**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. It also contains essential information about the current restrictions and procedures for conducting yourselves during this academic year in the shadow of the COVID19 pandemic. It is essential that you read the information that follows this foreward, on page 4.

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 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**

SS Neuroscience Coordinator

September 2020

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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

Prerequisites

(1) You will need to complete a College COVID-19 induction module in Blackboard.

(2) To comply with College and TBSI requirements for contact tracing purposes and also a daily declaration re COVID-19 symptoms, the School has created a minimal daily online log which takes about 20 seconds to complete and submit. **JS, SS and MSc students in the School** need to complete this log:

https://forms.office.com/Pages/ResponsePage.aspx?id=jb6V1Qaz9EWAZJ5bgvvlK0W WnvWNYqI0oCf4UxK880dURjNFT0dGTQyTlVFRzNMQjNPNlVESzhGTS4u

Please bookmark this page so you can access it easily and perhaps put a reminder in your calendar. **The log only needs to be completed if you are coming into TBSI.**

General Guidance Regarding COVID-19

It is highly recommended that students install the Safezone and the COVID Tracker (https://covidtracker.gov.ie/) apps.

At present (September 2020), the wearing of face masks is mandatory for all teaching and learning events for all students, in the Libraries, and public areas of the campus such as the Buttery and TBSI. Masks are not required if you are in a single occupancy office or while eating/drinking.

Trinity requires all students to wear face masks for all teaching and learning events including in laboratories.

There will cleaning stations set up in each room and students will wipe-on/wipe-off at the start and end of each lecture.

Food consumption in the Knowledge Exchange (37) and Tercentenary Bullnose (12) is allowed provided the maximum occupancy signs are observed and people sit well apart. Goldsmith Hall is also available.

Use clearly designated seating that maintains physical distancing.

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.
Hand sanitizers and 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, physical distancing and the wearing of face masks.

Use a one-way entry and exit route for buildings - where possible.

A one-person policy should be observed for all lifts on campus and to be used only by people with mobility issues or carrying heavy materials.

Stairs and corridors: A one-way, keep right and keep moving system has been drawn-up with stairs clearly identified and signed for ascent and descent.

Toilets: Signs have been placed on toilet doors reminding staff and students to maintain physical distancing and a maximum occupancy number will be displayed.

Gloves should not be worn unless to fulfil PPE requirements and must never be used as a substitute for hand hygiene.

After each group leaves a workspace, high-contact surfaces should be cleaned with water and detergent and not with disinfectant.

To the greatest extent possible, Trinity will keep records of attendance at all events for 4 weeks in case required for contact tracing purposes.

If people spend more than 2 hours or more in a shared space together, they may be regarded as COVID-19 contacts in the event that someone present is subsequently identified as a case.

If people are within 2 meters for >15 minutes, they may be regarded as COVID-19 contacts in the event that someone present is subsequently identified as a case.

For teaching and learning purposes, a physical distance of at least 1 m shoulder to shoulder should be maintained between students, with mandatory wearing of cloth face coverings, visors or face shields. For staff, a distance of 2 m should be maintained between the staff member and students. Where there is a risk that the 2 m distance could be compromised or where teaching activity requires the staff member to be less than 2m from the student, staff should wear a face covering, or other appropriate protection to be provided by the College.

This College website contains a useful FAQ:
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/
**Daily 5-point self-checks**

Ask yourself these 5 questions each day prior to travelling to College, do you have:

1. A recent cough?
2. Shortness of breath?
3. A new respiratory illness?
4. Fever?
5. Loss of smell or taste?

If you answer yes to any of the above, please contact your GP immediately, follow their advice and inform your Course coordinator.

**Response Plan for Dealing with a Suspected COVID-19 Case**

The guiding principles for dealing with a suspected case of COVID-19 are outlined below. In all such cases the safety of the person seeking attention and the accompanying person is paramount.

- Anyone who feels unwell with ‘flu or ‘flu-like symptoms in advance of coming to work will be informed that they must stay at home, contact their GP and follow the guidelines provided by the HSE

- In cases where the onset occurs on campus, the person who feels unwell will immediately report to the isolation room on the B1.18, TBSI and inform their Course Coordinator and COVID-19 Coordinator (Liam McCarthy), maintaining strict physical distancing of at least 2m throughout.

