Neuroscience

Senior Sophister Course Handbook

2017–2018
Contents

Foreword 3

Course co-ordinator contact details 4

Senior Sophister Class list 2017-18 / Teaching Staff 5

Course structure and Important Dates 6

Module Summaries 7-31

BI4455 7
PG4460 11
NS4PH2 14
BI4455 16
GE4060 19
PS4020 22
BI4415 26
NS4495 29

Attendance & Submission deadlines for coursework 32

Recommended Textbooks and Websites 33-34

Examinations 35-36

Structure of Marks for Moderatorship in Neuroscience 37

Plagiarism 38

Class Descriptors 42-43

General statement on the course 45

Appendix: Instructions for writing reports 46-55

Neurosoc 56

Contacts 57
Foreword

This Handbook has been prepared as a guide to the Senior Sophister year, and contains information regarding the course content, course assessment, timetables, reading lists, guidance about conducting and writing up your final year project and also material on plagiarism and basic laboratory information. 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 and literature review that counts for 25% of your Senior Sophister year marks. Research projects will be allocated soon after Michaelmas term commences. 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 as 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! Peer to peer learning helps everyone involved!

We wish you every success over the next year.

Dr Colm Cunningham & Dr Gavin Davey
SS Neuroscience Coordinators
September 2017

The Neuroscience degree program is 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.
Timetables

We will provide a timetable for the Michaelmas term 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.

NOTE: There is now also the “Trinity MyDay” app, which gives ready access to timetable information. 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 communicated to you directly by e-mail.

Direct queries should be made to the course administrator in the first instance.

Course administrator

Gabrielle McCabe           Room 3.07, Biochemistry School Office, TBSI, Pearse St.
+353-1-8964195            gamccabe@tcd.ie

Course Coordinator (Senior Sophister year)

Dr Colm Cunningham
Room 6.05
Trinity Biomedical Sciences Institute
Pearse Street
+353-1-896 3964
E-mail: colm.cunningham@tcd.ie

Degree Co-ordinator

Dr Gavin Davey
Room 5.06
School of Biochemistry & Immunology
Trinity Biomedical Sciences Institute
Phone: +353-1-896 8408
E-mail: gdavey@tcd.ie
Teaching staff: Senior Sophister Neuroscience program

Dr Jerrard Hayes, School of Biochemistry & Immunology (jehayes@tcd.ie)
Dr. Colm Cunningham, School of Biochemistry & Immunology (colm.cunningham@tcd.ie)
Prof. Gavin Davey, School of Biochemistry & Immunology (gdavey@tcd.ie)
Dr. Aisling Dunne, School of Biochemistry & Immunology/Sch. Medicine (aidunne@tcd.ie)
Dr James Murray, School of Biochemistry & Immunology (james.murray@tcd.ie)
Dr. Andrew Harkin, School of Pharmacy and Pharmaceutical Sciences (aharkin@tcd.ie)
Dr. Pablo Labrador, School of Genetics and Microbiology (pablo.labrador@tcd.ie)
Prof. Marina Lynch, School of Medicine (lynchma@tcd.ie)
Prof. Kevin Mitchell, School of Genetics and Microbiology (kevin.mitchell@tcd.ie)
Dr. Aedin Minogue, School of Medicine (aminogue@tcd.ie)
Dr Marian Tsanov, School of Psychology (tsanovm@tcd.ie)
Dr Paul Dockree, School of Psychology (dockreep@tcd.ie)
Prof. Maeve Caldwell, School of Medicine (caldwelm@tcd.ie)

Overview

Course structure

<table>
<thead>
<tr>
<th>Module code</th>
<th>Module title</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI-4445</td>
<td>Neurochemistry II</td>
<td>5</td>
</tr>
<tr>
<td>GE-4060</td>
<td>Neurogenetics</td>
<td>5</td>
</tr>
<tr>
<td>PS-4020</td>
<td>Neuropsychology &amp; Systems Neuroscience</td>
<td>5</td>
</tr>
<tr>
<td>PG-4460</td>
<td>Neurophysiology II</td>
<td>5</td>
</tr>
<tr>
<td>BI-4455</td>
<td>Neuroimmunology &amp; Neurodegeneration</td>
<td>5</td>
</tr>
<tr>
<td>NS4PH2</td>
<td>Neuropharmacology</td>
<td>5</td>
</tr>
<tr>
<td>BI-4415</td>
<td>Research Literature Skills (Neuroscience)</td>
<td>15</td>
</tr>
<tr>
<td>NS-4495</td>
<td>Research Project</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>
## Important Dates

