Live app to access your timetable, digital ID, university way-finding, library account and exam results. https://trinitylive.tcd.ie*

While popular for obvious reasons, our experience of this so far has been that it is not updated in line with changes that staff may need to make to the timetable from time to time. The TCD portal **my.tcd.ie** remains the source of authoritative information. Changes required at short notice will be communicated to you directly by e-mail.

***Direct queries should be made to the course administrator in the first instance or to the SS Course coordinator if necessary*. Sending e-mails outside working hours are unlikely to be read before the following working day.**

Course administrator

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Course Co-ordinator (Senior Sophister year)

Dr Colm Cunningham

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Teaching Staff: Senior Sophister Neuroscience Program

Dr. Colm Cunningham, School of Biochemistry & Immunology (colm.cunningham@tcd.ie)
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Dr. Tomás Ryan, School of Biochemistry & Immunology (tomas.ryan@tcd.ie)
Dr. Andrew Harkin, School of Pharmacy and Pharmaceutical Sciences (aharkin@tcd.ie)
Dr. Pablo Labrador, School of Genetics and Microbiology (jp.labrador@tcd.ie)
Dr. Eva Jimenez, Dept. of Physiology, School of Medicine (jimeneze@tcd.ie)
Prof Maeve Caldwell, Dept. of Physiology, School of Medicine (maeve.caldwell@tcd.ie)
Prof. Kevin Mitchell, School of Genetics and Microbiology (kevin.mitchell@tcd.ie)
Prof. Mark Cunningham, Dept. of Physiology, Sch of Medicine (mark.cunningham@tcd.ie)
Dr. Tamara Boto, Dept. of Physiology, Sch of Medicine (botot@tcd.ie)
Dr. David Loane, School of Biochemistry & Immunology *(loaned@tcd.ie)*
Dr. Redmond O'Connell, *School of Psychology (reoconne@tcd.ie)*

Overview

Course structure

Module code	***Module title***	***ECTS***
BIU44445	Neurochemistry II	5
GEU44500	Neurogenetics	5
PSU34540	Social Neuroscience	5
PGU44004	Neurophysiology II	5
BIU44455	Neuroimmunology & Neurodegeneration	5
NSU44PH2	Neuropharmacology	5
BIU44415	Research Literature Skills (Neuroscience)	10
NSU44490	Research Project	20
Total		**60**

Important Dates *

Semester 1 (teaching)	Monday 11th September– Friday 1st December
Project choices Due	Monday 25th September
Project Design Seminars	Week beginning 16th October (Thursday & Friday)
Reading Week	Week beginning 23rd October
Project Lab. Start	Tuesday 31st October
Literature Review Due	Tuesday 31st October (12 noon)
Semester 1 Exams	Week beginning 11th December (projected)
Christmas closure	
Semester 2 (teaching)	Monday 22nd January 2024 – Friday 12th April
Project Lab. Finish	Friday March 1st
Reading Week	Week beginning 4th March
Project Submission	22nd March
Poster Presentation	Week beginning 25th March
Semester 2 Exams**	Week beginning 29th April

* These dates are subject to change according to School/College/Examinations office constraints

** A number of students will be selected for a ***Viva Voce*** **Exam** and these will take place approximately 3 weeks after the last written exam. This period allows marking of all semester 2 exams, confirmation of semester 1 marks, input of external examiner and cannot be shortened. Attending for *viva voce* is not obligatory but it is a useful opportunity to bring your mark up to the next division if you have a borderline mark (***within 1% of the next grade***). Your mark/grade cannot deteriorate as a result of the *viva voce* exam but there is also no guarantee that you will receive the higher grade. These exams will take the form of an interview and will only take place **in person**. It is the student's responsibility to make themselves available if they wish to avail of this opportunity.

Programme Structure: Module Summaries

Module Descriptor - Neurophysiology II (5 ECTS)

1. Module Code	**PGU44004**
2. Module Name	**Neurophysiology II**
3. Semester taught	**Michaelmas**
4. Contact Hours	**22 hours**
5. Module Personnel	**Profs Eva Jimenez, Maeve Caldwell, Aine Kelly, Colm Cunningham and Mark Cunningham**

6. Learning Aims

The module is designed to explore the neurophysiology of glia and neurons. The module will begin by providing an understanding of stem cells and their differentiation into neural subtypes including glia. The concept of adult neurogenesis and the effect of exercise will also be discussed.

Thereafter we discuss astrocytes and microglia and appreciate their ability to adopt different phenotypes. The diverse roles of astrocytes and microglia will be considered. We will compile practical examples of how astrocytes and microglia help to maintain homeostasis and respond to injury. Astrocytes are the most prevalent glial cell in the brain and the module will continue by exploring the many functions of astrocytes from the very well-defined role in providing metabolic support to neurons to the finding that astrocytes, like microglia, are active players in cerebral innate immunity. The role of astrocytes in blood brain barrier function will be described and the impact of changes in blood brain barrier permeability will be considered. This part will also consider the changes that occur in disorders of the central nervous system with a focus on exploring the impact of neuroinflammation in disease pathologies.

The second part of the module concerns the physiology of neuronal activity. The brain is composed of billions of interconnected neurons. The key objective of the neurophysiology lectures is to understand how neurons are organised, function, and how they ultimately determine network function in the brain. Core material delivered in this module will aim to develop students' understanding of the key concepts that underlie cellular neurophysiology, synaptic communication/plasticity and neuronal network activity. In this context, several pathological conditions, such as epilepsy, schizophrenia and Alzheimer's disease will be explored.

7. Module content: Programme of lectures.

Week	Lecture Topic & Lecturer	Lecturer
3	Stem cells - types and functions	Maeve Caldwell
3	Stem Cells for disease modelling	Maeve Caldwell
3	Exercise and glia	Áine Kelly
3	The Blood brain barrier and CSF	Eva Jimenez
3	Cerebrovascular disorders: Hypoxia in neonates, stroke and vascular Dementia	Eva Jimenez
4	Astrocytes: functions	Maeve Caldwell
4	Astrocytes: In health and Disease	Maeve Caldwell
5	Pathogen detection in the CNS	Aisling Dunne
5	Sterile inflammation in the CNS	Aisling Dunne
6	Microglia: dynamic responders to tissue disruption	Colm Cunningham
6	Microglia phenotypes in homeostasis and disease	Colm Cunningham
6	Astroctyes and Epilepsy	Mark Cunningham
6	Astroctyes and Epilepsy	Mark Cunningham
11	The Membrane Potential	Mark Cunningham
11	Ion channels and ionic currents	Mark Cunningham
11	Cell to cell communication	Mark Cunningham
12	Electrophysiological techniques	Mark Cunningham
12	Electrical properties of neurons	Mark Cunningham
12	Synaptic and intrinsic neuronal plasticity	Mark Cunningham
13	Basic neuronal circuits in the CNS	Mark Cunningham
13	Origin of brain rhythms	Mark Cunningham
13	Cognitive functions of network rhythms	Mark Cunningham

8. Learning Outcomes: On completion of this module, students should:

- Understand different types of stem cell and their functions.
- Describe the potential of stem cells to model disease.
- Describe the structure and function of the blood-brain barrier.
- Describe the mechanism associated with disruption of the blood flow and reduction of oxygen.
- Describe how exercise modulates the cell proliferation and survival in the brain that underpins adult hippocampal neurogenesis.
- Discuss how exercise exerts anti-inflammatory effects that may be neuroprotective.
- Appreciate some of the functions of astrocytes and the impact of astrocytes on neuronal function.
- Appreciate that microglia are highly responsive phagocytic cells and understand and be able to articulate mechanisms by which microglia sense and respond to disturbances in the tissue.
- Appreciate that the phenotype of microglia may vary according to the nature of the stimulus and that the nature and consequences of these different phenotypes constitutes a rapidly moving field that requires reading of current literature.

- Appreciate the cells, processes and molecular events involved in the detection of, and response to, endogenous and exogenous insults in the CNS
- The anatomical and biophysical properties of neurons of the CNS;
- Ion fluxes that generate the resting membrane potential of a neuron;
- The electrical properties and passive membrane properties of neurons;
- Electrophysiological techniques for the recording of a variety of neurophysiological signals using both *ex vivo* and *in vivo* approaches in animals and humans;
- Properties of glutamate and GABA-evoked synaptic potentials/currents;
- Synaptic plasticity of glutamate transmission including the mechanisms underlying the induction and expression of long-term potentiation and depressions;
- Plasticity of the brain and of information storage in the brain;
- The origin of the EEG signal.

9. Recommended Reading List: Reading material to support learning will be recommended by each participating lecturer. Additionally, following books are recommended for lectures week 12-13:

- C. Hammond, Cellular and molecular neurophysiology, AP (ISBN: 9780123741271)
- G. Shepherd, The Synaptic Organisation of the Brain, OUP (ISBN: 9780195159561)
- B. Hille, Ion Channels of Excitable membranes, Sinauer (ISBN: 9780878933211)
- E. Kandel et al., Principles of Neural Science, Elsevier (ISBN: 978-0071390118)
- H. Sontheimer, Diseases of the Nervous system, Elsevier (ISBN: 9780128002445)

10. Assessment Details: Formal Exam worth 100% of module mark.

11. Module Coordinator Eva Jimenez, Maeve Caldwell and Mark Cunningham.
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Module Descriptor – Neuropharmacology (5 ECTS)

1. Module Code: **NSU44PH2**

2. Module Name: **Neuropharmacology**

3. Semester taught: **I**

4. Contact Hours: **25**

5. Module Personnel: **Andrew Harkin**

6. Learning Aims: To learn the principles of neuropharmacology and drug therapies for disorders of the central nervous system.

Neuropharmacology covers drug-induced changes in functioning of the nervous system. The specific focus of this module is to provide a description of the cellular and molecular actions of drugs on synaptic transmission. This course refers to specific diseases of the nervous system and their treatment in addition to giving an overview of the techniques used for the study of neuropharmacology and provides up to date insights into current drug development efforts for central nervous system diseases.

7. Module content: Programme of lectures and practicals –
All lectures are delivered by Andrew Harkin

Week	Lecture Topic & Lecturer
3	Introduction to Neuropharmacology
3	Depression
3	Antidepressants
4	Atypical antidepressants
4	Bipolar and mood stabilisers – lithium
4	Anxiety disorders
5	Anxiolytics
5	Hypnotics
5	Schizophrenia
6	Antipsychotics I
7	Antipsychotics II
7	Anti-parkinsonian drugs
7	Drug treatment of Alzheimer's disease
8	Brain ischemia and neuroprotection
8	Epilepsy
8	Anticonvulsant drugs
9	**Reading Week**
10	Anticonvulsants II
10	Drug dependence and addiction – reward circuitry, drugs of abuse.