- The COVID-19 Coordinator, Course Coordinator and the Response Team will be provided with a COVID Kit equipped with hand sanitiser, wipes, tissues, face masks and latex gloves

- The isolation room will be equipped with a hand sanitiser, wipes, tissues, face masks, latex gloves and a clinical-waste disposal bin

- The unwell individual will be required to wear a face mask at all times and to avoid touching people, surfaces and objects

- The COVID-19 Coordinator/Course Coordinator/Response team will assist the unwell individual to contact the College Health Centre at (01) 896 1591/01 896 1556 or their own GP

- The COVID-19 Coordinator will report the incident and the use of the isolation room to College Security at (01) 896 1317
• The COVID-19 Coordinator/Course Coordinator/Response team will note the names and contact details (address, mobile number) of all people who work in the same area as the unwell person or who have come into close contact with the unwell person to provide to the HSE for the purposes of contact tracing.

• Following a suspected case being reported, the individuals in the building who have been in close contact (working in the same office/area or have been <2m from the person for more than 15 minutes) will be advised to go home, avoiding public transport, and follow HSE guidelines. All close contacts must avoid TBSI until the suspected case receives a negative result. For any confirmed case in TBSI, all close contacts must self-isolate for 2 weeks. All suspected or confirmed cases should be notified to their Course Coordinator, who in turn should notify the Director of TBSI.

• The COVID19 Coordinator for B&I/Compliance Officer/Safety Officer will contact Estates and Facilities to arrange a decontamination/deep clean of the areas where the person has been located.

**Guidance for Working in Laboratories and Reading Rooms**

Dr Darren Fayne, the School Safety Officer, will give two formal pre-recorded Health and Safety briefings wherein COVID-19 precautions will also be discussed.

In addition to the prerequisite COVID-19 induction module and online log mentioned above, you also need to complete a School of Biochemistry and Immunology specific online COVID-19 Training module available on Blackboard [http://mymodule.tcd.ie/](http://mymodule.tcd.ie/) in module BIP77100.

It is essential that you complete and submit this COVID-19 Training prior to commencing lab work. On the final results screen please copy the information from “User” to “Time elapsed”, include your name in the subject line and E-mail to Darren (fayned@tcd.ie).

Trinity requires all students to wear face masks for all teaching and learning events.

Personal Protective Equipment (PPE), such as a face mask, will be required for general research work. After use, PPE should be disposed of via the lab waste stream.

Standard laboratory PPE must be used by all researchers as they would normally do in the course of their work.

Laboratory groups are required to clean their workspaces (and instruments, including key pad on computer) with ethanol wipes or 70% ethanol at the beginning and end of the day or at the end of an instrument session.
Student project work needs to be incorporated into the pattern of attendance appropriate to the laboratory’s working needs while maintaining physical distancing and staying below the maximum occupancy levels.

Reading rooms can be used provided the maximum occupancy limits are observed. The rooms should only be used for essential research purposes as writing up of results should be done at home. Personnel must sit well apart to achieve a physical distancing of at least 1 metres and wear a face mask unless in a single occupancy office. It will not be possible, for example, to sit at adjacent desks.
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. Given the remote nature of lectures in semester 1 some modules may upload slides/videos at particular times of the day of the scheduled lecture rather than specifically at the time of the lecture. Please check with module coordinator if there is uncertainty about the arrival, on Blackboard, of course content.

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 or to the SS Course co-ordinator if necessary.

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

Course Co ordinator (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
Class List
Teaching staff: Senior Sophister Neuroscience program

Dr. Colm Cunningham, School of Biochemistry & Immunology (colm.cunningham@tcd.ie)
Prof. Gavin Davey, School of Biochemistry & Immunology (gdavey@tcd.ie)
Dr. Tomas 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. David Loane, School of Biochemistry & Immunology (loaned@tcd.ie)
Dr. Paul Dockree, School of Psychology (DOCKRREP@tcd.ie)