<table>
<thead>
<tr>
<th>Event</th>
<th>Date and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester 1</strong></td>
<td>Monday 25&lt;sup&gt;th&lt;/sup&gt; September – Friday 15&lt;sup&gt;th&lt;/sup&gt; December</td>
</tr>
<tr>
<td><strong>Semester 2</strong></td>
<td>Monday 15&lt;sup&gt;th&lt;/sup&gt; January – Friday 6&lt;sup&gt;th&lt;/sup&gt; April</td>
</tr>
<tr>
<td>Project Choices Due</td>
<td>Friday 28&lt;sup&gt;th&lt;/sup&gt; October (5pm)</td>
</tr>
<tr>
<td>Literature Review Due</td>
<td>Friday 15&lt;sup&gt;th&lt;/sup&gt; December (12 noon)</td>
</tr>
<tr>
<td>Project design seminar</td>
<td>Monday to Wednesday 11-13&lt;sup&gt;th&lt;/sup&gt; December (2-5pm)</td>
</tr>
<tr>
<td>Research Project Begins</td>
<td>Monday 15&lt;sup&gt;th&lt;/sup&gt; January</td>
</tr>
<tr>
<td>Research Project Ends</td>
<td>Friday 23&lt;sup&gt;rd&lt;/sup&gt; March</td>
</tr>
<tr>
<td>Thesis Submission Due</td>
<td>Thursday 5&lt;sup&gt;th&lt;/sup&gt; April (2 pm)</td>
</tr>
<tr>
<td>Poster Presentations</td>
<td>Tuesday 10&lt;sup&gt;th&lt;/sup&gt; April (2-5pm)</td>
</tr>
<tr>
<td>Exams</td>
<td>TBA</td>
</tr>
</tbody>
</table>
Programme Structure: Module Summaries

BI-4445: Neurochemistry II (Michaelmas term)

Credits: 5

Mode of Assessment: End of year examination

(a) BI-4401: Neurochemistry: Brain Biochemistry & CNS Acting Drugs

(Michaelmas term)

Lecturer: Dr. G. Davey

This course will focus on the following topics:

Lecture 1:
• Energy substrates for the brain
• Glucose/lactate transporters
• What uses ATP in the brain?
• Astrocytes-neuron lactate shuttle hypothesis
• Glucose sensing neurons
• What controls blood flow in the brain?

Lecture 2:
• Energy thresholds in the brain
• Mitochondria control glutamate release
• Mitochondrial fusion/fission dynamics
• Complex I activity & mitochondrial fusion

Lecture 3:
• In vivo techniques for measuring neurotransmitter release and actions
• Microdialysis & HPLC
• Classical neurotransmitters
• Atypical neurotransmitters
• Nitric oxide

Lecture 4:
• GABA metabolism & GHB
• Polyamine NTs
• Glial cells and NT release (D-serine, taurine, NAAG & neuropeptides)

Lecture 5:
• Melatonin as a NT
• Aspartate & pheromones

References: to be supplied closer to lectures
(b) BI-4402: Neurobiology (Michaelmas term)
Lecturer: Dr. Jerrard Hayes

This course will focus on the following topics:

Lecture 1:
- SNARE hypothesis of exocytosis:
- experimental approaches leading to this theory (pharmacology, electrophysiology)
- neurotoxins which affect exocytosis.

Lecture 2:
- Cholinergic signalling:
- Voltage-gated ion channels vs. ligand-gated ion channels
- Nicotinic vs. muscarinic Acetylcholine receptors
- Prerequisites to obtain information on structure and function of receptor proteins (using nAChR as an example)

Lecture 3:
- Inhibitory neurotransmission
- Glycinergic neurotransmission (receptors, mechanisms and pharmacology)
- GABA-ergic neurotransmission (receptors, mechanisms and pharmacology)

Lecture 4:
- Glutamatergic neurotransmission (receptors, mechanisms and pharmacology)
- Involvement of glutamatergic signalling in learning and memory formation
- Cannabinoid signalling (involvement of cannabinoid receptors in extinction and PTSD)

Lecture 5:
- Neurotransmitter transporter proteins as drug targets
- Serotonergic neurotransmission
- Neurobiology of depression
- Animal models of depression
- Molecular mechanisms of antidepressant treatment
- Non-synaptic neurotransmission and somatodendritic neurotransmitter release

References: to be supplied closer to lectures
This course will focus on the following topics:


**Lectures 2-3**: Parkinson’s disease-pathology, anatomy, protein aggregation, dopaminergic neuron destruction, mitochondria, ROS production, genetics, epidemiology, MPTP + neurotoxins, alpha-synuclein, prevention in animal models. Treatments – new therapies.

**Lectures 3-4**: Alzheimer’s disease – pathology, PET scans, neurofibrillary tangles, tau protein, tangles, beta-amyloid, presenilin, apolipoprotein E. Treatments.