10	Anaesthetics (General)
11	Anaesthetics (Local)
11	Pain – nociception, spinal and supraspinal pain pathways
11	Narcotic analgesics and other CNS acting analgesics
12	Narcotic analgesics and other CNS acting analgesics II
13	Module review
13	Module review II
Dec 11th	**Assessment Week**

Description of each Lecture

1. Introduction to Neuropharmacology
   Neurotransmission, key steps in synaptic transmission and targets for drug action.
2. Depression: Aetiology, symptoms, diagnostic criteria
3. Antidepressants: Tricylic antidepressants, monoamine oxidase inhibitors, Selective serotonin reuptake inhibitors; pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
4. Atypical antidepressants: Dual acting agents; non-monoaminergic antidepressants, rapid acting antidepressants; Neurobiological adaptation.
5. Bipolar disorder: Aetiology, symptoms, diagnostic criteria
6. Mood stabilisers: Lithium - pharmacodynamic mechanisms, pharmacokinetics, adverse effects and toxicity
7. Anxiety disorders: Phobias, panic, stress related disorders, generalised anxiety, obsessive compulsive disorder. Aetiology, symptoms, diagnostic criteria
8. Anxiolytics: Drugs for the treatment of anxiety; benzodiazepines and others. Pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
9. Hypnotics: Z-drugs for insomnia and others. Pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
10. Schizophrenia: Aetiology, symptoms, diagnostic criteria
11. Antipsychotics: First generation, atypicals and others. Pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
12. Drug dependence and addiction: The reward circuit and role of dopamine in mediating the reinforcing effects of drugs of abuse.
13. Drugs of abuse: Psychostimulants, depressants, psychedelics and hallucinogens. Pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
14. Anaesthetics (General): Pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
15. Anaesthetics (Local): Clinical applications, pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
16. Epilepsy: Classifications, aetiology, symptoms, diagnostic criteria
17. Anticonvulsants
18. Pain processing: Nociception, spinal and supra spinal pain pathways
19. Narcotic analgesics: Opiates. Pharmacodynamic mechanisms, pharmacokinetics, adverse effects. Special considerations in clinical use.

20. Other CNS acting analgesics: Pharmacodynamic mechanisms, pharmacokinetics, adverse effects. Factors guiding choice of analgesic in clinical practice.
21. Neurodegeneration: Acute and chronic mechanisms of neurodegeneration.
22. Anti-parkinsonian drugs: Drug treatment for Parkinson's disease. Pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
23. Drug treatment of Alzheimer's disease: Cholinesterase inhibitors and others. Pharmacodynamic mechanisms, pharmacokinetics, adverse effects.
24. Brain ischemia and neuroprotection: Antiplatelet drugs, anti-coagulant drugs, thrombolytics. Neuroprotective drugs.
25. Module review

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

1. Discuss the diagnostic criteria and symptom presentation, biological basis and drug treatment of affective and anxiety disorders, insomnia, schizophrenia, drug dependence, pain, epilepsy, Parkinson's and Alzheimer's disease and acute ischemic stroke.

2. Describe the mechanisms of action and clinical uses of local and general anaesthetic drugs

3. Identify the pharmacokinetic characteristics and adverse effects associated with antidepressant, mood stabilising, anxiolytic, hypnotic, analgesic, anaesthetic, anticonvulsant, anti-Parkinsonian and cognitive enhancing drugs

4. Discuss the neurobiological theory of CNS disorders and neurobiological adaptation to psychotropic drugs

5. Assess and evaluate recent advances in the drug treatment of CNS disorders and provide an up-to-date insight into CNS drug development.

9. Recommended Reading List:

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)

Fundamentals of Psychopharmacology (3rd Ed.) by B. Leonard

Goodman and Gilman's The Pharmacological Basis of Therapeutics (13th Ed.) 2017

Nestler, Hyman and Malenka's Molecular Neuropharmacology: A Foundation for Clinical Neuroscience (4th Ed.) 2020.

The Biochemical Basis of Neuropharmacology (8th Ed.) by J.R. Cooper, F.E. Bloom, R.H. Roth

10. Assessment Details: Written examination 100%

11. Module Coordinator: Andrew Harkin
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Executive Officer: Gabrielle McCabe
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Module Descriptor - Social Neuroscience (5 ECTS)

1. Module Code: PSU34540

2. Module Name: Social Neuroscience

3. Semester taught: Michaelmas Term

4. Contact Hours: 11 pre-recorded lectures with live Blackboard ultimate sessions
(1 lecture in each week of the semester); 103 hours of independent study

5. Module Personnel: Redmond O'Connell

6. Learning Aims:

Social Neuroscience is one of the newest fields in Psychology and explores the neural systems underlying social behaviour. Emerging from a synthesis of ideas and methods from social psychology and the neurosciences, social neuroscience seeks to broaden our understanding of human brain function beyond basic motor, perceptual and cognitive processes by elucidating the brain's fundamental role in governing interpersonal relations. This endeavour has the potential to greatly improve our understanding of how the brain works and, at the same time, to refine theories of social processes.

This course will outline the theoretical origins of the field, basic neuroanatomy and core methodologies including brain imaging techniques and behavioural paradigms. In addition, key areas that will be covered include how the brain enables the processing of faces, emotions, theory of mind, prejudice and stereotypes, moral judgments and economic decision making. In so doing, the course will highlight prominent disorders of social function, such as autism, and how limitations in seemingly 'non-social' cognitive abilities can greatly influence our social behavior. Finally, the course will also consider some of the ethical implications associated with our growing understanding of the neural determinants of interpersonal behaviour and the impact this knowledge can have on our notion of free will and responsibility.

7. Module content: Programme of lectures with online Blackboard sessions.

The following topics will be covered:

- The Emergence of Social Neuroscience
- The Methods of Social Neuroscience
- Feeling and Recognising Emotion
- Reading Faces and Bodies
- Mirror Neurons
- Empathy and Theory of Mind
- Identity, prejudice and stereotypes
- Disorders of social cognition
- Neuroeconomics
  Moral decision making
- Neuroethics and Free Will

8. Learning outcomes

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

- Understand the structure and function of brain systems underlying social processes and human interaction (PO1)
- Understand and critically evaluate the principles and methods involved in doing research in this area (PO4,5,6)
- Discuss and evaluate prominent principles, models and theories within social neuroscience (P02,4,6)
- Discuss and evaluate social neuroscience's contribution to our understanding of the brain and of social psychology and how it synthesises these two sources of knowledge (PO1,3)
- Evaluate the distinction between uniquely social brain processes and general cognitive function and their interaction (PO1,6)
  Evaluate what disorders and disruptions reveal about the representation of social processes in the brain (PO1,4)
-

9. Recommended reading

Decety, J. and J. T. Cacioppo (2011). The Oxford Handbook of Social Neuroscience, Oxford University Press.

Cacioppo, J. T. and G. C. Berntson (2005). Social Neuroscience: Key Readings, Psychology Press.

As this is an advanced sophister research-led taught module, state-of-the-art and up-to-date journal articles from the relevant research literature will be made available throughout the module.

10. Assessment details

100% in-course essay

11. Module Coordinator Redmond O'Connell
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Module Descriptor – Research Literature Skills (10 ECTS)

1. Module Code: BIU44415

2. Module Name: Research Literature Skills

3. Semester taught: I

4. Contact Hours: 20 hours

5. Module Personnel: Co-ordinator Colm Cunningham, Gavin Davey, David Loane, Tomas Ryan, Mark Cunningham, Tamara Boto, Eva Jimenez, Kevin Mitchell

6. Learning Aims: This module is designed to orient and train students in the dissection and critique of original research papers and to train them in synthesis of key information for short oral presentation.

7. Module content:

- Oral presentation of a published original research paper (chosen by lecturers).
- Oral presentation of a second original research paper (chosen by the student).
- Tutorials on analysis and synthesis of research papers.
- Journal article comprehension examination

Week	Topic & Staff	Practical
Semester 1		
3	Tutorial on analysis and synthesis of research papers (CC)	
3-4	Tutorials on reproducibility, peer review, preprint archives CC, KJM)	
3	Provision of articles for '***Journal club'*** presentation 1 (CC)	
4	Presentation of papers (1) by each individual student	Oral presentation 1
4-6	Performance/submission of '***peer review***'	Written assignment
6	Peer to peer 'reviewers meeting' (facilitated discussion)	Discussion/tutorial
6	Submission of consensus review	Written assignment
6	Submission of proposal for further experiments	Written assignment
12*	Students to choose own article for second '***Journal club'*** Presentation (approval by capstone project PI is necessary) Presentation of papers (2) by each individual student	Oral presentation 2
13	Tutorial on 'Journal comprehension' examination paper	
14	Journal comprehension Examination	Written assessment

***** *The week of those exercises after reading week are estimates at the current time.*

8. Learning outcomes

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

- Perform detailed dissection of research papers, with attention to the details of the methods used, the results presented, the analysis performed and the conclusions/interpretations drawn. This will allow the student to develop their skills in

analysis, synthesis and integration of information from a widely used format in the field of neuroscience.

- Demonstrate their ability to think independently and critically with respect to data and other information sources.

- Demonstrate comprehension of experimental methods particular to the area of research of the selected papers.

- Develop peer to peer discussion and constructive debate skills.

- Demonstrate their ability to communicate effectively in oral and written formats.

10. Assessment details

Component	*Weighting (ECTs)*
Journal club Presentation 1	2
Peer Review exercise	3
Journal club Presentation 2	2
Examination	3

11. Module Coordinator

Colm Cunningham
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Executive Officer:

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Module Descriptor – Neurochemistry II (5 ECTS)

1. Module Code: **BIU44445**

2. Module Name: **Neurochemistry II**

3. Semester taught: **1**

4. Contact Hours: **16**

5. Module Personnel: **Profs Gavin Davey & David Loane**

6. Learning Aims: To understand how neurochemical mechanisms in brain cells interact and control neurotransmission and emergent cognitive behaviour. To understand how structure and function of neurotransmitters and receptors are critical to normal and abnormal brain function. To understand the neurochemical mechanisms by which brain activity is matched by energy provision and how this changes in various situations.

