BIO-615

Neural circuits for reward and aversion learning

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Cursus	Sem.	Type
Neuroscience		Opt.

Language of teaching	English
Credits	2
Session	
Exam	During the semester
Workload	60h
Hours	**56**
Courses	4
Exercises	52
Number of positions	**12**

Frequency

Every 2 years

Summary

Animals must learn from past experiences, to adapt their behavior to an ever-changing environment. Students will learn about the neuronal circuit mechanisms of reward-based learning, and of aversively-mediated learning, by studying the current scientific literature on these topics.

Content

- Behavioral techniques, recording techniques, as well as circuit tracing and optogenetic approaches to study associative learning in rodents and monkeys

- Definition of reward, aversion, valence, conditioned stimulus (CS) and unconditioned stimulus (US)

- The crucial role of midbrain dopamine neurons in reward learning

- Synaptic inputs and outputs of a midbrain dopaminergic area

- Dopamine control of plasticity at excitatory synapses

- Acetylcholine signals for reinforcement learning

- Fear conditioning as a model for aversively-motivated learning

- Plasticity at excitatory synapses in the basolateral amygdala (BLA) as a substrate for fear learning

- Representation of signals with both positive and negative valence in the BLA

- In-vivo imaging of changes in the neuronal population response to a CS during fear learning

- What drives aversively-motivated learning? - a representation of painful stimuli via glutamatergic connections and/or neuromodulatory systems?

Note

Time: Thursdays 9:00 - 11:00 - from 23rd September (Week 1) to 4th November (Week 7) (first half of semester)
Thereafter, Wednesdays 9:00 - 11:00 - from 10th November (Week 8) to 22nd December (Week 14) (second half of semester)
By the end of this course, students should be able to critically assess the scientific literature that analyzes neuronal circuits in associative learning.

Keywords

Mouse behavior, reward, aversion, fear, valence, associative learning, neuronal circuits, optogenetics, in-vivo recording of neuronal activity, circuit mapping, conditioned stimulus, unconditioned stimulus.

Learning Prerequisites

Required courses

None

Recommended courses

'Neuroscience: cellular and circuit mechanisms (BIO-482)' or equivalent

Resources

Bibliography

- Published papers available online / in the EPFL library
- additional materials will be handed out when relevant