Overview

Course structure

<table>
<thead>
<tr>
<th>Module code</th>
<th>Module title</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIU44445</td>
<td>Neurochemistry II</td>
<td>5</td>
</tr>
<tr>
<td>GEU44500</td>
<td>Neurogenetics</td>
<td>5</td>
</tr>
<tr>
<td>PSU34710</td>
<td>Case Studies in Neuropsychology</td>
<td>5</td>
</tr>
<tr>
<td>PGU44004</td>
<td>Neurophysiology II</td>
<td>5</td>
</tr>
<tr>
<td>BIU44455</td>
<td>Neuroimmunology &amp; Neurodegeneration</td>
<td>5</td>
</tr>
<tr>
<td>NSU44PH2</td>
<td>Neuropharmacology</td>
<td>5</td>
</tr>
<tr>
<td>BIU44415</td>
<td>Research Literature Skills (Neuroscience)</td>
<td>10</td>
</tr>
<tr>
<td>NSU44490</td>
<td>Research Project</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>60</strong></td>
</tr>
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</table>
### Important Dates

<table>
<thead>
<tr>
<th>Event</th>
<th>Date/Time Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester 1 (teaching)</strong></td>
<td>Monday 28&lt;sup&gt;th&lt;/sup&gt; September – Friday 18&lt;sup&gt;th&lt;/sup&gt; December</td>
</tr>
<tr>
<td><strong>Semester 2</strong></td>
<td>Monday 1&lt;sup&gt;st&lt;/sup&gt; February – Friday 23&lt;sup&gt;rd&lt;/sup&gt; April</td>
</tr>
<tr>
<td><strong>Project Choices Due</strong></td>
<td>Friday 9&lt;sup&gt;th&lt;/sup&gt; October (2 pm)</td>
</tr>
<tr>
<td><strong>Research Project Begins</strong></td>
<td>Monday 19&lt;sup&gt;th&lt;/sup&gt; October</td>
</tr>
<tr>
<td><strong>Project design seminar</strong></td>
<td>Wednesday/Thursday 28-29&lt;sup&gt;th&lt;/sup&gt; October</td>
</tr>
<tr>
<td><strong>Literature Review Due</strong></td>
<td>Monday 23&lt;sup&gt;rd&lt;/sup&gt; November (12 noon)</td>
</tr>
<tr>
<td><strong>Semester 1 exams</strong></td>
<td>Week beginning January 11&lt;sup&gt;th&lt;/sup&gt; 2021</td>
</tr>
<tr>
<td><strong>Research Project Ends</strong></td>
<td>Friday 10&lt;sup&gt;th&lt;/sup&gt; March (subject to change)</td>
</tr>
<tr>
<td><strong>Thesis Submission Due</strong></td>
<td>Tuesday 6&lt;sup&gt;th&lt;/sup&gt; April (2 pm)</td>
</tr>
<tr>
<td><strong>Poster Presentations</strong></td>
<td>To be decided</td>
</tr>
<tr>
<td><strong>Semester 2 Exams</strong></td>
<td>Week beginning 10&lt;sup&gt;th&lt;/sup&gt; May (provisional)</td>
</tr>
</tbody>
</table>
Programme Structure: Module Summaries

**Neurophysiology II**

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.

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

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)
- B. Hille, Ion Channels of Excitable membranes, Sinauer (ISBN: 9780878933211)

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

11. Module Coordinator Eva Jimenez, Maeve Caldwell and Mark Cunningham.
Email: jimenez@tcd.ie, maeve.caldwell@tcd.ie and mark.cunningham@tcd.ie
Phone: 01896 2710, 01896 4852 and 01896 8569

Executive Officer: Christine Monahan
Email: physiol@tcd.ie
Phone 01 8962723
Module Descriptor – Neuropharmacology