7. Module content: Programme of lectures

Week	Topic & Lecturer
	Neurotransmitters and brain biochemistry (Gavin Davey)
	Neurotransmission & Molecular mechanisms of exocytosis
	Techniques for studying Neurotransmission
	Molecular mechanisms in excitatory neurotransmission
	Molecular mechanisms in inhibitory neurotransmission
	Cholinergic signaling & neurotoxins
	Dopamine signaling and molecular neurobiology
	Serotonin and molecular neurobiology underlying depression
	Energy producing systems in the brain
	Energy thresholds and mitochondrial dynamics
	Atypical neurotransmission
	Melatonin & aspartate neurotransmission
	Success & Failure in brain energy metabolism (David Loane)
	Neurovascular coupling and energy substrate usage by neurons and astrocytes
	Catastrophic disruption: bioenergetic mechanisms in stroke pathophysiology
	Energy disruption in hypoxia and hypoglycemia
	Impaired glucose metabolism, insulin resistance and alternative fuels (ketone bodies)
	Brain lipid metabolism and immunometabolism
	Neuro- and Immunometabolism: new targets for therapy

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

- To describe the energy producing systems in the brain and common techniques that such systems to be characterised
- To describe the criteria that needs to be satisfied in order for a molecule to be classified as an atypical neurotransmitter.
- To describe the molecular biology, structural properties and mechanisms of actions of excitatory and inhibitory neurotransmission in the brain.
- To describe the relationship between dysfunctional neurotransmission and effects on cognitive function.
- To describe the fundamental mechanisms that facilitate energy supply and metabolism under homeostatic conditions
- To understand consequences when the brain is deprived of glucose, oxygen or both and to appreciate alternative energy sources and how address bioenergetic changes may offer targets for therapies against neurodegenerative of neuropsychiatric conditions.

9. Recommended Reading List:

Basic Neurochemistry (Siegal, Albers, Brady, Price) Academic Press, 7th Edition. (6th Edition is online free at https://www.ncbi.nlm.nih.gov/books/NBK20385/?term=basic%20neurochemistry)

Scientific publications provided at time of lectures

10. Assessment Details: Written examination 100%

11. Module Coordinator: Gavin Davey
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Module Descriptor - Neuroimmunology & Neurodegeneration (5 ECTS)

1. Module Code: BIU44455

2. Module Name: Neuroimmunology & Neurodegeneration

3. Semester taught: 2 (Hilary)

4. Contact Hours: 21

5. Module Personnel: Colm Cunningham, David Loane

6. Learning Aims: Introduction to the basic principles of neuroimmunology: brain influences on the immune system and immune system activation influences on brain function. The course will also interrogate the role of the immune system in neurodegenerative diseases and injuries including stroke, spinal cord and traumatic brain injury. Thereafter the course will deal with chronic neurodegenerative diseases, the mechanisms common to these diseases and the animal model systems used to study these diseases.

7. Module content: Programme of lectures with tutorial/discussion sessions.

Week	Lecture Topic & Lecturer	Practical
Semester 2		
26*	Introduction to the immune system	
26	Neurotransmitter (ACh, NA, GC) effects on immune system	
26	Brain as an immune privileged organ	
26	Multiple sclerosis	
26	Innate immunity inflammation in CNS with acute insults.	
26	Stroke, TBI & spinal injury. Contribution of immune system (David Loane).	
26	Spinal cord regeneration (David Loane).	
26	Contribution of TBI to development of dementia (David Loane).	
26	Alzheimer's disease (pathology, genetics & development of Models)	
26	AD: status of therapeutic efforts, inflammation	
27	Systemic inflammation: Sickness Behaviour and impact on vulnerable states (delirium/dementia)	
27	Potential for Discussion/Revision session	
27	Common themes in neurodegeneration: prion disease	
27	The prion concept & protein aggregation	
27	Parkinson's, inflammation, α-synuclein, ubiquitin proteasome system	
27	Autophagy	
28	Prion disease, endoplasmic reticulum stress/unfolded protein response	
28	Compartmentalised Neurodegeneration, synaptic loss	
28	Axonal Degeneration/Tau, Huntington's, MND, Stress granules, RNA-BPs	
28	Potential for Discussion/Revision session	

** Schedule is approximate at the time of going to press.*

8. Learning outcomes

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

- Describe how hormones and neurotransmitters impact upon immune system functioning, and how psychological stress can alter immune function via hormone/neurotransmitter release
- Describe the way in which different innate and adaptive immune responses occur in the brain with respect to other organs and to discuss multiple sclerosis and EAE with respect to immune responses to CNS antigens
- Describe CNS response to bacterial endotoxin: toll-like receptor activation, inflammatory cytokine and chemokine production, endothelial activation and cell infiltration
- Describe and discuss innate immune activation in infectious and sterile inflammation including stroke, TBI, spinal cord injury; eoncompassing microglial activation, cellular infiltration (cytokine production, phagocytosis, oxidative burst and ligand receptor interactions that limit microglial activation)
- Recall and integrate knowledge of the role of microglia and peripheral immune cells in acute and chronic neurodegeneration
- Discuss and criticise animal models of Alzheimer's disease and the investigation of amyloid vaccination strategies in humans
- Describe how systemic inflammation signals to the healthy brain (detailing sickness behaviour with respect to 1) symptomology and brain areas involved in expression of same 2) routes of activation 3) the role of cytokines and prostaglandins in sickness behavior. Extend this information to the impact of similar insults on the vulnerable/degenerating brain.
- Discuss common themes in neurodegeneration including protein aggregation, dysfunction of the ubiquitin proteasome pathway and autophagy and inflammation.
- Describe the basic neuroanatomy of common neurodegenerative diseases including Prion diseases, Tauopathies (AD, FTD), ALS (Motor Neuron disease), Huntington's disease, Parkinson's disease and Alzheimer's disease and draw on the 'common themes' above to explain mechanisms of degeneration.
- Describe key animal model approaches to studying these neurodegenerative diseases.

9. Recommended reading

There is no recommended textbook for this module

Journal articles *(these are some suggestions; others are cited during the lectures)*

Neurotransmitter and stress effects on immune function

- **Sternberg EM.** (2006) Neural regulation of innate immunity: a coordinated nonspecific host response to pathogens. Nat Rev Immunol. 6: 318-28.
- Chavan SS, Pavlov VA, **Tracey KJ**. Mechanisms and Therapeutic relevance of Neuroimmune communication. Immunity. 2017 Jun 20;46(6):927-942.

Immune Privilege and Neuroimmunology of EAE and multiple sclerosis

- **Engelhardt** et al., (2017) The movers and shapers in immune privilege of the CNS. Nat Immunol. 2017 Feb;18(2):123-131. doi: 10.1038/ni.3666.
- **Galea I,** Bechmann I, Perry VH. (2006) *What is immune privilege (not),* TRENDS in Immunology 28(1)
- Louveau A, Harris, TJ, **Kipnis J** (2015) Revisiting the mechanisms of CNS Immune Privilege. Trends in Immunology 36(10) 569-577
- **Sospedra M,** Martin R. (2005) Immunology of multiple sclerosis. Annu Rev Immunol. 2005;23:683-747.
- **Yednock TA**, Cannon C, Fritz LC, Sanchez-Madrid F, Steinman L, Karin N (1992) Prevention of EAE by antibodies against a4b1 integrin. Nature, vol 356
- **Ransohoff**, **R**. Natalizumab for multiple sclerosis. New England Journal of Medicine 356 (25), 2622-2629

Microglial activation states, DAMPs, PAMPS etc.

- **Ransohoff, R.M.** & Perry, H.V. Microglial Physiology: Unique Stimuli, Specialized responses. Annual Review Immunology (2009) **27**: 119-145.
- **Ransohoff, R.M** How Neuroinflammation contributes to neurodegeneration **(**2016) 353(6301):777-83. doi: 10.1126/science.aag2590
- **Lucin and Wyss-Coray** (2009) Immune activation in brain aging and neurodegeneration: too much or too little? Neuron 64(1):110-22.

Alzheimer's disease and Immunotherapy

- **Van Dyck, C (2018) Anti-**Amyloid-β Monoclonal antibodies for Alzheimer's Disease: pitfalls and promise. Biological Psychiatry.
- **Karran & De Strooper** (2016) The amyloid cascade hypothesis: are we poised for success or failure. J. Neurochem. Oct;139 Suppl 2:237-252. doi: 10.1111/jnc.13632.

Systemic inflammation impact on the brain/sickness behavior, depression, delirium

- Konsman JP, Parnet P, **Dantzer R**. (2002) Cytokine-induced sickness behaviour: mechanisms and implications. Trends Neurosci. **25**: 154-159.
- **Saper CB**, Romanovsky AA. Scammell TE. (2012). Neural circuitry engaged by prostaglandins during the sickness syndrome. Nature Neuroscience 15; 1088-1095
- **Cunningham C. (2013)** Microglia and Neurodegeneration, the role of systemic inflammation. Glia. Jan;61(1):71-90. doi: 10.1002/glia.22350.

Neurodegenerative disease (General*: more specific & recent articles are cited in lectures)*

- **Jellinger KA.** (2009) Recent advances in our understanding of neurodegeneration. J Neural Transm. 2009 Sep;116(9)

10. Assessment details

100% Written exam. Semester II

11. Module Coordinator Colm Cunningham
colm.cunningham@tcd.ie
01 896 3964

Executive Officer: Gabrielle McCabe
Email: gamccabe@tcd.ie
01-8964195

Module descriptor – Neurogenetics (5 ECTS)

1. Module Code **GEU44500**

2. Module Name **Neurogenetics**

3. Semester taught **2**

4. Contact Hours **20**

5. Module Personnel **Juan Pablo Labrador, Kevin Mitchell**

6. Learning Aims This course has two components: Genetics of Neural Development and Behavioural Genetics. Within Genetics of Neural Development will examine how a developmental program encoded in the genome directs the assembly of the nervous system, creating a remarkably stereotyped but highly plastic and responsive structure. It will address how nervous tissue is set aside in the early embryo, how it becomes patterned, how individual cell types differentiate through the expression of different combinations of genes, and how these genes specify various properties that define each cell type: cell migration to the correct position, establishment of appropriate connections, electrical properties, neurotransmitter expression, etc. covers different aspects of nervous system development from neural induction to early steps of circuitry assembly. There is a focus on different genetic experimental methods employed to identify central mechanisms of nervous system development. We will use different models to explain processes and provide examples of networks and concepts. The emphasis will be on the conservation of signaling pathways in development of very diverse organisms. This will include Drosophila melanogaster, mouse as well as embryological studies in frogs and chick. It will also cover a number of human genetic disorders associated with defects in these processes.

The Behavioral Genetics section will examine how genes influence behavior through effects on cellular physiology and neuroanatomy. More specifically, it will look at how *variation* in genes can cause *variation* in behavior. It will encompass the use of genetic approaches to dissect the cellular and biochemical components of complex behaviors in model organisms (worms, flies, mice) as well as the heredity of behavioral characteristics and psychiatric disorders in humans.