**References**: to be supplied closer to lectures

**Reading/Learning Resources**:

– The best on synaptic bioenergetics (out of print but there is a copy in the library).
- The Biochemical basis of neuropharmacology by JF Cooper, FE Bloom and RH Roth Oxford University Press, Eighth Edition
**PG-4460: Neurophysiology II (Michaelmas term)**

**Credits:** 5

**Mode of Assessment:** End of year examination

**(a) PG-4750: Cellular Neurophysiology (Michaelmas term)**

**Credit weighting:** 2.5 ECTS

**Lecturer:** Prof. M. Lynch

**Description of course:**

The course is designed to explore the neurobiology of glia and assess the impact of glia on nervous system function. The first part of the course is designed to provide an understanding of microglial plasticity and appreciate their ability to adopt different phenotypes. The diverse roles of microglia will be considered. Special focus will be placed on their phagocytic role and the changes that occur in microglia to facilitate phagocytosis. The importance of cytoskeletal proteins in enabling phagocytosis will be explored.

Astrocytes are the most prevalent glial cell in the brain and the course 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.

Microglia, and also astrocytes, are the primary cytokine-producing cells in the brain and the course will continue by examining the broad family of cytokines, their functions in the brain and the signaling cascades induced by interaction of specific cytokines with their receptors. A special focus will be placed on interleukin-1β and the inflammasome. The impact of some named cytokines on neuronal function will be explored. A brief description of chemokine families, their receptors and signaling will be included in this course.

The last few lectures will consider the changes that occur in neurodegenerative diseases with a focus on exploring the impact of neuroinflammation and oxidative changes in the neuropathogenesis of the disease. The changes in glial function in a number of conditions will be discussed.

**On completion of this module, students should**

1. Understand the diverse roles of microglia and the impact of microglia on neuronal function.
2. Appreciate the diversity of microglial phenotypes and the effects of various stimuli
3. Add to their understanding of the importance of cytoskeletal proteins in cell function and appreciate the fact that the role cytoskeletal proteins
extend well beyond the important function of providing support for the cell.

4. Understand some of the functions of astrocytes and the impact of astrocytes on neuronal function

5. Understand the structure and function of the blood brain barrier, the pivotal role of astrocytes in barrier function, and the fact that barrier changes occur in disease.

6. Gain an understanding of the broad family of pre-inflammatory (with a focus on IL-1β and the inflammasome) and anti-inflammatory cytokines, their receptors and the signaling induced by specific cytokines, the cell source of cytokines and the effect of cytokines on the major cell types in the brain.

7. Understand the role of chemokines, appreciate the breadth of this family of proteins and their impact on specific brain functions.

8. Appreciate the factors that contribute to the neuroinflammation that characterizes several neurodegenerative diseases.

Reading/Learning Resources:

Reading material will be suggested throughout the course.

(b) PG4851 Advanced Topics in Neurophysiology

Term: Michaelmas
Credit weighting: 2.5 ECTS
Lecturer: Dr. Aedín Minogue

Module Description:

This module focuses on the physiological properties of neurons, synaptic transmission and synaptic plasticity. In particular, the module builds on knowledge acquired from PG3360 and describes, in-depth, biophysical membrane properties of neurons including membrane resistance and capacitance; time and length constants; ion fluxes and permeabilities and membrane potential, Nernst equilibrium potentials and the GHK equation for determining membrane potential; electrical properties of neurons; Hodgkin-huxley recording of the squid action potential and modern electrophysiological techniques; the quantal nature and probability of neurotransmitter release; molecular features of ion channels including conductance, selectivity filters and gating; integrative properties of neurons, dendrites, and dendritic conductance; spatial and temporal summation; synaptic plasticity mechanisms; neuronal and network functions, oscillatory networks, pacemakers, resonators and rebound activity. The module also describes methodology for investigating neuronal function e.g. current and voltage-clamping, patch-clamping and optogenetics.
Details of the module:

Membrane Potential
Ionic Channels and Currents
Electrical Properties of Neurons
Electrical Properties of Neurons
Electrophysiological Techniques
Synaptic Transmission
Neuronal firing Patterns
Neural Plasticity

TOTAL HOURS 8 h

Learning Outcomes:

Students should have in-depth knowledge of:

- the 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 potentials and currents from brain cells including whole-cell and single channel currents.
- properties of acetylcholine, 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.

Assessment: Examination (100%)

Reading/Learning Resources:

NS4PH2: Neuropharmacology (Michaelmas)

Credits: 5

Mode of Assessment: End of year examination

Lecturer: Dr Andrew Harkin

AIMS: To teach the principles of neuropharmacology and drug therapies for disorders of the central nervous system.

PRE-REQUISITES: Completion of General principles of Pharmacology, NS3PH1.

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.
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.