1. Module Code: NS4PH2
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

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Topic &amp; Lecturer</th>
<th>Practical</th>
</tr>
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<tbody>
<tr>
<td>3</td>
<td>Introduction to Neuropharmacology</td>
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<tr>
<td>3</td>
<td>Depression</td>
<td></td>
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<tr>
<td>3</td>
<td>Antidepressants</td>
<td></td>
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<tr>
<td>4</td>
<td>Atypical antidepressants</td>
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<tr>
<td>4</td>
<td>Bipolar</td>
<td></td>
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<tr>
<td>4</td>
<td>Mood stabilisers – lithium</td>
<td></td>
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<tr>
<td>5</td>
<td>Anxiety disorders</td>
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<tr>
<td>5</td>
<td>Anxiolytics</td>
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<tr>
<td>5</td>
<td>Hypnotics</td>
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<tr>
<td>6</td>
<td>Schizophrenia</td>
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<tr>
<td>6</td>
<td>Antipsychotics</td>
<td></td>
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<tr>
<td>6</td>
<td>Drug dependence and addiction – reward circuit</td>
<td></td>
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<tr>
<td>7</td>
<td>Drugs of abuse</td>
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<tr>
<td>7</td>
<td>Anaesthetics (General)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Anaesthetics (Local)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Epilepsy</td>
<td></td>
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<tr>
<td>8</td>
<td>Anticonvulsants</td>
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<tr>
<td>8</td>
<td>Pain – processing</td>
<td></td>
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<tr>
<td>9</td>
<td>Reading Week</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Narcotic analgesics</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>other CNS acting analgesics</td>
<td></td>
</tr>
</tbody>
</table>
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:
   Brody's Human Pharmacology: Molecular to Clinical (6th Ed.) by Lynn Wecker
   Fundamentals of Psychopharmacology (3rd Ed.) by B. Leonard
   Molecular Neuropharmacology: A Foundation for Clinical Neuroscience (4th Ed.) by Eric Nestler, Steven Hyman, Robert Malenka
   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
Email: aharkin@tcd.ie
Phone: 01-8968575

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

12. Module Website: Not applicable
Module Descriptor - Case Studies in Neuropsychology

1. Module Code: PSU34710
2. Module Name: Case Studies in Neuropsychology
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: Paul Dockree
6. Learning 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

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

The following topics will be covered:

Introduction to concepts and methods in neuropsychology

Perceptual Disorders: Visual agnosia, Art and brain injury, Synaesthesia

Memory Disorders: Remembering and forgetting our autobiographical pasts, Confabulation

Executive function Disorders: Breakdown of executive functions, Dysexecutive Syndrome

Motivational Disorders: Apathy, Impulsivity and disinhibition
Metacognitive Disorders: Anosognoisa, Impaired self-awareness

Connectomics and neuropsychology: Diaschisis: remote effects of brain lesion, Maladaptive and compensatory brain changes, Guided recovery and rehabilitation

8. Learning outcomes

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

- 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.

9. Recommended reading

There is no core textbook for this module.

Journal articles: Articles from journals including *Brain, Neuropsychologia, NeuroCase, Cognitive Neuropsychology* and *Neuropsychological Rehabilitation* will be uploaded to Blackboard on a weekly basis together with each lecture.

Books for orientation to Neuropsychology:

*Into the Silent Land: Travels in Neuropsychology*. Paul Broks

10. Assessment details

100% Assignment in semester 1 examination period (subject to confirmation)

11. Module Coordinator

Paul Dockree
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Executive Officer:
Gabrielle McCabe
Email: gamccabe@tcd.ie
Phone: 01-8964195
Module Descriptor – Research Literature Skills

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
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

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic &amp; Staff</th>
<th>Practical</th>
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<tbody>
<tr>
<td>3</td>
<td>Tutorial on analysis and synthesis of research papers</td>
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<tr>
<td>3</td>
<td>Provision of articles for presentation 1 (Cunningham)</td>
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<tr>
<td>4</td>
<td>Presentation of papers (1) by individual students</td>
<td>Oral presentations</td>
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<tr>
<td>4-6</td>
<td>Students to choose own article for second presentation</td>
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<tr>
<td>6</td>
<td>Presentation of papers (2) by individual students</td>
<td>Oral presentations</td>
</tr>
<tr>
<td>14</td>
<td>Tutorial on ‘Journal comprehension’ examination paper</td>
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<tr>
<td>Jan 2021</td>
<td>Examination</td>
<td></td>
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</tbody>
</table>

8. Learning outcomes

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

- Perform a detailed dissection of a research paper, with attention to the details of the methods used, the results presented and the analysis used. 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.

- Demonstrate their ability to communicate effectively in an oral formats.
10. Assessment details

<table>
<thead>
<tr>
<th>Component</th>
<th>Weighting (ECTs)</th>
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<tr>
<td>Presentation 1</td>
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<tr>
<td>Presentation 2</td>
<td>2</td>
</tr>
<tr>
<td>Examination</td>
<td>6</td>
</tr>
</tbody>
</table>

11. Module Coordinator

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

Executive Officer:

Gabrielle McCabe
Email: gamccabe@tcd.ie
Phone: 01-8964195
Module Descriptor – Neurochemistry II

1. Module Code: BIU-44445
2. Module Name: Neurochemistry II
3. Semester taught: 1
4. Contact Hours: 16
5. Module Personnel: Drs 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 that underlie neurodegeneration and give rise to common neurodegenerative disorders.