Major topics (examples of relevant psychiatric disorders are shown in parentheses): 1. Circadian rhythms and Sleep, 2. Addiction and Appetite, 3. Aggression, Social behavior (Schizophrenia), 4. Sexual behavior, 5. Anxiety (Depression), 6. Learning and Memory, 7. Language, Handedness and Cerebral Asymmetry (Autism, Dyslexia), 8. Personality and Intelligence (Lack of).

Each topic will be covered by one or more reviews and its study will be required for a successful completion of the course.

7. Module content: Programme of lectures

Week	Lecture Topic & Lecturer
22	Genetics of Neural Development –Neural Induction
22	Genetics of Neural Development – Nervous System Patterning in Drosophila
22	Behavioral Genetics – Introduction to Behavioral Genetics
22	Behavioral Genetics – Circadian rhythms and Sleep,
23	Genetics of Neural Development - Neural Induction in Drosophila
23	Genetics of Neural Development - Spatiotemporal information in neuronal fate specification Drosophila
23	Behavioral Genetics – Addiction and Appetite,
23	Behavioral Genetics – Aggression
24	Genetics of Neural Development – Asymmetric division and neuronal fate specification Drosophila
24	Genetics of Neural Development – Patterning in the vertebrate nervous system
24	Behavioral Genetics – Social behavior (Schizophrenia)
24	Behavioral Genetics – Sexual behavior
25	Genetics of Neural Development – Neuronal specification in vertebrates.
25	Genetics of Neural Development – Axon guidance in invertebrates and the labeled pathways hypothesis.
25	Behavioral Genetics – Anxiety (Depression)
25	Behavioral Genetics – Learning and Memory
26	Genetics of Neural Development – Axon guidance, screens and midline guidance in Drosophila
26	Genetics of Neural Development – Midline guidance in vertebrates
26	Behavioral Genetics – Language, Handedness and Cerebral Asymmetry (Autism, Dyslexia)
26	Behavioral Genetics – Personality and Intelligence (Lack of).
27	
28	**Reading Week**

8. Learning Outcomes:

The goal of this course is to provide a concise and stimulating investigation of the field of Developmental Neurogenetics. Course lectures will explain different developmental processes of the nervous system, discuss the current issues and questions, and provide a framework for reading scientific literature. Upon completion of this course, students will not only understand the basic concepts but will understand the current challenges within each field of study. Students will gain an appreciation for the complexity of neural development at the cellular, molecular and genetic level and behavior. Upon completion, students should also be able to approach any scientific literature related to this course.

9. Recommended Reading List: As a very basic introductory literature for the course any Developmental Biology book such as Developmental Biology by Scott F. Gilbert and

Introduction to Genetic Analysis by Anthony J.F. Griffiths can be used. However, this literature should be used as a starting point for this course since the material covered in the lectures needs to be studied in more specific and advanced reviews on each topic that will be provided with each lecture.

10. Assessment Details: Final exam 100%.

11. Module Coordinator Juan Pablo Labrador
Email: labradoj@tcd.ie
Phone Ext: 1966

Executive Officer: Genetics
Email: genetics@tcd.ie
Phone Ext: 1140

Module Descriptor - Capstone Project (20 ECTS)

1. Module Code: NSU44490

2. Module Name: Capstone Research Project

3. Semester taught: 1 & 2

4. Contact Hours:

5. Module Personnel: Co-ordinator Colm Cunningham & individual lab Principal Investigators

6. Learning Aims: The capstone project is common element across all degrees in TCD and is weighted at 20 ECTS. This project requires a significant level of independent research by the student. It will be an integrative exercise that requires students to demonstrate skills and knowledge developed across a range of activities over your four years of study. The goal is the production of a significant piece of original work that will provide you with the opportunity to demonstrate your attainment of the graduate attributes (to think independently, to communicate effectively, to develop continuously and to act responsibly).

7. Module content: Performance of a literature review (25%)
Oral presentation of project introduction & experimental design (10%)
Performance of research, production of dissertation (60%)
Presentation of data in conference-style poster format (5%)

Week	Topic & Staff	Practical
Semester 1 *		
3	Introduction to the capstone project & provision of selection of projects (Cunningham)	
4	Deadline for submission of project choices	
7	Project design seminar (Cunningham & other PIs)	Oral presentation
10	Laboratory project begins ** (individual PI labs)	Laboratory work
10	Submission of literature review	Assignment
10-14	Lab work continues**	Laboratory work
Semester 2 *		
22-27	Lab work continues **	Laboratory work
28-30	Dissertation writing & submission	
31	Poster presentation (Cunningham & other PIs)	Poster presentation

*** Students **should not** be expected or asked to skip lectures in order to perform lab work. If this occurs, it should be entirely self-motivated and should be done mindful of the importance of lectures. If you are being asked to skip lectures and do not wish to do so, please inform me as soon as this occurs (colm.cunningham@tcd.ie). If you choose to prioritise project work over lectures, accommodations should not be sought from module or course coordinators at a later time. You have agency to direct your efforts but management of time and how you prioritise it, is your own responsibility.*

8. Learning outcomes

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

Perform a detailed and up to date literature review on the topic of the project. Modelled on published scientific reviews, this will allow the student to develop their skills in literature research, synthesis and integration of information from multiple sources and scientific writing.

Demonstrate their ability to think independently and critically with respect to data and other information sources.

Demonstrate competence in a range of skills particular to the laboratory/setting in which the capstone project is performed.

This will provide the student with rich experience of independent research and train them in laboratory, analytical and presentation skills that will be useful in academic, research, regulatory or industrial settings.

Demonstrate their ability to present information in multiple oral and written formats, significantly developing their ability to communicate effectively.

10. Assessment details

Component	***Weighting in ECTs***	***(% of module)***
Literature review	5	(25%)
Project Design Seminar	2	(10%)
Lab Conduct & competence	2	(10%)
Dissertation	10	(50%)
Poster presentation	1	(5%)

11. Module Coordinator

Colm Cunningham
colm.cunningham@tcd.ie
01 896 3964

Executive Officer:

Gabrielle McCabe
Email: gamccabe@tcd.ie
Phone: 01-8964195

Stages involved in the research project

Literature Review:

Your research project will be preceded by a review of the literature pertaining to your project. The review should be concise and incisive, and must not exceed 5000 words, exclusive of references. *Students are required to write the number of words on the front page of their literature review. Students may exceed the word limit only by 10% e.g., if the word limit is 5,000 words, a word count of 5,500 will be accepted. Following discussions with the external examiner in 2016, penalties will be considered for failure to adhere to these guidelines.*

- It is critically important that work is correctly cited — it is plagiarism to use the work of others without proper acknowledgement. See *Plagiarism* (especially §54) and *Instructions for Writing Reports* for guidelines on citation and form of references.

- The number of references quoted should not exceed 50 (again ±10%). If at all possible, reviews should only be used to refer to earlier work and most references should then be those reporting recent work and developments more closely related to your topic. One assessment criterion is how you exercise critical judgement in choosing the references that you draw on.

- Please seek advice from your supervisor as to sources of historic reviews and pertinent current journal papers. Also, seek your supervisor's advice in writing the review. Each supervisor will expect to see a complete draft at some stage and in offering a project has also agreed to offer feedback on one complete draft.

Input from the project supervisor

The project supervisor will read **one** complete draft of the literature review prior to submission. Do not expect your supervisor to read incomplete or multiple drafts of your work. You should provide your supervisor with a draft of your literature review at least one week before the submission date, in order to leave time for them to read it, and for you to take on board any suggestions that they may have for improvements. It is your responsibility to take the lead in this. However, if you find your supervisor unresponsive to phone, e-mail or in-person requests for feedback please bring the matter to the attention of your year co-ordinator (colm.cunningham@tcd.ie)

An electronic (pdf) copy of the literature review should be submitted by e-mail to the Course Administrator gamccabe@tcd.ie and to colm.cunningham@tcd.ie by 12 noon on Friday 3rd of November.

Project Design Seminar: Each student will have a 15-minute time slot in which to give a 10–12-minute presentation of the background to the project, the question to be investigated

and the material/subjects and methods to be used. Up to five minutes will be available for questions. *These times must not be exceeded and the chair will stop you if you do run over this time (and you may be penalized). Similarly, planning a talk that does not use the time available and presents a very superficial background will not attract good marks.*

These presentations will happen in person, in the week beginning 16th of October.

The presentation will enable the teaching staff to satisfy themselves that students have a reasonable understanding of the *underlying theoretical basis* for the investigations proposed and that the *methods* and *design* are appropriate. Staff will also judge whether the project is practicable in the time available. It is therefore important that students emphasise these points in their talks. It is not possible to summarise all the literature in the time available — students must make critical judgements. See *Instructions for Writing Reports* for some guidelines on oral presentations. It is not possible to properly show and discuss more than 10-12 slides. Keep them simple and populate slides with images or concepts around which to build discussion (rather than filling with text, which can only be read and which does not tend to produce compelling presentations).

Students should consult with their supervisors when preparing presentations. They should rehearse presentations several times and preferably have at least one 'dress-rehearsal' with the other members of the class.

Assessment Criteria: The following criteria will be used to assess presentations.

- Content
- Ability to convey key concepts
- Appropriate use of the available time
- Quality of slides
- Style/fluency of delivery
- Ability to answer reasonable questions about the study (*NB it is your responsibility to equip yourself for presenting the project and preparing for relevant questions. You might ask your supervisor to discuss questions that are relevant to the study design, or you may generate such questions in your own reading)*

Dissertation: Dissertations should be written according to the style outlined here and in *Appendix I: Instructions for Writing Reports*. Dissertations are assessed by the supervisor but also by one other staff member, who may not be expert in the precise field of study. The style of the dissertation should be designed to be read by a neuroscientist, but one not necessarily expert in the field of the specific project.

Although there is some overlap, the literature review (which will have been submitted around the time of starting in the laboratory) is not the same thing as the introduction of the dissertation. Therefore, the literature review must not simply be repurposed as the *Introduction* to your Dissertation. Instead, the introduction to the project thesis will be considerably shorter and focused explicitly on introducing the experiments to be conducted, providing essential information to place the work in context. Any recent

literature that comes to your attention between November and February should of course be included. Changes in emphasis, as a consequence of the practicalities/pitfalls of your research, as it actually occurs in the laboratory, should also be made. Many journals allow introductions of less than 1000 words. **For the purposes of this thesis, the introduction should be a maximum of 1500 words.**

Overall, the Dissertation should be a maximum length of 40 A4 pages (excluding title pages, contents, plagiarism declaration, abstract, references and any appendices) with 1.5 spacing and font no smaller than 11Point. Therefore, it means 40 pages of text (introduction, methods, results, discussion) and all pages with graphs counting towards the 40-page total.