LECTURES (AH)

1, 2, 3 Depression and antidepressants
4 Mood stabilizers – Lithium
5, 6 Anxiety disorders and anxiolytics
7 Hypnotics
8, 9, 10 Schizophrenia and antipsychotics
11, 12 Addiction and drug dependence – reward circuitry and drugs of abuse
13, 14 Anaesthetics (Local, General)
15, 16, 17 Epilepsy and anticonvulsants
18, 19, 20 Pain – nociception, spinal and supra spinal pain pathways
  Narcotic analgesics and Other CNS acting analgesics
21, 22 Parkinson’s disease and anti-Parkinsonian drugs
23, 24 Alzheimer’s disease and drug treatment of Alzheimer’s disease
25 Brian ischemia and neuroprotection
Reading/Learning Resources:

Brody's Human Pharmacology: Molecular to Clinical (4th Ed.) by K.P. Minneman
Fundamentals of Psychopharmacology (3rd Ed.) by B. Leonard
Goodman and Gilman's The Pharmacological Basis of Therapeutics (12th Ed.) 2010
Molecular Neuropharmacology: A Foundation for Clinical Neuroscience (2nd Ed.)
by E.J. Nestler, S.E. Hyman, R. Malenka
The Biochemical Basis of Neuropharmacology (8th Ed.) by J.R. Cooper, F.E. Bloom, R.H. Roth

ASSESSMENT

Pass mark = 40%
Written Examination: Neuroscience paper III, 2 essay questions

SUMMARY OF HOURS

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Tutorials</th>
<th>Total contact</th>
<th>Guided study</th>
<th>Total</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1</td>
<td>26</td>
<td>75</td>
<td>101</td>
<td>5</td>
</tr>
</tbody>
</table>
BI-4455: Neuroimmunology & Neurodegeneration (Michaelmas term)

Credits: 5
Mode of Assessment: End of year examination
Lecturers: Dr. C. Cunningham, Dr. A. Dunne, Dr. J Murray

This course will focus on bi-directional communication between the nervous and immune systems, role of the immune system in neurodegenerative disease states, and neuropathological features of neurodegenerative disease states.

L1-2 Introduction to the immune system & neurotransmitter and stress effects on immune system

L3-4 Brain as an immune privileged organ, multiple sclerosis & treatment

L5. Acute neuroinflammation in infection/stroke/TBI.

L6. CNS inflammation induced by systemic inflammation (Sickness Behaviour)

L7-8. Aspects of microglial activation: microglial phenotypes, PAMPs, Microglial downregulators

L9. Sterile inflammation, DAMPs in the context of neurodegeneration

L10-11. Alzheimer’s disease pathology, treatments, models, inflammation, delirium

L12-17. Common themes in neurodegeneration: protein aggregation, ubiquitin proteasome system, inflammation, Tau, RNA binding proteins, mitochondrial dysfunction, axonal dysfunction: Alzheimer’s, Huntingtons, Prion, motor neuron and Parkinson’s diseases

L13-14. Autophagy in Neurodegenerative Disease (James Murray)

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 at the level of toll-like receptor activation, pro-inflammatory cytokine production, chemokine production, endothelial activation and cell infiltration
- Explain microglial activation as defined by several different parameters and activities. Key features/roles of the microglial cell such as 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
- Describe in detail sickness behaviour with respect to 1) symptomology 2) routes of activation of the brain by systemic inflammation 3) brain areas involved in expression of sickness behaviour 4) the role of cytokines and prostaglandins in sickness behaviour
- Discuss and criticise animal models of Alzheimer's disease and the investigation of amyloid vaccination strategies in humans
- Outline the concept of compartmentalised neurodegeneration and discuss dysfunction of the ubiquitin proteasome pathway and autophagy drawing on evidence from Prion diseases, Tauopathies (AD, FTD), ALS (Motor Neuron disease), Parkinsons disease.

Reading/Learning Resources:

Reference Textbooks


Journal articles

Neurotransmitter and stress effects on immune function


Inflammatory mediator actions in the brain/sickness behaviour

Immune Privilege and Neuroimmunology of EAE and multiple sclerosis

- **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

Neurodegeneration & inflammation


Neurodegenerative disease (General: more specific articles cited in lectures)

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

Microglial activation states, DAMPs, PAMPs etc

GE-4060: Neurogenetics (Hilary term)

Credits: 5

Mode of Assessment: End of year examination

(a) GE-4054: Behavioural Genetics (Hillary term)
Lecturer: Dr. K. Mitchell

This course will examine how genes influence behaviour through effects on cellular physiology and neuroanatomy. More specifically, it will look at how variation in genes can cause variation in behaviour. It will encompass the use of genetic approaches to dissect the cellular and biochemical components of complex behaviours in model organisms (worms, flies, mice) as well as the heredity of behavioural characteristics and psychiatric disorders in humans.

Major topics (examples of relevant psychiatric disorders are shown in parentheses):

Energy Balance, Learning and Memory, Social Behaviour, Sexual Behaviour, Cognitive Genetics, Autism, Schizophrenia

Reading/Learning Resources:
Reading material will be suggested throughout the course

(b) GE-4053: Genetics of Neural Development (Hilary term)
Lecturer: Dr. J.P. Labrador

This course will examine how a developmental programme 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. The course 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 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. Each topic will be covered by one or more reviews and its study will be required for a successful completion of the course. 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. Upon completion, students should be able to approach any scientific literature related to this course.