7. Module content: Programme of lectures – All lectures are divided into 3 courses

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Topic &amp; Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Neurochemistry: Brain Biochemistry &amp; CNS Acting Drugs (Gavin Davey)</strong></td>
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<td></td>
<td>Energy producing systems in the brain</td>
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<td></td>
<td>Energy thresholds and mitochondrial dynamics</td>
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<tr>
<td></td>
<td>Neurotransmission studying techniques &amp; atypical neurotransmitters</td>
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<tr>
<td></td>
<td>Atypical neurotransmission</td>
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<tr>
<td></td>
<td>Melatonin &amp; aspartate neurotransmission</td>
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<tr>
<td></td>
<td><strong>Neurobiology (Gavin Davey)</strong></td>
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<tr>
<td></td>
<td>Molecular mechanisms of exocytosis</td>
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<td></td>
<td>Cholinergic signalling</td>
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<td>Molecular mechanisms in inhibitory neurotransmission</td>
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<td></td>
<td>Molecular mechanisms in excitatory neurotransmission</td>
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<tr>
<td></td>
<td>Molecular neurobiology underlying depression</td>
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<tr>
<td></td>
<td><strong>Neurodegenerative disorders: An interdisciplinary approach (David Loane)</strong></td>
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<td></td>
<td>Common mechanisms of neurodegeneration</td>
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<td></td>
<td>Alzheimer’s disease</td>
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<td></td>
<td>Parkinson’s disease</td>
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<td></td>
<td>Huntington’s disease</td>
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<tr>
<td></td>
<td>ALS (Motor Neuron Disease)</td>
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<tr>
<td></td>
<td>Stroke</td>
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</tbody>
</table>

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 satisifed 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 underlie neurodegenerative disorders.

To describe the multidisciplinary approach to understanding and treating neurodegenerative disorders.

9. Recommended Reading List:


Scientific publications provided at time of lectures

10. Assessment Details: Written examination 100%

11. Module Coordinator: Gavin Davey
   Email: gdavey@tcd.ie
   Phone: 01-868408

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

12. Module Website: Not applicable
Module Descriptor - Neuroimmunology & Neurodegeneration

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.

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Topic &amp; Lecturer</th>
<th>Practical</th>
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</thead>
<tbody>
<tr>
<td>Semester 2</td>
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<tr>
<td>26</td>
<td>Introduction to the immune system</td>
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<td>26</td>
<td>Neurotransmitter (ACh, NA, GC) effects on immune system</td>
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<tr>
<td>26</td>
<td>Brain as an immune privileged organ</td>
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<tr>
<td>26</td>
<td>Multiple sclerosis</td>
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<td>26</td>
<td>Innate immunity inflammation in CNS with acute insults.</td>
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<td>26</td>
<td>Spinal cord regeneration (David Loane).</td>
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<tr>
<td>26</td>
<td>Contribution of TBI to development of dementia</td>
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<td>26</td>
<td>Alzheimer’s disease (pathology, genetics &amp; development of Models)</td>
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<tr>
<td>26</td>
<td>AD: status of therapeutic efforts, inflammation</td>
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<tr>
<td>27</td>
<td>Systemic inflammation: Sickness Behaviour and impact on vulnerable states (delirium/dementia)</td>
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<tr>
<td>27</td>
<td>Discussion/Revision session</td>
<td></td>
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<tr>
<td>27</td>
<td>Common themes in neurodegeneration: prion disease</td>
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<tr>
<td>27</td>
<td>The prion concept &amp; protein aggregation</td>
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<tr>
<td>27</td>
<td>Parkinson’s, inflammation, β-synuclein, ubiquitin proteasome system</td>
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<tr>
<td>27</td>
<td>Autophagy</td>
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<tr>
<td>27</td>
<td>Prion disease, endoplasmic reticulum stress/unfolded protein response</td>
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<tr>
<td>28</td>
<td>Compartmentalised Neurodegeneration, synaptic loss</td>
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<tr>
<td>28</td>
<td>Axonal Degeneration, Huntington’s Disease, MND, Tau</td>
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<tr>
<td>28</td>
<td>Motor Neuron Disease, Stress granules, RNA-binding proteins</td>
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<tr>
<td>28</td>
<td>Discussion/Revision session</td>
<td></td>
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</tbody>
</table>
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 at the level of toll-like receptor activation, pro-inflammatory cytokine production, chemokine production, endothelial activation and cell infiltration
- Describe and discuss innate immune activation in infectious and sterile inflammation including stroke, TBI, spinal cord injury; encompassing 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, Parkinsons 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 text book for this module