It is not necessary to limit yourself to 1 graph per page. You should arrange your data in a way that best suits the data: both from the point of view of aesthetics or just for organising related things together - 4 genes on a certain pathway or 3 outputs from a certain cell type etc. Where you have a lot of figures, take your lead from scientific papers where there are sometimes several panels within 1 figure. One rule that should be observed, however, is that the figure and figure legend remain together, either on the same page or on 2 pages facing each other. Having a figure legend that is not available to look at in the same place as the figure is very inconvenient for the reader and will irritate markers.

It is not essential to have an ONLY figure and a legend on one page, but it does looks smarter if you avoid mixing main text with a figure and legend on the same page. Try to intersperse the figures among the results text in a way that is sensible – i.e. the figure should come very soon after you have written about it, but it also does not make sense to have a paragraph of text and then to leave most of the page empty just so that you can put the figure on the next page. Try to exercise some common sense about how best to organise the layout. Putting all the figures at the end is very unhelpful.

At the present time, the default position is that the student will submit an electronic copy of the thesis on the advised deadline (to BOTH me and Gaby).

Notes: Following recommendations by the Neuroscience external examiner in 2016, penalties will be considered for failure to adhere to these page/word count guidelines.

Likewise, excessive description of and presentation of results from experiments not actually carried out by the student will attract penalties. It is important that, in discussions with your supervisor, you are clear about what you will actually carry out (as opposed to only describing the aspirations of some larger project in which the sophister project is embedded). In simple terms, if you did not do it yourself, it should not be given prominence in your results section.

A declaration must appear, at the beginning of your thesis, in which you verify that the work is entirely your own. Work contributed by members of the host laboratory must

be acknowledged here since inclusion of work, without acknowledgement, performed in part by others constitutes plagiarism.

Scheduling:

Methods can be written quite early in the project and 'polished' later.

It is possible, and advisable, to prepare results/figure and to perform statistical analysis as you complete individual parts of the project (i.e., during the practical part of the project and not necessarily waiting until you have finished in the lab).

The *Introduction* will normally be finalised last and will use some material from your Literature Review but should not be a re-tread of the literature review and must be more focused on introducing the work that was *actually carried out* during the project and brought up to date with new, more relevant papers not available at the time of the literature review. The introduction should also still provide sufficient explanation of the key methodological approaches to allow any neuroscientist to understand the techniques that underpin the research (while full details of those methodological approaches will be contained in the methods section).

Assessment of the dissertation: The dissertation will be double marked by two members of the academic staff. The following will be among the criteria used (see also the Descriptors on p 40).

- Overall presentation (layout, accuracy, literacy)
- Use of literature, including grasp of different lines of evidence
- Clarity of statement of aims, results
- Clarity of explanation of methodological approaches
- Graphical representation of data (selection and value of the choice, clarity, integration into text, clarity of legends)
- Use and interpretation of statistics (over-interpretation is a serious fault)

Input from the project supervisor: You should try to discuss progress with your supervisor on a reasonably frequent basis, even if you are supervised day-to-day by a member of the laboratory. The supervisor may intentions or ideas that are not apparent to all lab members. In addition, the project supervisor will read **<u>one</u>** complete draft of the project report prior to submission. Do not expect your supervisor to read incomplete or multiple drafts of your work. You should provide your supervisor with a draft of your project report one week before the submission date, in order to leave time for them to read it, and for you to take on board any suggestions that they may have for improvements. **PLEASE DISCUSS YOUR TIMELINE FOR SUBMISSION OF DRAFTS AND RECEIPT OF FEEDBACK WITH YOUR PI TO ENSURE THAT THEY CAN MAKE TIME TO READ AND PROVIDE THIS FEEDBACK IN TIME FOR YOU TO MAKE USE OF IT !**

Conduct of the Student throughout Project: Supervisors are asked to allocate a mark to the conduct of the student during project work. Some indication of the criteria to be used is given below.

- Application and commitment: reliability, punctuality and responsibility in the laboratory
- Proficiency and competence in the laboratory
- Literature: creativity in finding material and comprehension of that material
- Intellectual input and initiative
- Data analysis: understanding the bases of statistical tests and using them appropriately

Senior Sophister Neuroscience project deadlines

Project design seminar	*Week Beginning 16th October*
Laboratory start	*Tuesday 31st October*
Literature review submission	*Friday 3rd November*
Practical work ends	*March 1st.*
Project report submitted	*March 22nd*

Attendance and submission deadlines for coursework

Attendance

All students are expected to attend lectures, workshops and practical classes. **Videos of lectures will not be provided.** 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. In the event of not being able to attend classes due to illness, **please inform the Course coordinator and the course administrator.**

Attendance at Journal club sessions is mandatory. Reading and critically evaluating research papers is a key skill and this module accounts for 10 ECTS. Time spent in these sessions will benefit those who attend and engage with the material, as well as those actually performing talks.

If students wish to skip lectures in order to spend more time in the lab during capstone project, please be aware that this is entirely the choice of the student. We recommend attendance at lectures and appropriate planning of laboratory research hours. The duration of the project has already been extended to reflect that there are some periods of the project where there is also a significant lecture load. The course comprises 60 ECTs and there is no way to achieve this in 22 weeks without some periods of intense activity.

NOTE: Students should not be compelled by project supervisors or by PhD/post-doc advisors do skip lectures. If this occurs, please notify me as soon any such pattern arises.

Students who miss classes are responsible for updating themselves on any information provided during those classes. Recordings will not be provided.

Submission deadlines

For each item of course work (Literature review and project dissertation) there will be a submission deadline. Apart from maintaining equity between students, deadlines enable students to demonstrate the ability to schedule their work properly. **Students are expected to meet all deadlines.**

A case for special circumstances may be made to the Course Coordinator directly, or via the College Tutor. Extensions will only be given in exceptional circumstances.

Recommended textbooks and websites

Recommended General Neuroscience textbook

Principles of Neural Science (5th Ed.) by Kandel, Schwartz, Jessell, Hudspeth and Siegelbaum (2012) *McGraw Hill*

Excellent comprehensive text

Basic Neurochemistry; Principles of molecular, cellular and medical neurobiology (8th Ed) by Brady, Albers, Siegel & Price. Academic Press

ISBN 978-0-12-374947-5

Excellent text on Neurochemistry and Molecular Neurobiology

Principles of Neurobiology (2ND Ed) by Liqun Luo (2020) Taylor & Francis

ISBN: 9780815346050

Good on circuit and behavioral neuroscience and on modern methodological approaches

Fundamental Neuroscience (4th Ed) by L.R. Squire, F.E. Bloom, N.C. Spitzer, S. Du Lac, A. Ghosh, D. Berg (2008) Academic Press; ISBN: 9780123858702

A comprehensive reference text

Neuroscience: Exploring the Brain (3rd Ed) by M.F. Bear, B.W. Connors, M.A. Paradiso (2006) Lippincott Williams and Wilkins; ISBN: 9780781760034

A good basic text

Useful Web Sites

Reference databases:

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. This is the standard method used by researchers to search for neuroscientific research papers.

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

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.

http://sciencedirect.com

Neuroscience Web Sites

'The brain from top to bottom"
http://www.thebrain.mcgill.ca

The Allen brain atlas: A large data portal on brain connectivity and gene expression
www.**brain-map**.org

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

A useful tour of the brain, and a description of brain disorders
http://www.brainexplorer.org

The whole brain atlas

http://www.med.harvard.edu/AANLIB/home.html

Senior Sophister Neuroscience examinations

Under the Trinity Education Project and resulting semesterisation, the exact scheduling of examinations (and combining of modules within each exam paper) has not yet been finalised. ***What is certain*** *is that you will be examined on taught material at the end of the semester in which it was delivered.* Therefore, the list below (including the order and coupling of modules) is indicative only and is **likely to change.**

Examination papers

Paper sequence here is provisional: the exact sequence is determined by examinations office

Semester 1 (Examinations in December 2023)

NSU44PH2 (8.33% of year):

Neuropharmacology (Answer 2 questions out of the 4 provided)

PGU44004 (8.33% of year):

Neurophysiology II (Answer 2 Questions: 1 from each section: either/or format)

Section 1: Glial Physiology
Section 2: Neurophysiology

BIU44415. Journal comprehension exam (*now in-course assessed*)

Comprehension of a Journal article

(30% of module BIU44415 and 5% of year):

Answer all Questions

PSU34540: 100% in course-assessed **(8.33% of year).**

Semester 2 (Examinations in April/May 2024)

BIU44445 (8.33% of year):

Neurochemistry II (Answer 2 questions out of the 4 provided)

BIU44455 (8.33% of year):

Neuroimmunology and Neurodegeneration (Answer 2 questions out of the 4 provided)

GEU44500 (8.33 % of year):

Neurogenetics (2 Questions: Either/or format: answer *1 from each from each section)*

Viva Voce Examinations

Students may be requested to present for a *viva voce* (oral) examination by the External Examiner who has access to all examination answers and project reports, as well as a copy of this *Handbook*. This process has two functions. Firstly, to provide an opportunity to compare our course with other courses throughout the world. This ensures the quality and validity of the course. Secondly to assess whether our students have been marked fairly.

No mark is allocated to the *viva voce* examination. Candidates' marks cannot be reduced as the result of a *viva voce* examination, but the ranking of students within the class and the class of degree may be adjusted upwards based on sufficiently good performance.

Typically, students will not get more than a few days' notice of being called for *viva* given that selection for *viva* is dependent on the final marks received and processed, which do not become available until the end of the marking period. Although it is not mandatory to take the *viva* (i.e., your mark cannot be downgraded), it is up to individual students to ensure that they remain available to take this examination if they wish to take this opportunity to improve their grade.

Each *viva voce* examination will last approximately 20 minutes.

The final degree marks will typically be available within days of the viva voce examinations.

External Examiner (2022-2025)

Prof Vincent O'Connor

University of Southampton

Structure of marks for the Moderatorship in Neuroscience

The final Senior Sophister mark is comprised of a number of different components as follows.