Different subjects covered include:

- Neural Induction
- Neurogenesis
- Neural stem cells
- Temporal control of neuronal specification in Drosophila
- Neuronal specification in vertebrates
- Axon guidance genetics
- Gradients in retinotectal mapping
- Topographic mapping in the olfactory system

Reading/Learning Resources:

As a very basic introductory literature for the course any Developmental Biology book such as Developmental Biology by Scott F. Gilbert can be used. However, this literature should be used just 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:


PS-4020 (NS4PS1): Neuropsychology and Systems Neuroscience (Hilary term)

Credits: 5 ECTS

Mode of Assessment: End of year examination

a) Case Studies in Neuropsychology (Hilary Term)

Lecturer: Paul Dockree

Contact Hours: 11 lectures

Rationale and Aims
Case studies of patients with brain damage remain a critical part of cognitive neuropsychology's methods for understanding the organisation of cognitive systems, and devising principled approaches to rehabilitation. In this topic, there is great scope for clinicians and researchers to inform and learn from one another with respect to the manifestation of clinical disorders, their potential causes, and paths to rehabilitation. Students are aware of famous patients with brain damage (e.g. Phineas Gage and patient H.M.) but this module will address lesser-known cases, who have nevertheless provided important insights into contemporary research problems across several domains including attention, memory, dysexecutive syndrome and disorders of meta-cognition and social-cognitive processing.

This module aims to:
1) introduce the value of case studies in neuropsychology for dissociating mechanisms of human cognition and contributing to the development of theory.
2) highlight different methodological approaches that are employed to study patients with brain damage, and their advantages and limitations.
3) discuss the role of case studies in complementing other approaches in cognitive neuroscience, including imaging and electrophysiological studies.
4) explain the role of case studies in shaping novel approaches to neuropsychological rehabilitation

Objectives
To introduce students to theoretical and conceptual approaches to the study of cases in cognitive neuropsychology; to highlight methodological designs to investigate cognitive processes; to integrate the case study with other techniques used in cognitive neuroscience; to enable students to reflect on how case studies can inform rehabilitation approaches.

Course Content
The module will consist of 11 lectures, the first two will highlight the rationale for case study designs in neuropsychology and introduce basic and advanced methods to draw inference from single and multiple cases. Subsequent lectures will address different neuropsychological conditions (e.g. amnesia, dysexecutive syndrome), introduce each topic by way of a case history, illustrate how each case has influenced contemporary
theory and models of brain function, and examine the influence of these cases in shaping further experimental and rehabilitative approaches.

Indicative Resources

Reading:

There will be no core textbook for this module. Articles from journals including, *Brain, Neuropsychologia, NeuroCase, Cognitive Neuropsychology* and *Neuropsychological Rehabilitation* will be uploaded to Blackboard on a weekly basis in advance of each lecture.

Books for orientation to Neuropsychology:


*In to the Silent Land: Travels in Neuropsychology*. Paul Broks

Useful websites:

- [http://www.the-ins.org](http://www.the-ins.org)
- [http://www.the-bns.org/index.html](http://www.the-bns.org/index.html)
- [http://www.psihq.ie/psi-division-neuropsychology](http://www.psihq.ie/psi-division-neuropsychology)
- [http://www.scn40.org](http://www.scn40.org)

Learning Outcomes

On successful completion of this course, students will be able to:

- Understand broadly the function of different brain regions underlying cognitive function
- Knowledge of case study methods of assessment of brain structure and function
- Understanding of methods of assessment in cognitive neuropsychology
- Knowledge of the different types of neuropsychological syndrome that can arise following particular lesions to the brain
- Understanding the relationship between case studies in neuropsychology and techniques in cognitive neuroscience (e.g. imaging and electrophysiological methods)
- Knowledge and understanding of the mechanisms and methods of recovery and rehabilitation following brain damage.

Methods of Teaching and Student Learning

The format of lectures is conventional but students are encouraged to ask questions and to engage the lecturer in discussion where possible
b) Systems Neuroscience (Neurophysiology)

**Lecturer:** Dr. Marian Tsanov

This course examines general principles of the brain organization and also considers memory brain systems in some detail. Topics include limbic system and spatial memory as well as dysfunction of the memory systems and the relevance of each brain region to the amnesic syndrome. The students will learn about information processing in biological and theoretical networks, encoding and processing of the neuronal signal and its dependence on experience. This course will cover novel neuroscience methodology: massive parallel recording and isolation of single units with electrophysiological techniques. Optogenetic techniques will be used to demonstrate advanced manipulation of networks and behaviour. The course will address fundamental approaches as well as state-of-the-art techniques for recordings from brains of various species **in vivo**. The lectures will present the cellular and network substrates of hippocampal memory that mediate the neural bases of spatial memory and navigation. Finally, the course introduces contemporary theories of behavioural conditioning and reinforcement learning.

