LF108-12 Cell Biology of Neurons

23/24

Department
Life Sciences
Level
Undergraduate Level 1
Module leader
Bruno Frenguelli
Credit value
12
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module will provide introductory understanding of the nervous system, concentrating on the physiology and cell biology of neurones.

Module aims

This module will cover the cell biology of neurons and glial cells of the nervous system. It will provide insight into the basic structure and function of these cells and describe the cell biological process that give rise to them (neurogenesis), allow them to migrate to their correct location, to establish synaptic and other contacts (axon guidance), to satisfy metabolic needs at sites distant from the cell body (axonal transport, localised protein synthesis and receptor trafficking). The aim of the module is to introduce the students to how the wiring of the nervous system arises through an understanding of the differentiation and development of individual cell types. Such process can go awry and give rise to neurodevelopmental conditions such as autism. The module will provide valuable knowledge that will aid student learning throughout the Neuroscience degree. While not a compulsory module, students of Neuroscience will be expected to take this module, but not taking it does not preclude students from other degree streams transferring to Neuroscience at the end of Year 1.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1 Overview of the nervous system

Basic review of the anatomy of the brain, spinal cord and cellular specialisations

1. Early brain development

Formation of the nervous system

1. Cellular anatomy and bioenergetics of the nervous system

Introduction to the cell types of the nervous system, their fuels and their genesis

1. Cellular migration in the nervous system

Origins and destinations

1. Construction of neural circuits

Neuronal polarization and site-specific protein synthesis as a prerequisite for circuit formation

1. Axon guidance and transport

Intrinsic and extrinsic signals determining axon elongation and development

1. Synapse formation

Activity-dependent formation, retraction and stabilisation of synapses

1. Critical periods in the development of the nervous system

Neural activity as determinant of brain development and maturation

1. Repair and regeneration in the nervous system

The damaged brain, repair and functional re-organisation

1. Neurogenesis and regenerative medicine

Evidence for neurogenesis and potential for stem cells in regenerative medicine

1. escape behaviour - Squid/aplysia
2. escape behaviour - Insects
3. escape behaviour - Vertebrates
4. Olfaction in mammals
5. Taste in mammals
6. Olfaction/taste insects
7. Temperature
8. Pain/touch
9. magneto/electrosensing

10. Time & Space perception

Workshop

Microscopic analysis of histological sections of brain tissue: matching form to function
Measurement of electrical activity in the nervous system

Learning outcomes

By the end of the module, students should be able to:

- Demonstrate understanding of cellular anatomy of the nervous system
- Demonstrate understanding of the differences in structure and function between different nervous system cell types
- Demonstrate understanding of neuronal cell differentiation
- Demonstrate understanding of neuronal cell migration
- Demonstrate understanding of axon guidance
- Demonstrate understanding of axonal transport
- Demonstrate understanding of localised proteins synthesis
- Demonstrate understanding of the establishment of synaptic contacts
- Demonstrate understanding of genetic mutations that disrupt these process and lead to clinical conditions
- Demonstrate an understanding of neurogenesis and the potential of stems cells in neurological disorders
- Demonstrate an understanding of sensory systems

Indicative reading list

Bear, Connors and Paradiso, Neuroscience – Exploring the Brain, 4th Edn. (Walters Kluwer, 2016).
Purves et al, Neuroscience 6th Edn. (Sinauer/Oxford UP, 2019)
Kandel, Schwartz, Jessell and Hudspeth, Principles of Neural Science, 5th edn. (McGraw-Hill, 2012).

Subject specific skills

LO1 Demonstrate understanding of cellular anatomy of the nervous system
LO2 Demonstrate understanding of the differences in structure and function between different nervous system cell types
LO3 Demonstrate understanding of neuronal cell differentiation
LO4 Demonstrate understanding of neuronal cell migration
LO5 Demonstrate understanding of axon guidance
LO6 Demonstrate understanding of axonal transport
LO7 Demonstrate understanding of localised proteins synthesis
LO8 Demonstrate understanding of the establishment of synaptic contacts
LO9 Demonstrate understanding of genetic mutations that disrupt these process and lead to clinical conditions

LO10 Demonstrate an understanding of neurogenesis and the potential of stems cells in neurological disorders
LO11 Demonstrate an understanding of sensory systems such as taste, olfaction, spaceand time perception

Transferable skills

Self directed learning, adult learning, team based learning, technology enhanced learning

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Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (15%)
Practical classes	2 sessions of 3 hours (5%)
Private study	107 hours (80%)
Total	133 hours

Private study description

Self directed learning and revision

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group D1

	Weighting	Study time
Neuronal Structure lab-based assessment	10%	
Electrical activity in the nervous system	10%	
Summer Exam	80%	

	Weighting	Study time
MCQ exam - delivered electronically in SLS		

Assessment group R1

	Weighting	Study time
Reassessment Exam (capped) September exam - locally arranged	100%	

Feedback on assessment

Written feedback

Past exam papers for LF108

Availability

Post-requisite modules

If you pass this module, you can take:

- LF268-15 Invertebrate Neuroscience

Courses

This module is Core for:

- Year 1 of ULFA-B140 Undergraduate Neuroscience (BSc)
- Year 1 of ULFA-B142 Undergraduate Neuroscience (MBio)
- Year 1 of ULFA-B143 Undergraduate Neuroscience (with Industrial Placement) (MBio)
- Year 1 of ULFA-B141 Undergraduate Neuroscience (with Placement Year) (BSc)