Welcome to the PSY397H Biological Rhythms, Winter, 2023.
Tuesdays 11am-2 pm.

Instructor: Dr. Martin Ralph Tel: (416) 978-7621 Room SS4017; Lab: (416) 978-3433
TA: Ann Zhang (416) 978-3433

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
<th>READINGS</th>
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<tbody>
<tr>
<td>Jan. 10</td>
<td>Biological and psychological representations of time; Temporal biology and the organization of living things; Adaptive significance; “hierarchy” of circadian clocks; Temporal programs.</td>
<td>A</td>
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<td>Jan. 17</td>
<td>Properties and synchronization of biological clocks. Resetting by light and nonphotic mechanisms including social zeitgebers and metabolism.</td>
<td>B</td>
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<td>Jan. 24</td>
<td>Molecular mechanisms of rhythm production and regulation – Molecular clocks throughout the living world. Discovery of clock genes. First models – Fruit flies, fungus.</td>
<td>C</td>
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<td>Jan. 31</td>
<td>The structure of circadian systems. Comparative anatomy and physiology across the 5 taxonomic groups.</td>
<td>D</td>
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<tr>
<td>Feb. 14</td>
<td>The &quot;other&quot; circadian systems? Food entrainable oscillators; amphetamine sensitive oscillators; metabolic clocks, circadian disorganization in chronic mental disorders.</td>
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<td>Feb. 21</td>
<td>Reading week (20 – 24)</td>
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<tr>
<td>Feb. 28</td>
<td>Non-circadian biological clocks: tidal, lunar, annual, ultradian Time memory, time-place learning and the perception of time</td>
<td>G</td>
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<td>Mar. 07</td>
<td><strong>TEST 2</strong> (30%) Covers up to and including Feb 28. Followed by: Seasonality,</td>
<td>H</td>
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<td>Mar. 14</td>
<td>Photoperiodic time measurement,Sleep, hibernation and memory</td>
<td>I</td>
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<td>Mar 21</td>
<td>Migration orientation and the sun compasses</td>
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<td>Mar. 28</td>
<td>Circadian disorganization, chronic disease, and longevity</td>
<td>J</td>
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<td>Apr. 4</td>
<td>The different conceptualizations of Time in biology. Integration of timing mechanisms; and adaptive significance for living beings</td>
<td>K</td>
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PSY397 Biological Rhythms

Tuesdays 11-2 pm

Instructor: Martin R. Ralph, Ph.D.
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Course description

Biological rhythmicity is found throughout Nature, from bacteria to humans. While all living systems display various cycles, specific types of rhythms have evolved which provide temporal organization to the physiology and behavior of organisms and the ability to anticipate regular, cyclic changes in their environments. These are what we call “biological clocks”. Some mechanisms have become adapted for use in complex behaviors such as migration, seasonality, and coordinated reproduction. In addition, organisms gain an adaptive advantage from being able to predict the possible recurrence of conditioned that they have experienced. This is time memory, an aspect of circadian biology that is used in concert with the biological clock to predict the likelihood that significant events are going to recur at the same time as the initial experience. In this course, we will examine both mechanisms, the highly conserved systems that predict the regular changes in the environment, as well as the systems that underlie the memory of events that are not regular, nor linked to specific times of day. We will review current findings at all levels of organization from molecular genetic, to anatomical, to behavioral, always coming back to the question of how these rhythmic systems are able to function to predict demand, thereby operating as biological clocks, and we will examine the consequences of disordered timing systems.

Marking scheme

Term test 1: 25%; Term test 2: 30%; Final 2 hour exam: 45%

Tests will be a combination of multiple choice, short answer, matching, and fill-in-the-blanks. Some minor arithmetic calculations are required for some questions. No aids are allowed on tests.

Missed tests may be made up only with University of Toronto approved documentation, and must be taken before marked tests are returned to the class (~1 week). Students who are unable to make up test must show evidence for why this was not possible, again with U. of Toronto approved documentation.

Asking questions, office hours and reviews

Within reason, you are encouraged to ask questions during the lectures. Bear in mind that although the instructor may be responsive in this way, your fellow students may not appreciate too many interruptions. The instructor will reserve some lecture time at the end of each class to answer questions. Official office hours: 11-12 am Fridays. Other hours by appointment.
Recommended resources


Seasons of Life: The Biological Rhythms That Enable Living Things to Thrive and Survive by Russell G. Foster and Leon Kreitzman | Jun 30 2009

TEXTBOOK (recommended)

The BioClock Studio, UCSD: https://ccb.ucsd.edu/the-bioclock-studio/index.html

Reading list (articles)

A. Week 1; January 10


B. Week 2; January 17


C. Week 3; January 24

7 Lundkvist, GB, Block, GD. (2005) Role of Neuronal Membrane Events in Circadian Rhythm Generation METHODS IN ENZYMOLoGY, VOL. 393:623-642.

D. Week 4; January 31


E. Week 5; February 7


F. Week 6; February 14


Week 7; February 21 READING WEEK
G. Week 8; February 28