**This course will focus on the following topics:**

**Lecture 1:** Memory Systems in the Brain

Classification of the memory systems, Declarative memory, Episodic memory and hippocampal formation, Procedural memory, Brain regions involved in anterograde and retrograde amnesia.

**Lecture 2:** Biological and Computational Neural Networks

Models of network connectivity, Complex networks, Types of connectivity in neuronal networks, Small-world networks, Scale-free networks.

**Lecture 3:** Ensemble Neuronal Activity and Local Field Oscillations

Electrophysiological recordings, Single-unit recordings, Signal encoding and storage, Local field potential, Neuronal oscillations, Synchronization of oscillators.

**Lecture 4:** Techniques for Manipulation of Neuronal Networks and Behaviour

Electrical stimulation, Optogenetics, Experience-dependent plasticity, brain-computer interface, neural implants and prostheses.

**Lecture 5:** Neural Mechanisms of Spatial Orientation

Limbic system, Place cells, Engram cells, Head-direction cells, Navigation and landmark control, Allocentric and egocentric modes of spatial orientation.

**Lecture 6:** Neurobiology of Reinforcement Learning

Learning models, Reinforcement learning, Reward and aversion systems in the brain, Operant conditioning, Dopamine neuromodulation, Pathophysiology of goal-directed behaviour.
Recommended text books:

The Hippocampus Book; edited by Per Andersen, Richard Morris, David Amaral, Tim Bliss, and John O'Keefe, first edition.


Short Course: Visualizing Large-Scale Patterns of Activity in the Brain: Optical and Electrical Signals, SFN, edited by György Buzsáki.

Reading/Learning Resources:

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.
**BI-4415: Scientific Literature Skills (Michaelmas term)**

**Credits:** 15  
**Modes of Assessment**  
<table>
<thead>
<tr>
<th>Assessment</th>
<th>Weighting (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of year examinations</td>
<td>66.66%</td>
</tr>
<tr>
<td>Seminar/Journal Club</td>
<td>13.33%</td>
</tr>
<tr>
<td>Literature review</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Lecturers:** Dr Jerrard Hayes, Dr. G. Davey, Dr. C. Cunningham, Dr. A. Dunne & Literature review supervisor

(a) **Journal Club**

Students will have to comprehend, present and critically analyse research articles from high impact Neuroscience Journals. Each 2.5 hr session will be composed of 5 student presentations. This course will also prepare students for examination Paper IV which is focused on comprehension of a journal article. Each student will be required to present two Journal articles, one chosen by a member of the academic staff, and the second chosen by the student. The Journal articles chosen by the member of academic staff will be circulated to the class at the start of term (2 weeks in advance of the journal club week). We suggest that that journal article chosen by the student could be related to the topic of their Senior Sophister research project.

**Journal Club I: Convenor’s choice of article:**

**Session 1:** Mon 9th October, 10 am – 1pm  
**Session 2:** Tues 10th October, 10 am - 1pm  
**Session 3:** Thurs 12th October, 3 – 6 pm  
**Session 4:** Fri 13th October, 10 am – 1 pm

**Journal Club II: Student’s choice of article:**

**Session 1:** Tue 21st November, 2-5 pm  
**Session 2:** Wed 22nd November, 2-5 pm  
**Session 3:** Thurs 23rd November, 2-5 pm  
**Session 4:** Fri 24th November, 2-5 pm
Assessment

End of year examination paper VI: 10 ECTS

Journal Club presentation: 2 ECTS (1 ECTS per presentation)

Seminar, Questions and Discussion

- Prepare a 15 min seminar on the Journal article (15 slides max) + 5 min Q&A.
- Avoid lots of writing on your slides; use drawings, flowcharts and cartoon to convey principles, hypotheses, experiments and mechanisms.
- Reading from your slides will attract low marks; practice your talk in front of your class beforehand

On the day of the Journal Clubs Your participation in ALL the sessions is expected. We will be expecting you to ask lots of questions!

(b) 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 must not exceed 50. If at all possible, reviews should be used to refer to earlier work and the references should 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 reference list.

- The review will become the basis of the Introduction to your Dissertation. Any recent literature which comes to your attention between January and April may of course be included. Changes in emphasis as a consequence of the realities of your research may also be made.

- 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.
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 one week before the submission date, in order to leave plenty of time for them to read it, and for you to take on board any suggestions that they may have for improvements.

