

Functional Aspects of the Central Nervous System (D012538)

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0

Study time 150 h

Course offerings and teaching methods in academic year 2025-2026

A (semester 2)

English

Gent

lecture

Lecturers in academic year 2025-2026

Labro, Alain

GE33

lecturer-in-charge

Lissoni, Alessio

GE33

co-lecturer

Offered in the following programmes in 2025-2026

[Master of Science in Biomedical Sciences](#)

crdts

5

offering

A

Teaching languages

English

Keywords

Synaptic communication, neural plasticity, neurotransmitters, LTP/LTD, Calcium-signaling, CNS disorders, stroke, Alzheimer's disease, dementia, learning & memory, glial cells, calcium signaling, ischemia, neuromuscular disorders, and neurodegeneration.

Position of the course

This course aims to provide knowledge, understanding, and insight into fundamental and clinical neurophysiology, based on selected neuroscience topics where significant new findings have recently emerged. The approach focuses on the molecular, cellular, electrophysiological, and systems levels, and includes methodological and technical aspects of research. The lectures are largely based on primary and secondary scientific source material. Active student participation is required, including reading and engaging in discussions of the assigned source materials.

Contents

- An update on the most important excitatory and inhibitory neurotransmitters and receptors, their downstream signaling, and prototypical examples of their connections.
- The role of glial cells in physiological and pathological conditions, including their involvement in synaptic communication, neurovascular coupling, and neurometabolic coupling within the central nervous system (CNS).
- In-depth study of glutamatergic synaptic communication.
- Mechanisms of long-term potentiation (LTP) and long-term depression (LTD), and the role of calcium signaling in learning and memory.
- Molecular pathways involved in Alzheimer's disease.
- Stroke: mechanisms and neurophysiological consequences.
- Neuromuscular and neurodegenerative disorders of both the peripheral and central nervous systems, including Charcot-Marie-Tooth disease (CMT), amyotrophic lateral sclerosis (ALS), and Parkinson's disease.
- Selected topics related to the visual system
- Selected methodological aspects of experimental neurophysiological research.

Initial competences

Having successfully completed the courses General biochemistry, Biochemistry II, Molecular biology I, Molecular biology II, General physiology, Physiology of the organ systems and Human pathogenesis from the bachelor program biomedical

sciences, or having acquired the desired knowledge by other means.

Successful completion of the bachelor degree in biomedical sciences or having acquired the relevant desired competence by other means.

Final competences

- 1 • Demonstrate knowledge of various types of glutamatergic transmission, the molecular and electrophysiological activity of glutamatergic receptors and specific synaptic function.
- 2 • Demonstrate knowledge of the most important modulatory neurotransmittersystems
- 3 • Identify and explain disturbances in neurotransmitter systems in neurological disorders.
- 4 • Explain the function and dysfunction of glial cells, and indicate their role in the function of the neural tissue.
- 5 • Describe the principles of neurovascular coupling and its relevance in brain physiology.
- 6 • Explain the basic mechanisms of long-term potentiation (LTP), long-term depression (LTD), and coincidence detection in the context of learning and memory.
- 7 • Describe the neuropathological mechanisms underlying Alzheimer's disease, stroke, and other neurodegenerative and neuromuscular disorders (e.g., ALS, CMT, Parkinson's).
- 8 • Discuss selected neurophysiological functions of the visual system.
- 9 • Demonstrate familiarity with key methodological approaches in experimental neurophysiology
- 10 • Critically engage with and make effective use of primary and secondary scientific source material as a learning and research resource.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, Independent work

Study material

None

References

- Roger Carpenter & Benjamin Reddi, Neurophysiology: A Conceptual Approach, Fifth Edition
- Duane E. Haines, Fundamental Neuroscience, Churchill Livingstone, recentste editie
- Squire et al., Fundamental Neuroscience, Academic Press, recentste editie
- Kandel et al., Principles of Neural Science, McGraw-Hill, recentste editie

Course content-related study coaching

Student questions can be directed to the lecturer, via email or at the occasion of the lectures.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment, Written assessment with multiple-choice questions, Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Oral assessment, Written assessment with multiple-choice questions, Written assessment with open-ended questions

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

There is **end-of-term evaluation** as well as **continuous assessment** during the interactive teaching activities. Continuous assessment is based on student participation and seminar presentation.

Calculation of the examination mark

The **final score** is the sum of the **end-of-term** and **continuous assesment** with a weigth of 85% and 15%, respectively.

The end-of-term assessment is a written examination composed of a MCQ part that counts for 45% of the final score and open questions that count for 40% of the final score. For the multiple choice questions (MCQ part) the principle of standard setting is applied.

The continuous assessment counts for 15% of the final score and includes evaluation on active participation during the course and the evaluation of a seminar presentation.