Introduction to Neuroscience: Behavioral Neuroscience

Weizmann Institute of Science

2019-2020, 2\textsuperscript{nd} semester

Coordinator: Nachum Ulanovsky
Core courses at the Weizmann Institute in Brain Sciences: Systems, Computational and Behavioral Neuroscience

Levels of Analysis of the Nervous System

- Molecular
- Cellular
- Synaptic
- Network
- System
- Behavior

Four Core Courses in Neuroscience

- Introduction to Neuroscience:
  Molecular Neuroscience - Genes to Behavior
- Introduction to Neuroscience:
  Cellular and Synaptic Physiology
- Introduction to Neuroscience:
  Systems Neuroscience
- Introduction to Neuroscience:
  Behavioral Neuroscience
Course coordinator: **Nachum Ulanovsky**

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**Course Website** *(will include ALL the presentations + zoom recordings):*

[www.weizmann.ac.il/neurobiology/labs/ulanovsky/courses](http://www.weizmann.ac.il/neurobiology/labs/ulanovsky/courses)

All lectures will be delivered via Zoom.

If we will return to frontal teaching – lectures will be delivered at the scheduled times in the location(s) listed on the website above.
Course syllabus (by week)

Characteristics of this course:

• No classical structure to courses in Behavioral Neuroscience (unlike the course in Cellular and synaptic Physiology) – as there is no Grand Theory of Behavior.

• We structured the course based on the Tradeoff between two approaches:
  The Neuroethological approach and the Neuropsychological approach.

<table>
<thead>
<tr>
<th>Part A: Introduction to Brain and Behavior (Ray)</th>
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<tbody>
<tr>
<td>1. Introduction to Behavior. (20/4/2020) [NOTE: special date. Monday 11:15-14:00. Location: Wolfson auditorium (the usual location)]</td>
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### Course Syllabus (by week)

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

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Date</th>
<th>Notes</th>
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<tbody>
<tr>
<td>3.</td>
<td>Sensory ecology: evolutionary adaptations of animal sensory systems to their environment. (27/4/2020)</td>
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<td>[NOTE: special date. Monday 11:15-14:00. Location: Wolfson auditorium (the usual location)]</td>
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<td>4.</td>
<td>Example system #1: Echolocation in bats: Sensory ecology, echolocation behavior, principles of biosonar signal design, neural processing. (30/4/2020)</td>
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<td>5.</td>
<td>Example system #2: Multisensory integration in the brain of the barn owl. (Guest lecture by Prof. Yoram Gutfreund, Technion) (7/5/2020)</td>
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<td>6.</td>
<td>Example system #3: The bird song system: behavior, neuroanatomy, physiology, models. (Guest lecture by Dr. Liora Las, Weizmann Institute) (14/5/2020)</td>
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<td>7.</td>
<td>Example system #4: Neurobiology of spatial cognition. Introduction to spatial memory and navigation: (i) Navigational strategies in different animals. (ii) Sensory mechanisms of navigation: vision, magnetic navigation, etc. The navigation circuits in the mammalian brain: Place cells, grid cells, head-direction cells, etc. (21/5/2020)</td>
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### Course syllabus (by week)

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

<table>
<thead>
<tr>
<th>Week</th>
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<th>Date</th>
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<tr>
<td>10</td>
<td>Example system #6: Reward-based learning and its neural basis. (18/6/2020)</td>
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<td>11</td>
<td>Example system #7: Decision-making in the brain. (25/6/2020)</td>
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<td>12</td>
<td>Visual psychophysics, visual perception. <em>(Guest lecture by Prof. Dubi Sagi, Weizmann Institute)</em> (2/7/2020)</td>
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</table>
Formalities

**Grading:** 100% - Final exam (*open material*). NO compulsory reading.

**Bibliography:**

We will use three main textbooks in this course:

- *Behavioral Neurobiology*, Carew J. (Sinauer, 2000)
- *Learning and Behavior*, Bouton M. (Sinauer, 2007)

Additional material for some of the lectures is covered in the following books:

- *Sensory Ecology*, Dusenbery D. (Freeman, 1992)