Two printed copies of the literature review should be submitted to the Course Administrator and an electronic copy e-mailed to colm.cunningham@tcd.ie by 12 noon on Friday 15th December.
NS-4495: Research Project (Hilary Term)

Credits: 15

<table>
<thead>
<tr>
<th>Modes of Assessment</th>
<th>Weighting (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Design Seminar</td>
<td>15</td>
</tr>
<tr>
<td>Dissertation</td>
<td>60</td>
</tr>
<tr>
<td>Supervisors conduct mark</td>
<td>15</td>
</tr>
<tr>
<td>Poster presentation</td>
<td>10</td>
</tr>
</tbody>
</table>

Students will conduct a 10 week research project in one of the Neuroscience laboratories across campus, including those contributing to Trinity College Institute of Neuroscience. The research project is a major component of the Senior Sophister year comprising 25% of the final degree mark. The project is assessed in a variety of ways: an oral presentation outlining the background to your project, the conduct of the student during project work, a poster presentation outlining the major findings, and finally the written report (dissertation) of the project.

**Stages involved in the research project**

**Project Design Seminar:** Each student will have a 15-minute time slot in which to give a 10-minute presentation of the background to the project, the question to be investigated and the material/subjects and methods to be used. Five minutes will be available for questions. *These times must not be exceeded and the chair will stop you if you do and you may be penalised.*

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 show properly more than 10 slides. Keep them simple. Students should avoid reading if possible — a few hesitations are acceptable.

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
- Quality of slides
- Style of delivery
- Answering of questions

**Dissertation:** Dissertations should be written according to the style outlined in Appendix I: *Instructions for Writing Reports*. Dissertations are assessed by staff members who may not be expert in the precise field of study. The style of the dissertation should be designed for that readership.

The Dissertation should be a maximum length of 40 A4 pages (excluding references). The course advisor requires three copies for assessment purposes (in addition to the electronic copy). One copy will be retained by the course advisor, one retained by the supervisor and the other returned to the author.

**Notes:** Following recommendations by the Neuroscience external examiner in 2016, penalties will be considered for failure to adhere to these 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 appears 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 would constitute plagiarism.*

**Scheduling:**

*Methods* should be written very early in the project and polished later.

*Results* should be in the process of being written up during the practical part of the project.

The *Introduction* will normally be written last and will use material from your Literature Review, but more focused on how the work has panned out in reality, and brought up to date with new, more relevant papers.

**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 30).

- Overall presentation (layout, accuracy, literacy)
- Use of literature, including grasp of different lines of evidence
- Clarity of statement of aims, results
- Graphics (selection and value, clarity; integration into text)
- Use and interpretation of statistics (over-interpretation is a serious fault)

*Input from the project supervisor:* The project supervisor will read **one** 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 plenty of time for them to read it, and for you to take on board any suggestions that they may have for improvements.

**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 in the laboratory
- Quality of discussion time
- Literature: understanding and creativity in finding material
- Data analysis: understanding the bases of statistical tests and using them appropriately

**Senior Sophister Neuroscience project deadlines**

*Project design seminar*
Monday 11th to Wednesday 13th December (2-5pm)

*Practical work begins*
Monday 15th January

*Practical work ends*
Friday 23rd March

*Project report submitted to the Course Administrator in Hard copy* (three copies in total), and via e-mail to colm.cunningham@tcd.ie by Thursday 5th April (by 2 pm).

*Poster presentation of project results*
Tuesday 10th April (afternoon).
Attendance and submission deadlines for coursework

Attendance
All students are expected to attend lectures, workshops and practical classes. 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 Advisor.

Students who miss classes are responsible for updating themselves on any information provided during those classes.

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 them 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 Adviser directly, or via the College Tutor. Extensions will only be given in exceptional circumstances.
Recommended textbooks and websites

**Recommended General Neuroscience textbook**


*A good basic text*


*A very comprehensive reference text*


**Excellent comprehensive 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.


**Science Direct**

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

[http://sciedirect.com](http://sciedirect.com)

**Neuroscience Web Sites**

An excellent website called “the brain from top to bottom”

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/~Brainmdl/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

Examination paper structure

Paper I (16.66% of year)

Section I:
Neurochemistry II (4 Questions)

Section II:
Neuroimmunology and Neurodegeneration (4 Questions)

Answer 4 Questions: Two from each from each section

Paper II (16.66% of year)

Section I:
Neurogenetics (2 Questions: Either or format)

Section II:
Neuropsychology and Systems Neuroscience (2 Questions: Either or format)

Answer 4 Questions: Two from each from each section

Paper III (16.66% of year)

Section I:
Neuropharmacology (4 Questions)

Section II
Neurophysiology II (2 Questions: Either or format)
Answer 4 Questions: Two from each section

Paper IV (16.66% of year)

Analytical paper: Comprehension of a Journal article

Answer all Questions

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. No mark is allocated to the viva voce examination. Candidates' marks are not 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 on the basis of good performance.

Each viva voce examination will last approximately 20 minutes.