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

Neurotransmitter and stress effects on immune function


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

Microglial activation states, DAMPs, PAMPS etc

Alzheimer’s disease and Immunotherapy

Systemic inflammation impact on the brain/sickness behavior, depression, delirium
• Saper CB, Romanovsky AA. Scammell TE. (2012). Neural circuitry engaged by prostaglandins during the sickness syndrome. Nature Neuroscience 15; 1088-1095

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)

10. Assessment details

100% Written exam. Semester II

11. Module Coordinator

Colm Cunningham
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01 896 3964

Executive Officer:
Gabrielle McCabe
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01-8964195
Module descriptor - Neurogenetics

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.


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

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

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: x1966

   Executive Officer: Genetics
   Email: genetics@tcd.ie
   Phone: x1140

12. Module Website: (not applicable)
Module Descriptor - Capstone Project

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%)

<table>
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<th>Practical</th>
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<tr>
<td>3</td>
<td>Provision of selection of projects (Cunningham)</td>
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</tr>
<tr>
<td>4</td>
<td>Deadline for submission of project choices</td>
<td>Laboratory work</td>
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<tr>
<td>6</td>
<td>Laboratory project begins (individual PI labs)</td>
<td>Laboratory work</td>
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<tr>
<td>7</td>
<td>Project design seminar (Cunningham &amp; other PIs)</td>
<td>Laboratory work</td>
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<tr>
<td>11</td>
<td>Submission of literature review</td>
<td>Laboratory work</td>
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<tr>
<td>7-14</td>
<td>Lab work continues</td>
<td>Laboratory work</td>
</tr>
<tr>
<td>23-28</td>
<td>Lab work continues</td>
<td>Laboratory work</td>
</tr>
<tr>
<td>28-30</td>
<td>Dissertation writing &amp; submission</td>
<td>Laboratory work</td>
</tr>
<tr>
<td>31</td>
<td>Poster presentation (Cunningham &amp; other PIs)</td>
<td>Poster presentation</td>
</tr>
</tbody>
</table>

* Due to COVID19 restrictions both timing and content of projects may be subject to change

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

<table>
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<tr>
<th>Component</th>
<th>Weighting in ECTs</th>
<th>(% of module)</th>
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</thead>
<tbody>
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<td>Literature review</td>
<td>5</td>
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</tr>
<tr>
<td>Project Design Seminar</td>
<td>2</td>
<td>(10%)</td>
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<tr>
<td>Lab Conduct &amp; competence</td>
<td>2</td>
<td>(10%)</td>
</tr>
<tr>
<td>Dissertation</td>
<td>10</td>
<td>(50%)</td>
</tr>
<tr>
<td>Poster presentation</td>
<td>1</td>
<td>(5%)</td>
</tr>
</tbody>
</table>

* Should COVID19 guidelines necessitate abandoning of lab activities, contingencies for adapting projects will be implemented

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 must not exceed 50 (again ±10%). If at all possible, reviews should 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 reference list.

- 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 and to colm.cunningham@tcd.ie by 12 noon on Monday 23rd 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 and you may be penalised. Similarly, planning a talk that does not use the time available and presents a very superficial background will not attract good marks.

At the current time, the proposal is that these presentations will happen in person but like everything else, this is subject to change according to COVID19 guidelines.

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).

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 of delivery
- Ability to answer reasonable questions about the study (NB it is your responsibility to ask the supervisor questions that are relevant to the study design in order to equip yourself for presenting the project)

Dissertation: Dissertations should be written according to the style outlined 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 for a neuroscientist but one not necessarily expert in the field of the specific project.

