BS362-15 Integrative Neuroscience

21/22

Department
Life Sciences
Level
Undergraduate Level 3
Module leader
Nicholas Dale
Credit value
15
Module duration
10 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module will cover selected topics in contemporary neuroscience in a hierarchical manner. The content will be closely related to the research interests of the teaching staff. The overall aim of the module is to consider the important cellular components of the CNS and how these determine and contribute to the integrative function of the nervous system. The module will cover signalling in the CNS, genetic targeting and manipulation of brain cells, the roles of glial cells, cortical function and development, motor control, sleep, sexual behaviour and consciousness.

Module web page

Module aims

At the end of this module, a student should understand the mechanisms that control the electrical properties of neurons, why these are important, and the methods and mechanisms of communication used within the nervous system. The student should understand the operation of neural circuits in the context of motor control, how the components of neurons can influence the operation of these circuits, and how these circuits can generate both autonomic and higher-order behaviour. Students should understand how breakdown in the neural components can lead to disorders and the implications that such a breakdown has on human health. Students should understand how higher brain functions including consciousness can be studied

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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 Communication in the Nervous System (8 lectures - Dr. M. J. Wall/Professor N. E. Dale/ Professor G. Koentges)
Ion channels and how to study them, application of molecular methods, examples of function. Synaptic transmission using glutamate and GABA as models. Purinergic signalling – signalling roles of ATP and adenosine. Glial cells, their types and roles in the brain; glia – neuron communication. Signalling via gap junctions and hemichannels. Methods to visualize neuronal circuits, traditional and genetic. Genetic manipulation and targeting of specific cells in the brain. Optogenetic approaches to analyze and experimentally modify specific neuronal circuits.
Motor Control (2 lectures - Dr. M. J. Wall)
Role of cerebellum in motor control; motor learning; disorders of movement based on cerebellum. Disorders of movement based in higher centres: Parkinson’s, Huntington’s and the polyglutamine diseases. Development of Forebrain and Cortex (2 lectures - Professor G. Koentges)
Genetic control of forebrain development, specification of neuronal areas, development of the cortical regions and layers, the hippocampus, principles of circuit formation – we will explore the mechanisms by which the forebrain builds various maps of the outside world.
Cortical Function and Signalling (2 lectures - Dr. M. J. Wall)
These 2 lectures cover neocortical morphology and cortical wiring and discusses the emergent neural activity that can be produced. It also covers pyramidal cell properties and the different classes of GABAergic interneurons in the neocortex.
Neurobiology of Sleep (2 lectures - Professor N. E. Dale)
The functions of sleep, and the neural mechanisms that control sleep and wakefulness.
Higher Brain Function (1 lecture - Professor N. E. Dale)
What is consciousness? Split brain studies – what they reveal about the operation of the brain and neurobiological basis of consciousness.

Learning outcomes

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

- LO1 Demonstrate understanding of communication within the nervous system
- LO2 Demonstrate understanding of motor control and disorders that are associated with a breakdown in control mechanisms
- LO3 Demonstrate understanding of brain development and the R&D techniques needed to

study development
- LO4 Demonstrate understanding of cortical function and structure
- LO5 Demonstrate understanding of the neurobiology of sleep

Indicative reading list

Bear, Connors and Paradiso, Neuroscience – Exploring the Brain, 3rd edn. (Lippincott Williams and Wilkin, 2007).
Kandel, Schwartz, Jessell and Hudspeth, Principles of Neural Science, 5th edn. (McGraw-Hill, 2012).
More specific background literature will be supplied in conjunction with the lectures.

Subject specific skills

a. Demonstrate clear understanding of the scientific topic
Percentage
100%
BS362-12 as of 30th Jan 2021 at 07:00
b. Contain evidence of extended reading and lateral integration of material not covered in the lectures
c. Demonstrate independent thought and deep understanding
d. Specifically answer the set question using information from multiple lectures and sources
e. Be structured and formatted in a way that demonstrates understanding and logical flow
f. Use multiple sources to construct complex scientific arguments and integrating these to build and develop the student's own scientific conclusions.

Transferable skills

1. Critical appraisal of source material
2. Self directed learning
3. Adult learning

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (12%)
Private study	130 hours (76%)
Assessment	20 hours (12%)
Total	170 hours

Private study description

130 hrs of self-study and directed reading to prepare for the open book assessment

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

Assessment component	Weighting	Study time	Eligible for self-certification
Open Book Assessment	100%	20 hours	No

Final assessment for the module will be on open book assessment. This is an essay based assessment consisting of 4 questions- students need to answer 2. The essays cannot be answered using lecture notes alone- students will need to perform background research and essays will need to be fully referenced.

Reassessment component is the same

Feedback on assessment

Pastoral meetings with personal tutor

Availability

Courses

This module is Core for:

- Year 3 of ULFA-B140 Undergraduate Neuroscience (BSc)
- Year 3 of ULFA-B142 Undergraduate Neuroscience (MBio)
- Year 3 of ULFA-B143 Undergraduate Neuroscience (with Industrial Placement) (MBio)

This module is Optional for:

- Year 3 of UBSA-C700 Undergraduate Biochemistry
- ULFA-C1A2 Undergraduate Biochemistry (MBio)
    - Year 3 of C1A2 Biochemistry
    - Year 3 of C700 Biochemistry
- Year 4 of ULFA-C702 Undergraduate Biochemistry (with Placement Year)
- Year 3 of ULFA-C1A6 Undergraduate Biochemistry with Industrial Placement (MBio)
- Year 3 of UBSA-3 Undergraduate Biological Sciences
- Year 3 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 4 of ULFA-C113 Undergraduate Biological Sciences (with Placement Year)
- Year 3 of ULFA-C1A5 Undergraduate Biological Sciences with Industrial Placement (MBio)
- Year 3 of UBSA-C1B9 Undergraduate Biomedical Science
- ULFA-C1A3 Undergraduate Biomedical Science (MBio)
    - Year 3 of C1A3 Biomedical Science
    - Year 3 of C1B9 Biomedical Science
- Year 3 of ULFA-C1A7 Undergraduate Biomedical Science with Industrial Placement (MBio)
- Year 4 of ULFA-CB18 Undergraduate Biomedical Science with Placement Year