

BIO-499

**Neural circuits of motivated behaviors**

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<b>Cursus</b>	<b>Sem.</b>	<b>Type</b>
Life Sciences Engineering	MA2, MA4	Opt.
Neuro-X minor	E	Opt.
Neuro-X	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

Motivated behaviors fulfil the basic physiological needs of animals and enable their safety. In this course, you will learn about the neuronal circuits that detect potential dangers in the environment, sense internal states of the animals and initiate appropriate behavioral responses.

**Content**

- Fundamentals of brain anatomy in the mouse model
- Optogenetic and other techniques to study the structure, and function of neuronal circuits
- The nociceptive system; behaviors aimed at avoiding pain (nocifensive behaviors).
- The visual system and the visual midbrain: innate defensive behavior
- The olfactory system and the detection of other individuals; social behavior.
- Monitoring of internal bodily states by the brain (hypothalamus), and the regulation of energy state, water homeostasis, and temperature modulation.
- Concept of sensory stimuli / percepts with "positive" and "negative" valence
- Associative learning and how the brain attempts to predict future outcomes.
- Reward-based learning, instrumental learning; associated brain areas (cortex, striatum).
- Fear learning: Anticipation of situations with likely negative outcome (amygdala, midbrain, hypothalamus).

**Keywords**

animals, physiology, homeostasis, mouse model, brain anatomy, neuronal connectivity, neurotransmitters, glutamate, GABA, neuropeptides, physiological needs, safety, danger, fear, social behavior, associative learning, valence of a sensory percept

**Learning Prerequisites****Required courses**

BIO-482 (Neuroscience: cellular and circuit mechanisms)

**Recommended courses**

BIO-311 (Neuroscience)

BIO-377 (Physiology by Systems)

**Important concepts to start the course**

Good knowledge about basic neuroscience; curiosity and willingness to learn about new concepts.

**Learning Outcomes**

By the end of the course, the student must be able to:

- Systematize the knowledge of the methods used in research on neuronal circuits
- Assess / Evaluate critically the conclusions of a research paper in the area of neuronal circuit function in motivated behaviors
- Explain the basic functioning of neuronal circuits and their underlying functional neuroanatomy
- Design prototypic experiments testing the function of neuronal circuits in motivated behavior
- Draw simple circuit diagrams, which include the actions of neurotransmitters and neuropeptides, to illustrate the basic function of a neuronal / endocrine regulation circuit

### Transversal skills

- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Demonstrate the capacity for critical thinking
- Demonstrate a capacity for creativity.
- Summarize an article or a technical report.

### Teaching methods

Lectures (2h weekly); Exercises / group work with the teaching assistants (2h weekly)

### Expected student activities

- read background literature to the lectures
- read assigned research papers
- prepare presentations to discuss research papers
- pro-actively prepare for lecture content ahead of time
- perform work in small groups to discuss the course contents with fellow students and the teaching assistants

### Assessment methods

Thesis paper during semester (50%), and Written exam in exam period (50%)

### Supervision

Office hours	No
Assistants	Yes
Forum	No

### Resources

#### Virtual desktop infrastructure (VDI)

No

#### Bibliography

Principles of Neural Science. Ed. by E.R. Kandel, J.H. Schwartz, T.M. Jessell et al., McGraw-Hill Education / Medical (2013)