60 ECTS = 100 % of SS mark

5 ECTS = 8.33%

Senior Sophister marks

58.33 % In-course assessments (35 ECTS)

- Research Literature skills (BIU44415, 10ECTS, 16.67%)

- Journal Club presentations x2 (6.67 %),
- Peer review exercise (5%),
- Journal comprehension exam (5%)

- Neuropsychology (PS34540, 5 ECTS, 8.33%): essay (8.33%)

- Capstone Research project (NSU44490, 20 ECTS, 33.33 %)

- Literature review: 8.25 %
- Project design seminar: 3.33 %
- Supervisors conduct mark: 3.33 %
- Poster presentation: 1.65 %
- Project report: 16.65 %

33.33%

41.66 % Examinations (25 ECTS)

- Paper 1: 8.33 %
- Paper 2: 8.33 %
- Paper 3: 8.33%
- Paper 4: 8.33 %
- Paper 5: 8.33%

Overall degree mark

70 %: Senior Sophister marks

30 %: Junior Sophister Neuroscience

Plagiarism & Artificial Intelligence (AI)

This has become significantly more important with the recent use of open-book exams and with the recent emergence of AI tools.

It is essential that you understand the meaning of plagiarism in all its forms. Actions in respect of plagiarism were taken in the 2020/21 exam session in the Neuroscience class.

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 might give an unfair advantage over other students.

In order to support students in understanding what plagiarism is and how they can avoid it, Trinity has created an **online central repository** to consolidate all information and resources on plagiarism in order to communicate this information to students in a clear and coherent manner. The central repository is being hosted by the Library and is located at http://tcd-ie.libguides.com/plagiarism

It includes the following:

(i) The College Calendar entry on plagiarism for undergraduate and postgraduate students;
(ii) The matrix explaining the different levels of plagiarism outlined in the Calendar entry and the sanctions applied;
(iii) Information on what plagiarism is and how to avoid it;
(iv) 'Ready, Steady, Write', an online tutorial on plagiarism which must be completed by all students;
(v) The text of a declaration which must be inserted into all cover sheets accompanying all assessed course work;
(vi) Details of software packages that can detect plagiarism, e.g. Turnitin.

When submitting assessed work, students must confirm that they have read the college regulations on plagiarism by signing declarations to that effect:

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

I have also completed the Online Tutorial on avoiding plagiarism 'Ready, Steady, Write', located at http://tcd-ie.libguides.com/plagiarism/ready-steady-write <http://tcd-ie.libguides.com/plagiarism/ready-steady-write>

Although not included with the library recommended declaration, it is important to also explicitly ***state that the work you are submitting is entirely your own****. This has a particular reference in the capstone project where others in the lab may have carried out significant portions of the protocols you are including in your dissertation. That work must be explicitly credited if you are to avoid 'presenting it as your own'.*

Therefore, submitted dissertations should also carry the statement:

I declare that the submitted work has not been plagiarised in any way. Where experimental procedures included in this work have been carried out by others, these are explicitly acknowledged in the text.

You are also urged to read, very carefully, the following extract from the College Calendar on plagiarism — the improper use of others' work. Plagiarism is a very serious offence and is against the spirit of proper academic and scientific enquiry. 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.

1.32 Plagiarism

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

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.

2 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 [*this is occurring regularly in submitted exams/dissertations and significant instances of this will be followed up*]

(iii) fail to distinguish between information which needs no acknowledgement because it is firmly established in the public domain and information which might be less or more 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.

3 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 may 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 used later in dissertation or other submitted work.

4 It is the responsibility of the author of any work to ensure that he/she does not commit plagiarism.

5 Students should ensure the integrity of their work by seeking advice from their lecturers, tutor or supervisor on avoiding plagiarism. All departments should include, in their handbooks or other literature given to students, advice on the appropriate methodology for the kind of work that students will be expected to undertake.

6 If plagiarism as referred to in (2) above is suspected, the Course coordinator 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 course Coordinator 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 Section 5 (Other general regulations).**

7 If the course coordinator forms the view that plagiarism has taken place, he/she must decide if the offence can be dealt with under the summary procedure set out below. In order for this summary procedure to be followed, all parties noted above must be in agreement. If the facts of the case are in dispute, or if the course coordinator feels that the penalties provided for under the summary procedure below are inappropriate given the circumstances of the case, he/she will refer the case directly to the Junior Dean, who will interview the student and may implement the procedures set out in Section 5 (Other General Regulations).

8. If the offence can be dealt with under the summary procedure, the course coordinator will recommend

a) that the piece of work in question receives a reduced mark, or a mark of zero.

or

b) if satisfactory completion of the piece of work is deemed essential for the student to rise with his/her year or to proceed to the award of a degree, the student may be required to re-submit the work. However, the student may not receive more than the minimum pass mark applicable to the piece of work on satisfactory re-submission.

9. Provided that the appropriate procedure has been followed and all parties above are in agreement with the proposed penalty, the course coordinator may approve the penalty and notify the Junior Dean accordingly. The Junior Dean may nevertheless implement the procedures set out in Section 5 (Other General Regulations).

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

Use of Artificial Intelligence (AI).

AI tools such as ChatGPT may not be used for work submitted on the Neuroscience course.

AI tools can generate logical and well-constructed text that is related to your search. However, the material it generates is rather vague, the language tends to be excessively ornate and sometimes repetitive, it is not good at critical analysis and is subject to bias emerging from the sources on which it has been trained. It also does not do a good job of citing relevant literature and, because it is trained on material that was available some time earlier than its release, it does not keep up to date and is, therefore, unable to draw on more recently emerging information. This is an important factor for submitted work at the Sophister stage, since you will be expected to use individual papers from the literature to support your answers and to populate literature reviews etc.

Irrespective of all of those issues, it is important to note that use of ChatGPT or similar tools is a breach of academic integrity and **crosses the line into Plagiarism,** since submitting work generated by AI constitutes presentation of another's work as your own. Finally, given that the precise course content is known to the lecturers, who also mark your work, essays/submitted works that draw on information derived from AI, at the expense of material that WAS on the course as taught, will draw attention to the likely provenance of your submitted work.

Tools now exist that help to identify whether work has been generated by AI and these have been tested in-house and show good sensitivity in detecting AI-generated answers.

More important than all of the above is the reality that if you rely on AI to generate answers or other content, you will not engage with the material on your course in the way that is best for your education and progress as a student of Neuroscience, or as a researcher of accurate, properly sourced information.

Class Descriptors

The following 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 examiners will give credit for evidence of critical discussion of facts or evidence.

Guidelines on Grades for Sophisters' Essays and Examination Answers

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

Guidelines on Marking for Project/Dissertation Assessment

Class	Mark Range	Criteria
I	*85-100*	Exceptional project report showing broad understanding of the project area and excellent knowledge of the relevant literature. Exemplary presentation and analysis of results, logical organisation and ability to critically evaluate and discuss results coupled with insight and originality.
	70-84	A very good project report showing evidence of wide reading, with clear presentation and thorough analysis or results and an ability to critically evaluate and discuss research findings. Clear indication of some insight and originality. A very competent and well-presented report overall but falling short of excellence in each and every aspect.
II-1	*60-69*	A good project report, which shows a reasonably good understanding of the problem and some knowledge of the relevant literature. Mostly sound presentation and analysis of results but with occasional lapses. Some relevant interpretation and critical evaluation of results, though somewhat limited in scope. General standard of presentation and organisation adequate to good.
II-2	*50-59*	A moderately good project report, which shows some understanding of the problem but limited knowledge and appreciation of the relevant literature. Presentation, analysis and interpretation of the results at a basic level and showing little or no originality or critical evaluation. Insufficient attention to organisation and presentation of the report.
III	*40-49*	A weak project report showing only limited understanding of the problem and superficial knowledge of the relevant literature. Results presented in a confused or inappropriate manner and incomplete or erroneous analysis. Discussion and interpretation of result severely limited, including some basic misapprehensions, and lacking any originality or critical evaluation. General standard of presentation poor.
Fail	*20-39*	An unsatisfactory project containing substantial errors and omissions. Very limited understanding, or in some cases misunderstanding of the problem and very restricted and superficial appreciation of the relevant literature. Very poor, confused and, in some cases, incomplete presentation of the results and limited analysis of the results including some serious errors. Severely limited discussion and interpretation of the results revealing little or no ability to relate experimental results to the existing literature. Very poor overall standard of presentation.
Fail	*0-19*	A very poor project report containing every conceivable error and fault. Showing virtually no understanding or appreciation of the problem and of the literature pertaining to it. Chaotic presentation of results, and in some cases incompletely presented and virtually non-existent or inappropriate or plainly wrong analysis. Discussion and interpretation seriously confused or wholly erroneous revealing basic misapprehensions.

General Statement of Course

This statement is designed to be helpful to employers and others by giving an idea of the skills acquired and tested during the Moderatorship programme in Neuroscience. It also gives an outline of the range of skills that students can demonstrate by the end of their degree and may be useful in compiling CVs.

The Neuroscience degree class is comprised of 22 Science students in their third and fourth years in College. They are treated as one group for the two years (although they share a number of courses with other groups). The course fosters students' responsibility for their own learning; good interpersonal skills; teamwork and supporting others; giving and taking appropriate criticism.

Extraction of information from primary written sources

(This skill is repeatedly used and repeatedly tested throughout the two years.)

- charts and graphs
- following an argument
- summarising key elements orally and in writing
- criticising evidence, methods, arguments, presentation (including statistics)

Presentation skills

A high standard of presentation is required with strict adherence to deadlines.
PowerPoint

presentation software is used for all oral presentations.

- reports of laboratory work
- literature reviews
- reports to a specified format using word-processing, spreadsheets and data analysis

applications.

Information Skills

Searching for primary and other sources of information using Internet and other electronic resources as well as other means.

Project work

Group projects foster teamwork skills (in which specific instruction is given).

Individual projects develop initiative, persistence, responsibility and coping skills.

further develop skills in the following areas:

- reviewing
- analysis
- numeracy
- literacy

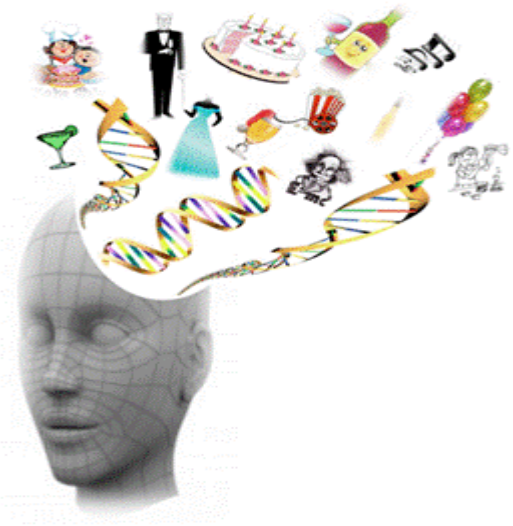
Do you want to learn about cutting-edge neuroscience research and still have a brilliant social life ?!!

JOIN NEUROSOC !!!

