

Introduction to Neuroscience: Behavioral Neuroscience

Tali Kimchi, Rony Paz, Nachum Ulanovsky

Weizmann Institute of Science

2009-2010, 1st semester

Neuroscience Courses at the Weizmann Institute

Levels of Analysis of the Nervous System

Molecular →

Cellular →

Synaptic →

Network →

System →

Behavior →

Four Fundamental Courses in Neuroscience

(will be given in precise 2-year alternation, one course/semester)

**Introduction to Neuroscience:
Molecular Neuroscience – Concepts and Methods**
(yr 2010-2011)

**Introduction to Neuroscience:
From Neuron to Synapse**
(yr 2009-2010, course # 20103142)

← Goes more deeply
than “similar” B.Sc
courses

**Introduction to Neuroscience:
Sensory-Motor and Memory Systems of the Brain**
(yr 2010-2011)

**Introduction to Neuroscience:
Behavioral Neuroscience**
(yr 2009-2010, course # 20103151)

These Fundamental Courses are highly recommended for students interested in Neuroscience.

The four courses are independent of each other, and can be taken separately.

Full list of Neuroscience courses in Weizmann for the year 2009–2010

- **Basic Models in Theoretical Neuroscience** / Shriki, Schneidman - # 20103192
- **Intro to Neuroscience: Behavioral Neuroscience** / Ulanovsky, Paz, Kimchi - # 20103151
- **Intro to Neuroscience: From Neuron to Synapse** / Lampl, Reuveny, Segal, Ulanovsky - # 20103142
- Introduction to Computer Vision** / Ullman, Basri, Irani, Levin - # 20104041
- Methods in Neuroscience (*intensive 2-week lab course*)** / Segal *et al.* (6 teachers) - # 20103172
- Molecular Neurobiology: From Development to Function (*seminar*)** / Levkowitz, Yaron - # 20103131
- fMRI Methods** / Malach, Dinstein - # 20103212
- Neuroanatomy** / Chalamish - # 20103081
- Neuroimmunology** / Schwartz - # 20103161
- Selected Models of Dynamic Brain Processing** / Tsodyks - # 20103191
- Systems Neuroscience Seminar** / Ulanovsky, Paz - # 20103141
- The Neurobiology of Learning, Memory and Forgetting** / Dudai - # 20103132
- * Additional general courses recommended for students interested in Neuroscience:*
- Introduction to Matlab & Data Analysis** / Kronik - # 20103182
- **Mathematics for Biologists** / Shamash - # 20103201

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- A printed version of the List of Neuroscience Courses is available here ↓
- For questions about the Neuroscience Courses in general, or our course in particular, feel free to contact me during course breaks, or anytime at:

Nachum Ulanovsky (*coordinator of this course and of the Neuroscience Courses*)

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Course syllabus (by week)

Part A: Introduction to Brain and Behavior (Kimchi, Ulanovsky)

1) Overview of the course (Ulanovsky).

Introduction to Behavior (Kimchi).

2) Sensory ecology: evolutionary adaptations of animal sensory systems to their environment (Ulanovsky).

3) *No lecture (24/11/2009)*

4) Hormonal mechanisms of behavior. Sexual behaviors and their neural mechanisms (Kimchi).

Course syllabus (by week)

Part B: Neural mechanisms of Behavior: the Neuroethological approach (Ulanovsky)

- 5) Basic concepts: neuroscience and neuroethology.
Example system 1: Electrolocation in weakly-electric fish.
- 6) Example system 2: Multisensory integration in the brain of the barn owl.
(Guest lecture by: Dr. Yoram Gutfreund, Technion)
- 7) Example system 3: Echolocation in bats: behavior, principles of biosonar signal design, neural processing.
- 8) Example system 4: Neurobiology of spatial cognition. Introduction to spatial memory, orientation and navigation: (i) Navigational strategies in different animals. (ii) Sensory mechanisms of navigation: vision, magnetic navigation, etc.
- 9) The navigation circuits in the mammalian brain: Place cells, grid cells, head-direction cells. Computational models of navigation.

Course syllabus (by week)

Part C: Neural mechanisms of Behavior: the Neuropsychological approach (Paz)

10) Introduction: Basic concepts, standard behavioral tasks.

Example system 5: The representation and production of voluntary movement in the brain. Computational models of artificial and natural movements.

11) Example system 6: A neuroscience approach to the study of learning. Reward and its representation in neural circuits.

12) Fear and its representation in neural circuits.

13) Example system 7: A neuroscience approach to the study of Emotions.

Formalities

- Course Website (*will include ALL the presentations*):

www.weizmann.ac.il/neurobiology/labs/ulanovsky/IntroBehavNeurosci/syllabus.htm

- Grading: Final exam. 20% of the exam will be on classical papers in behavioral neuroscience, which will be distributed to the students as compulsory reading material (we will distribute them 3-4 weeks before the semester ends).
- Bibliography:
 - Behavioral Neurobiology, Carew (2000).
 - Behavioral Neurobiology: An Integrative Approach, Zupanc (2004).
 - Learning and behavior, Bouton (2007).
 - The computational neurobiology of reaching and pointing, Shadmehr & Wise (2005).
 - Sensory Ecology, Dusenbery D. (Freeman, 1992).
 - An introduction to behavioral endocrinology, 3rd ed., Nelson R. (Sinauer, 2005).