BIO-499

Neural circuits of motivated behaviors

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Cursus	Sem.	Type
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
Hours	**4 weekly**
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

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 sense and regulate internal states, detect dangers in the environment, and organize appropriate behavioral responses.

Content

- Fundamentals of brain anatomy in the human brain and the analogy in the mouse model.
- Experimental approaches to study the structure and function of neuronal circuits.
- Monitoring of internal body states by the brain: Regulation of energy state and water homeostasis (feeding and drinking behavior; hypothalamus)
- The nociceptive system and behaviors aimed at avoiding pain (nocifensive behaviors)
- Innate defensive behavior driven by visual and olfactory sensory cues.
- Learned defensive behaviors: Associative learning (amygdala and midbrain).
- Instrumental learning and the mechanisms of addiction (midbrain dopamine system, cortex, striatum)
- Neural mechanisms of social behaviors: sociability, recognition, sexual behavior and parenting
- Neural mechanism of aggressive behavior (hypothalamus, extended amygdala)
- Neural circuit mechanisms of psychiatric diseases

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 original scientific papers relating to the Material covered in the lectures
- read assigned research papers for the exercises
- 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 TAs

Assessment methods

Active participation in exercises (20%), and Written exam in exam period (80%)

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

1. Neuroscience Ed. by D. Purves, G.J. Augustine, D. Fitzpatrick, W. C. Hall, A.-S. LaMantia, and L. E. White, 5th edition, Sinauer Associates (2012)
2.
3. Principles of Neural Science. Ed. by E.R. Kandel, J.H. Schwartz, T.M. Jessell et al., McGraw-Hill Education / Medical (2013)
4. Principles of neurobiology. Liqun Luo, Garland science, New York (2016)

Ressources en bibliothèque

- Purves. Neuroscience
- Kandel. Principles of Neural Science

- Liqun. Principles of neurobiology