Our weekly seminar series provides the student body with a chance to learn about the exciting cutting-edge neuroscience research carried out by academics from within Trinity as well as other Irish and foreign universities. It provides a truly unique opportunity for our members to chat to leaders in the field of neuroscience in an informal setting and gain valuable insights and ideas for future career paths.

As well as the exciting SCIENCE aspect to our society…. We also host a number of SOCIAL EVENTS throughout the year. Past events have included movie screenings, BBQ's, 12 bars of Christmas, table quizzes, lots of wine receptions and not forgetting the glitz and glamour of our annual Neurosoc Ball.

These social events are guaranteed nights to be remembered, as well as giving the new students a chance to make strong friendships with the current post-graduate and undergraduate members of the society.



neuro soc

For more information or any suggestions contact us at: neuroscience@csc.tcd.ie

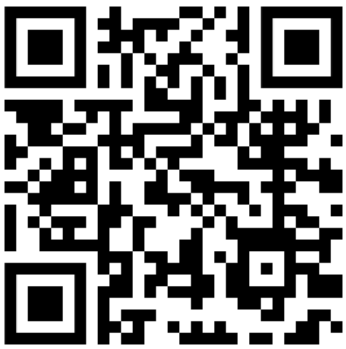
We'll be looking forward to seeing you soon, The neurosoc team.

Need support? Reach out to Trinity Student Counselling Service

https://www.tcd.ie/Student_Counselling/

Student Counselling Service (SCS) provides a compassionate, inclusive and student-centred service, embedding high quality social integration, academic development and mental health services.

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. The SCS strive to help all Trinity students irrespective of age, disability, sexual orientation, socioeconomic background, gender identity and expression, marital or family status, religion, ethnicity or culture.



SNAP (Support & Needs Assessment Planning)

A SNAP session is a student's first meeting with SCS. During a SNAP appointment you will meet with one of our clinicians for a conversation about what you are experiencing and to identify what resources might be helpful to meet your current needs. The goal of this appointment is to get you connected with the most effective and least time/energy intensive option to get your needs met. You can get assigned an individual counsellor after a SNAP session.

Sign up for a SNAP session at student-counselling@tcd.ie

Workshops

SCS offer workshops and psychoeducational talks free of charge on a number of topics relevant to student mental health and wellbeing.

- Minding our Mental Health in College
- Managing Stress and Anxiety
- Shyness and Social Anxiety
- Self-Esteem and the Inner Critic
- How to Support a Friend Who is Struggling

- Cultivating Mindfulness and Compassion
- Building Empathy Skills
- Suicide Awareness Skills

Please email student-counselling@tcd.ie to request a workshop or talk.

Need Urgent Support?

In the event of an emergency that cannot wait, the Student Counselling Service has emergency appointments available every weekday.

Email us at student-counselling@tcd.ie and we can book you in with the duty counsellor.

There are also a few services that are recognised by Student Counselling but run independently, and outside of normal hours such as:

Niteline, which is run by students.

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

Samaritans

www.dublinsamaritans.ie

Pieta House

http://www.pieta.ie/

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

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

TCD.Careers.Service

@TCDCareers

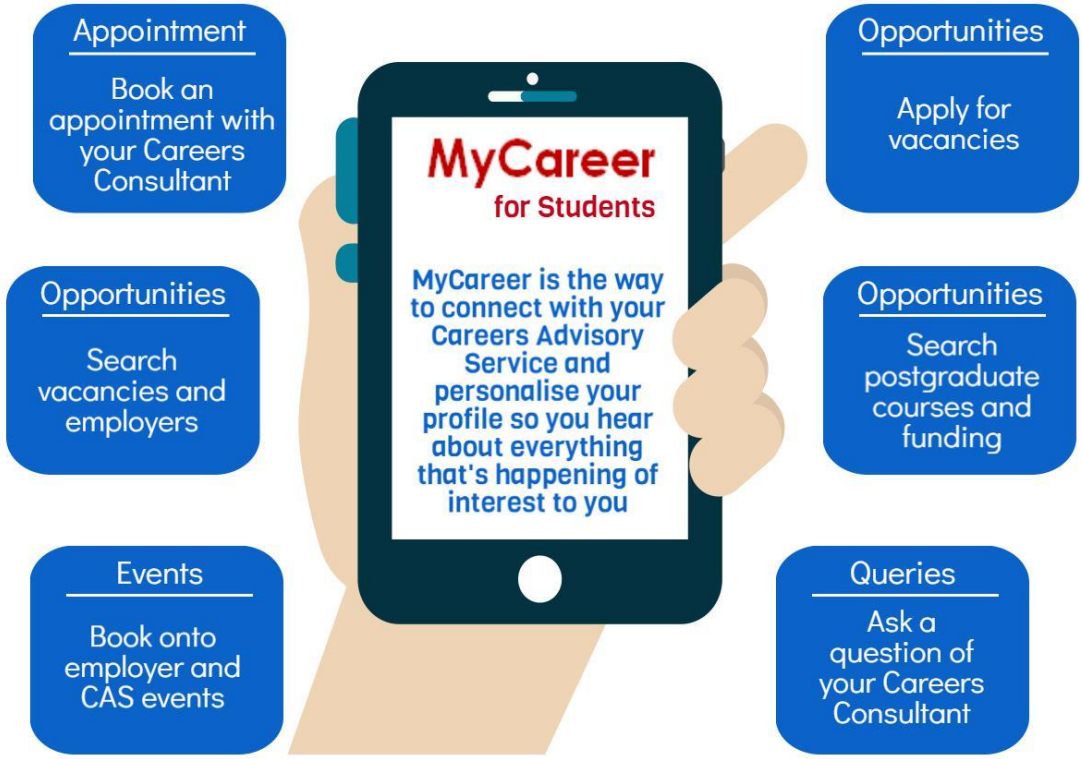
TCDCareers

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



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

Contacts:

Course Administrator:

Gabrielle McCabe

Room 3.07, Biochemistry School Office, TBSI, Pearse St.

Phone: +353-1-8964195

E-mail: gamccabe@tcd.ie

Senior Sophister year Coordinator:

Colm Cunningham

Trinity College Biomedical Sciences Institute (TBSI), Rm 6.05

(01) 896 3964

Email: colm.cunningham@tcd.ie

Appendix I: Instructions for Writing Reports

This is a rather long section with a lot of detail in it. This is because the department (and employers) regard the acquisition of communication skills as very valuable. I hope that these notes will help you to develop those skills and that you will take pride and pleasure in that development. You will find that you will not absorb all this information at a single reading. You should refer to these notes whenever you are doing a significant piece of writing and especially when you are writing your Project Report/Dissertation.

These instructions have been prepared to indicate to both staff and students the expected standard of report writing and they apply to all reports and the Senior Sophister Project. It is probably not an exaggeration to say that up to 20% of marks are lost by poor presentation of work. These notes are designed to help students to avoid the most common faults and to improve the presentation of work. While directed towards the writing-up of a major project report, almost all the advice can be applied to short reports and essays, which form the bulk of the in-course assessments during the Sophister years.

Preparing a Synopsis

It is essential to prepare a detailed synopsis of any piece of written work, which is likely to be more than one page long. A synopsis helps the writer to see clearly what the main points are and to arrange the material so as to bring the important points out. For a Project Report, the synopsis would show the order in which the material is to be presented, some idea of the length of each section, what is to be included in each section and an indication of the location of Figures, Tables and Plates.

There are two main objectives in preparing a synopsis:-

a) To help the writer to plan the work to the maximum effect.

b) To produce a written document which can be discussed with the supervisor before a great deal of writing is done. This is essential for large reports and is strongly recommended as a general practice.

A carefully produced synopsis can save hours of writing time and will allow alterations and additions. Work is not well-planned is likely to ramble and the main points will be lost.

The dissertation should be divided into the following standard sections:

Title

Abstract (Summary)

Acknowledgements

Introduction

Methods

Results

Discussion

References

Appendix

Very occasionally, the nature of the material may require a different format. **Students should consult supervisors before deviating from the standard arrangement.**

Now follows a short discussion of the headings listed above.

Title

This should be informative without being too long. Abbreviations should be avoided.

Abstract

The abstract (not to exceed 250 words) should be clearly written and readily comprehensible to a broad readership. The abstract should provide a concise summary of the objectives, methodology, key results, and major conclusions of the study. It should be written in complete sentences, without explicit subheadings.

Acknowledgements

The Acknowledgements should be placed at the end of the text (before the references) except in the Project Report, when they should immediately follow the Title and Summary.

As a matter of courtesy, *all* staff mentioned should be given a title (Prof., Dr, Mr, Ms) and both forename and surname. Only intimates should be referred to by first name only.

Work contributed by others to your project must be acknowledged. Such a situation would arise if, for example, stored samples generated by another researcher were used in the project or if the nature of specific experiments to be included in the project dictated that they must be carried out by an experienced researcher. The

titles and names of such contributors and the precise nature of their contribution must be included in this section in a clear statement of acknowledgement. **An omission of such an acknowledgement where required is plagiarism, which as outlined elsewhere in this Handbook (page 39-42) is regarded by College as a serious offence, and the student concerned will be penalised.**

All the foregoing is 'preliminaries' and should not be numbered with the main body of the text. Instead, give preliminaries Roman numerals (i, ii etc.). The pages of the main text should be numbered using Arabic numerals (1, 2, etc.).

Introduction

On the whole, short introductions are preferred. A long summary of the literature is not necessary and is better placed in the relevant sections of the Discussion. A clear statement of the problem and the immediate background as well as the aims of the project and its relevance should be given.

Methods

A clear account of all the animals, materials, methods (including statistical analyses) and experimental designs used must be given so that others can repeat the experiments. (The anonymity of human subjects must be preserved, by using code numbers or letters). In particular, it should always be clear to the reader exactly what is being measured, and how many measurements (or animals or subjects) there are in each value. Failure to do this will result in loss of marks. It may be useful to clarify here the contribution of others to the practical work (see *Acknowledgements*).

Results

This is usually the most poorly presented section of reports and yet it is the most important. The reader must be led carefully through the results step by step. The main observations must be brought out; it is **NOT** sufficient to present figures or tables and then leave the reader to work out the meaning (see later sections: *Figures* and *Tables*). When you state a result, you should always refer the read to the figure number in which it is illustrated (i.e., figure 2B etc.)

Second-order variables. If you are using some transformation (e.g., percentages) of the raw data, you should explain why you are doing so and, if possible, what, if any, difference the transform makes. When results are presented as % control, the absolute value of the control should be given in the Figure/Table legend.