External Examiner (2016-2018)

Professor Daniel Anthony

Department of Pharmacology

Mansfield Road

Oxford OX1 3QT

UK.
**Structure of marks for the Moderatorship in Neuroscience**

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

**Senior sophister marks**

33.33%: **In-course assessments (20 ECTS)**
- Journal Club (3.33%)
- Literature Review (5%)
- Research project (25%)
  - Project design seminar: 3.75%
  - Supervisors conduct mark: 3.75%
  - Poster presentation: 2.5%
  - Project report: 15%

66.66%: **Examinations (40 ECTS)**
- Paper I: 16.66%
- Paper II: 16.66%
- Paper III: 16.66%
- Paper IV: 16.66%

**Overall degree mark**

80 %: Senior Sophister marks
20 %: Junior Sophister Neuroscience (Group I mark)
Plagiarism
Each student is responsible for ensuring that their work is actually the result of his/her own efforts, skills and knowledge, and has not been produced by means that will give an unfair advantage over other students.

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 2015-16 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

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

You are urged to read very carefully the following extract from the College Calendar 2005/06 (pp. G13-G14) 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
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;
(iii) fail to distinguish between information which needs no acknowledgement because it is firmly in the public domain and information which might be widely known, but which nevertheless requires some sort of acknowledgement;
(iv) come across a distinctive methodology or idea and fail to record its source.

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

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

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 should either be quoted directly or paraphrased. Either way, an
explicit citation of the work referred to should be provided, in the text, in a footnote, or both. Not to do so is to commit plagiarism.

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

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

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.
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 also give credit for evidence of critical discussion of facts or evidence.

Guidelines on Grades for Sophisters’ Essays and Examination Answers

<table>
<thead>
<tr>
<th>Class</th>
<th>Mark Range</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>90-100</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>80-89</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>70-79</td>
<td>MAINLY OUTSTANDING ANSWER; falls short on presentation and reading or thought beyond the course, but retains insight and originality typical of first class work.</td>
</tr>
<tr>
<td>II-1</td>
<td>65-69</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>60-64</td>
<td>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.</td>
</tr>
<tr>
<td>II-2</td>
<td>55-59</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>50-54</td>
<td>INCOMPLETE ANSWER; suffers from significant omissions, errors and misunderstandings, but still with understanding of main concepts and showing sound knowledge. Several lapses in detail.</td>
</tr>
<tr>
<td>III</td>
<td>45-49</td>
<td>WEAK ANSWER; limited understanding and knowledge of subject. Serious omissions, errors and misunderstandings, so that answer is no more than adequate.</td>
</tr>
<tr>
<td></td>
<td>40-44</td>
<td>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.</td>
</tr>
<tr>
<td>Fail</td>
<td>35-39</td>
<td>MARGINAL FAIL; inadequate answer, with no substance or understanding, but with a vague knowledge relevant to the question.</td>
</tr>
<tr>
<td></td>
<td>30-34</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>0-29</td>
<td>UTTER FAILURE; with little hint of knowledge. Errors serious and absurd. Could also be a trivial response to the misinterpretation of a question.</td>
</tr>
</tbody>
</table>
### Guidelines on Marking for Project/Dissertation Assessment

<table>
<thead>
<tr>
<th>Class</th>
<th>Mark Range</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>85-100</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>70-84</td>
<td>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.</td>
</tr>
<tr>
<td>II-1</td>
<td>60-69</td>
<td>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.</td>
</tr>
<tr>
<td>II-2</td>
<td>50-59</td>
<td>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.</td>
</tr>
<tr>
<td>III</td>
<td>40-49</td>
<td>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.</td>
</tr>
<tr>
<td>Fail</td>
<td>20-39</td>
<td>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.</td>
</tr>
<tr>
<td>Fail</td>
<td>0-19</td>
<td>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.</td>
</tr>
</tbody>
</table>
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 20 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 team work 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
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.

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 commoner 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 which is not well-planned is likely to ramble and the main points will be lost.
Reports 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 the *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 are ‘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 badly-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*).
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 uncluttered as possible.

The Discussion will include the following.

a) Interpretation of the significance of your results.

b) A comparison of the results (not forgetting the control values) with those in
the literature.

c) A discussion of the relevant literature.
d) 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 (eg) Neuropharmacology = “Neuropharmacology”

Journal of Neuroscience = “J Neurosci”

Behavioural Brain Research = “Behav Brain Res”

Below is the reference style used by the Journal of Neuroscience.

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:


Book

Cited in text as: (Hille, 1974).

Cited in reference list as:


Chapter in a book

Cited in text as: (Stent, 1981)

Cited in reference list as:

**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. 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
[capitalis in bold print, centred, no underline or stop]

Subheading

Effect of NMDA receptor blockade on neuronal viability
[Upper and lower case in bold print, centred, no stop]

Further subheading

LDH release
[Upper and lower case in bold italic print, centred, no stop]

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 and apostrophe); the t should 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 spelt 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.
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 postgraduate and undergraduate members of the society.

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.
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 8528 / 3964
Email: colm.cunningham@tcd.ie

Neuroscience Degree coordinator:
Gavin Davey,
Trinity Biomedical Sciences Institute, Rm 5.06
(01) 896 8408
Email: gdavey@tcd.ie