Although there is significant overlap, the literature review (which will have been submitted before starting in the laboratory) is not the same thing as the dissertation introduction and therefore that 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 conducted, providing essential information to place the work in context. Any recent literature that comes to your attention between October and February should of course be included. Changes in emphasis as a consequence of the realities of your research 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 references), with 1.5 spacing and font no smaller than 11 point. 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. This is the situation at the current time, but all submissions may be required to be electronic (for COVID19 reasons) by the time the submission date arrives.

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 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 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 some material from your Literature Review, but must be more focused on introducing the work that is 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 methodological approach to allow any neuroscientist to understand the techniques that underpin the research.

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
- 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 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 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

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project design seminar</td>
<td>Week beginning October 26th</td>
</tr>
<tr>
<td>Literature review submission</td>
<td>Monday November 23rd</td>
</tr>
<tr>
<td>Practical work ends</td>
<td>Friday 10th of March</td>
</tr>
<tr>
<td>Project report submitted</td>
<td>Tuesday 6th April (by 2 pm).</td>
</tr>
</tbody>
</table>
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 coordinator and the course administrator.

Attendance at Journal club sessions is compulsory. 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.

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 Coordinator 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://sciencedirect.com](http://sciencedirect.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/~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 numbers are provisional since the exact sequence will be determined by the examinations office

Semester 1 (Examinations in January 2021)

Paper 1 (16.66% of year): PGU44004 & NSU4PH2
Section I: Neuropharmacology (4 Questions, answer 2)
Section II: Neurophysiology II (2 Questions: either/or format)
Answer 4 Questions: Two from each section

Paper 2 (60% of module BIU44415 and 10% of year):
Analytical paper: Comprehension of a Journal article
Answer all Questions

Semester 2

Paper 3 (16.66% of year): BIU44445 & BIU44455
Section I: Neurochemistry II (4 Questions)
Section II: Neuroimmunology and Neurodegeneration (4 Questions)
Answer 4 Questions: Two from each from each section

Paper 4 (8.33 % of year): GEU44500
Neurogenetics (2 Questions: Either or format)
Answer 2 Questions: 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. 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.

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.

External Examiner (2018-2021)

Juan Bolanos (University of Salamanca)
**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**

* 48.33%: In-course assessments (24 ECTS)
  - Journal Club presentations (6.66%)
  - Neuropsychology essay (8.33%)
  - Research project (33.33%)
    - Literature review: 8.33%
    - Project design seminar: 3.3%
    - Supervisors conduct mark: 3.3%
    - Poster presentation: 1.65%
    - Project report: 16.65%

* 51.66%: Examinations (36 ECTS)
  - Paper I: 16.66% (2 full modules @ 8.33%)
  - Paper II: 10%
  - Paper III: 16.66% (2 full modules @ 8.33%)
  - Paper IV: 8.33%

**Overall degree mark**

* 80%: Senior Sophister marks
* 20%: Junior Sophister Neuroscience
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 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.

NB There may follow further updates on plagiarism with respect to use of sources during open-book examinations, which are likely to occur this academic year.

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 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;

(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>II-2</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>III</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></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><strong>Fail</strong></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><strong>Fail</strong></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 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 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
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.

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.
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

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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:

\[
* = P < 0.05, \quad ** = P < 0.01, \quad *** = P < 0.001.
\]

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 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 (eg) 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:


**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

[capitals 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 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. *Garamond* (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.
Appendix II: Longer Module descriptors
(new version implemented in 2020)

PGU-44004: Neurophysiology II (Semester 1)

Credits: 5

Mode of Assessment: End of semester examination

(a) Glial neurophysiology (Semester 1)
Credit weighting: 2.5 ECTS

Co-ordinator(s): Prof Maeve Caldwell and Dr Eva Jimenez

The module is designed to explore the neurobiology of glia and assess the impact of glia on the function of the nervous system. The first part of the module is designed to provide 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. The second part of the module is designed to provide an understanding of 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 in different scenarios.

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.