Presentation of Statistics. This requires particular attention and is a skill that must be acquired. Always state clearly what measure (mean, etc.) and what measure of variation (SD, SEM, etc.) is being used. The number of observations (n) must be clearly stated and specifically given if SEM's are used. Do not give excessive numbers of decimal places; measures of variation should have one more significant figure than the mean. It is important to clearly state the **direction** and **magnitude** of the change observed. Do this first, and then give the result of any statistical tests used to determine significance.

Example: Pre-treatment with dexamethasone induced a significant decrease (80%) in TNF-α production from glial cells (P <0.01).

Significance Testing. Express significant differences by probability values or conventional symbols:

***** = P <0.05, ****** = P < 0.01, ******* = P < 0.001.

Over-interpretation of results is a serious error. You must demonstrate that you understand the significance of statistical testing. If a difference (or other statistical result, e.g., correlation) is not statistically significant, you should not treat it as if it is. If you want to discuss a non-significant 'trend' in your results, make it clear that you know the difference. (You should also have a sound biological reason for doing so.)

Discussion

This section often presents the most problems. In particular, it is often difficult to decide what should go in the Discussion and what should go in the Results (see *Preparation of a Synopsis*, below). A good guideline is 'When in doubt, put it in the Discussion', and leave the presentation of results as categorical and simple as possible. Inclusion of material that attempts interpretation of the data is likely to lead to a lack of clarity about what has been demonstrated and what is being inferred or guessed.

The Discussion will typically include the following.

a) A brief summary of the main results (single paragraph)
b) Interpretation of the significance of your results.
c) A comparison of the results (not forgetting the control values) with those in the literature.
d) A discussion of the relevant literature.
e) A critical discussion of possible sources of error in the results. *Critical* means not only listing the sources of error but also saying how important they are likely to be.

This list is by no means exhaustive and the categories will often overlap, but it should be helpful at the planning stage.

References

*Note that **all** references cited in the text must appear in the list of references — and **only** those references. General reading such as textbooks should not be cited, unless you are using a figure or referring to a very specific point.*

In the text…

- When you make a scientific statement of fact, you must reference an original article with data to support this fact (Smith *et al.*, 1999).

- If there is only one author, quote the name only followed by the year the paper was published (Jones, 2000).
- If there are two authors, use both names followed by the year the paper was published (Murphy & Quinn, 2001).
- If there are more than two authors, use *et al.* (always in italics with a full stop afterwards), which is the Latin term for 'and others' (Smith *et al.*, 1999).
- If you want to reinforce the point and use several articles, they should be listed from the earliest to latest, and separated by a semicolon (Smith *et al.*, 1999; Jones, 2000; Murphy & Quinn, 2001).
- If you are quoting two articles by the same person in the same year, denote one as 'a' and one as 'b'. This is done alphabetically according to the second author on the paper (Smith *et al.*, 1999a; Smith *et al.*, 1999b).
- When including the reference in the text, follow the following formats. 'Smith *et al.* (1999) have shown that…', 'It was shown by Smith *et al.* (1999) that…'.

Style of References

These days most journals use an abbreviated format for Journal titles.

When abbreviating Journal titles make sure to use the correct abbreviation. You can find the correct abbreviation of any journal on PUBMED (http://www.ncbi.nlm.nih.gov/entrez/)

Some examples are as follows:

Journals with a single word in the title are not abbreviated (e.g.) Neuropharmacology = "Neuropharmacology"

Journal of Neuroscience = "J Neurosci"

Behavioural Brain Research = "Behav Brain Res"

There are different styles for journal articles, books, and book chapters as illustrated below.

Journal article

*Cited in text as: (*Wang et al., 2004)

Cited in reference list as:

Wang Q, Rowan MJ, Anwyl R (2004) β-amyloid-mediated inhibition of NMDA receptor-dependent long-term potentiation induction involves activation of microglia and stimulation of inducible nitric oxide synthase and superoxide. J Neurosci 24: 6049-6056.

Book

Cited in text as: (Hille, 1974).

Cited in reference list as:

Hille B (1984) Ionic channels of excitable membranes. Sunderland, MA: Sinauer.

Chapter in a book

Cited in text as: (Stent, 1981)

Cited in reference list as:

Stent GS (1981) Strength and weakness of the genetic approach to the development of the nervous system. In: Studies in developmental neurobiology: essays in honor of Viktor Hamburger (Cowan WM, ed), pp288-321. New York: Oxford UP.

The most important thing to remember when citing references is to be consistent.

Appendix
This should contain essential raw data and details of any other methods (e.g., staining techniques *or other routine procedures*). Note that all entries in the Appendix must be properly described in suitable legends. It is not inappropriate to repeat relevant statistical summaries in the Appendix. All Tables in the Appendix must have fully descriptive titles so that they can be understood without reference to the main text.

Figures and Tables
These are a great deal of trouble to prepare and it is a pity to waste them for the sake of a little attention to detail. All Figures and Tables must be numbered and have a descriptive legend, so that each can be understood without reference to the text. Legends precede Tables and follow Figures. It may be desirable to include the important observation or conclusion in the legend, especially in histological figures. All units of measurement and statistical parameters must be identified. Axes on graphs and columns in tables must be labelled so that it is clear what each point or value represents. Try to keep graphs uncluttered — three lines are plenty. Use the conventional symbols of open and filled squares, triangles or circles. Shading will aid clarity in histograms. In recent years there has been an increasing imperative to show all data points (dot plots) rather than simple bar graphs so that the true range and variability in the data set can be appreciated. This should be observed wherever practical.

Tables should be as simple as possible. Try not to put all your results in one huge Table because the effect is too daunting for the reader.

The commonest fault is the failure to integrate Figures and Tables with the text. It is no use saying: 'The results of this experiment are summarised in Table 3.' and then proceeding to the next item. The reader must be guided and the main points clearly brought out — even at the cost of some repetition of material between legend and text. If Figures or Tables are large, it may not be possible to include the legend on the

same page. In such cases, put the legend on the facing page. If Figures, Tables or Plates (mounted groups of photographs) are brought together, rather than being interspersed with the text, say so and tell the reader where they are. Note that if it is necessary to put a figure or table sideways in the text, it should be arranged so that is viewed from the right.

If you have copied a figure from somewhere else, or modified it only a little, the original figure must be acknowledged (with reference in the legend and in the list) (*see* Plagiarism).

Grades of Heading
Careful attention should be given to this point at the planning stage. Examples of the usual grades of heading are given below with a short description of each in brackets). Use bold or italic type as shown.

Heading: **RESULTS**

[capitals in bold print, may be centred of left justified, no underline or period]

Subheading: **Effect of NMDA receptor blockade on neuronal viability**

[Upper and lower case in bold print, centred or left justified, no period]

Further subheading:

LDH release

[Upper and lower case in bold italic print, centred or left justified, no period]

Word Processing: There are some conventions that should be followed. Paragraphs should be created by leaving a blank line and not by indenting. Do not put spaces before a punctuation mark because it might then be carried over to the beginning of a new line.

All punctuation marks should have only a *single* space *after* them, never before. In the days of typewriters, colons and full points were conventionally followed by two spaces. It is not necessary or desirable to do so in a word-processor, because the application will stretch that space preferentially, especially in fully justified text (i.e., text with straight left and right margins as in this section).

Word-processors allow you to cut and paste graphs and figures into the text rather than putting them on separate pages with legends on the facing page. This should be done wherever possible.

Use the spelling checker but ensure that it is set to 'English (UK)' and not 'English (US)' by using the 'Language' option on the Tools menu. Remember that you will still

need to proof-read the final draft; the spelling checker will not find all errors. Pay special attention to names and technical terms.

Spelling.

'UK English' rather than 'US English' forms should be used: *e.g.,* fibre *not* fiber.

Student's *t* test should have a capital S and an apostrophe but the t should remain in lower case and be italicised.

"It's" should never be written in formal prose; always use 'it is'. The possessive is "its".

Numbers less than eleven should be spelled in full, unless they refer to specific units, e.g., '6 days', but 'six subjects.'

Note that 's', 'h', 'min' [no stop] and 'd' are the abbreviations for seconds, hours, minutes and days, respectively. The multiplier 'k' as in km (kilometre) is always lower case. The abbreviations for units never take an 's-plural'.

Headers and *Footers* are provided in word processors: a Header can be used to insert space and/or a running title at the top of each page; a Footer does the same at the bottom of the pages.

Pagination should be checked as the last stage in preparing a manuscript. It is usual to adjust the text so that odd lines or parts of lines do not appear at the beginning or end of a page. The adjustment may be done by inserting blank lines in appropriate places or by using the **Insert Page Break** command. *Word* has a 'Control widows and orphans' option (see **Format** menu, **Paragraph**, **Line & Page breaks** tab). Remember to set the page style (**Page Setup)** and printer type (*via* **Chooser**) before doing this and work from the beginning of the text.

Font. Choose your font with care. Some fonts take up a lot of space and others may not be suitable for laser-printing. For this reason, you should avoid fonts named after cities. *Garmond* (used in these notes) has been found to be a satisfactory, clear and reasonably compact font. Resist the temptation to use very ornate fonts (e.g., *London* or *Zapf Chancery*) for body-text. Resist also the more complex styles such as *Outline.* Underlining does not look very attractive in laser-printing and you may prefer to use italics for emphasis.

Fonts are designed for different purposes and a font that is easy to read on a screen (e.g., *Geneva*) is not necessarily suitable for body-text. *Times* is designed for narrow columns and does not look well in A4 pages and should not be used. *Times New Roman* shares many of the characteristics of *Times* (compact, with a lot of white space) but looks better.

Spacing. With conventional typewriters, it was conventional and desirable to double-space the text to aid clarity. If a type-size larger than 10 pt is used, it is unnecessary to double-space. If you use 12 pt body text, 1.5 spacing may be adequate. Try it and check with your supervisor if in doubt. (This text is 10 pt and single-spaced.)

Special Fonts. Greek characters are available in the font *Symbol*.

Preparing Material for PowerPoint presentations: Students are required to make oral presentations from time to time — another important skill. The usual means of presenting visual information is via Microsoft PowerPoint.

- *Legibility.* Anything less than 18 pt body text will be difficult to read. Headings should be about 24 pt. Using a 'sans-serif' font (e.g., *Helvetica*) will often improve legibility. *Times* is not suitable for projection. **Bolding** the text is helpful too. Diagrams will usually need to be enlarged before incorporating into slides. It is useless to merely copy pages from papers or books onto slides — the print size will be neither big enough nor dense enough.
- *Density.* Five lines is the useful maximum; and bullet points are better than continuous prose. If you are tempted to put more on, think again. Are you trying to write your speaking notes onto the acetate? It is not good technique to simply read out what is on the screen.