Total hours 11

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

(b) Advanced Topics in Neurophysiology

Term: Semester 1
Credit weighting: 2.5 ECTS
Lecturer: Prof. Mark Cunningham

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:**

NSU4PH2: Neuropharmacology (Semester 1)

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: 2 essay style questions

SUMMARY OF HOURS

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BIU-44445: Neurochemistry II (Semester 2)

Credits: 5

Mode of Assessment: End of semester 2 examination

(a) 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) Neurobiology (Semester 2)

Lecturer: Dr. Gavin Davey

This course will focus on the following topics:
Lecture 1:
- SNARE hypothesis of exocytosis:
- experimental approaches leading to this theory (biochemistry, 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

(c) Neurodegenerative disorders: An interdisciplinary approach

(Semester 2)

Lecturer: Dr. David Loane

This course will focus on the following topics:


References: to be supplied closer to lectures

Reading/Learning Resources:

- Proteins, Transmitters and Synapses by D.G. Nicholls (1994) Blackwell, Oxford – 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
BIU44455: Neuroimmunology & Neurodegeneration (Semester 2)

Credits: 5

Mode of Assessment: End of semester 2 examination

Lecturers: Dr. C. Cunningham, Dr. A. Dunne, Dr. D. Loane, 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, as well as neuropathological features and common mechanisms 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/immune tolerance

L5-7. Innate immunity inflammation in CNS with acute insults. PAMPs/PRRs, Microglial downregulators; Sterile inflammation, DAMPs in the context of neurodegeneration: infection, stroke, Traumatic brain injury, spinal injury regeneration.

L8-9. Alzheimer's (disease pathology, genetic basis and development of models, status of therapeutic efforts, inflammation)

L10. Systemic inflammatory impacts on the normal brain (Sickness Behaviour) and superimposed on vulnerable states (delirium/dementia)

L11-19*. Common themes in neurodegeneration: protein aggregation, ubiquitin proteasome system, inflammation, Tau, RNA binding proteins, mitochondrial dysfunction, axonal dysfunction: Parkinson’s, delirium, Huntingtons, Prion, motor neuron and

*Incorporating: 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.
- Describe and discuss innate immune activation in infectious and sterile inflammation including stroke, TBI, spinal cord injury; encompassing 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.

Reading/Learning Resources:

Reference Textbooks


Journal articles

Neurotransmitter and stress effects on immune function

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)

Microglial activation states, DAMPs, PAMPS etc


Alzheimer’s disease and Immunotherapy


Inflammatory mediator actions in the brain/sickness behaviour


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)
GEU44500: Neurogenetics (Semester 2)

Credits: 5

Mode of Assessment: End of year examination

(a) Behavioural Genetics (Hilary 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) 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:


**BIU44415: Scientific Literature Skills (Semester 1)**

Credits: 10

Modes of Assessment | Weighting (%)
--- | ---
End of sem. 1 examination | 60 %
Seminar/Journal Clubs | 40 %

**Lecturers:** Prof. Gavin Davey, Prof. Mark Cunningham, Prof. C. Cunningham, Prof. T. Ryan, Prof. David Loane & individual Literature review supervisors.

**(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 5-6 student presentations. 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 approximately 10 days in advance of the journal club. We suggest that that journal article chosen by the student could be related to the topic of their Senior Sophister research project. This course will also prepare students for an examination that is focused on the comprehension and dissection of a journal article. This exam will take place near or at the end of semester 2.

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

**Session 1:** Mon 16th September, 2-4 pm

**Session 2:** Tues 17th September, 2-4 pm

**Session 3:** Wed 18th September, 2-4 pm

**Session 4:** Thu 19th September, 10 am -12 midday

**Session 5:** Fri 20th September, 2-4 pm

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

**Session 1:** Mon 30th September, 10 am -12 midday

**Session 2:** Tues 1st October, 10 am -12 midday

**Session 3:** Wed 2nd October, 2-4 pm

**Session 4:** Thu 3rd October, 2-4 pm
**Session 5:** Fri 4\(^{th}\) October, 2-4 pm

**Assessment**

*Journal Club presentation:* 4 ECTS (2 ECTS per presentation) –

*Examination paper:* 6 ECTS

**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 classmates beforehand.
- The aim is to understand and explain the methodological approaches used and to critically assess the data presented with a view to understanding and critiquing (not simply accepting) the findings.

**On the day of the Journal Clubs:** Your participation in ALL the sessions is expected. The preparation for the exam *occurs in the journal club sessions through reading and dissecting the papers featured and through listening to the feedback and the explanations and discussion that arises in those sessions*. Therefore attendance is obligatory and we will be expecting you to ask questions since you should be reading the papers!