

*Advanced Neuroscience Laboratory*

**NROD63H3**

**(Wed 09:00-11:00 am; Thurs 12:00-13:00 pm)**

***Instructor: Suzanne Erb***

*Office: SW-531*

*Office hours: Wed 1:30-3:30 pm*

*E-mail: [erb@utsc.utoronto.ca](mailto:erb@utsc.utoronto.ca)*

---

***T.A.: Sarah Johnson***

*E-mail: [s.johnson@utoronto.ca](mailto:s.johnson@utoronto.ca)*

***COURSE DESCRIPTION***

This course is designed to introduce students to a variety of neuroanatomical techniques and histochemical procedures used in behavioural neuroscience, that permit scientists to link neurobiology with function and behaviour. The course will offer students in-depth training on how to navigate a brain atlas in order to identify neural regions of interest, and will provide demonstrations of how brain atlases can serve as powerful tools for many different applications in behavioural neuroscience. In addition, students will learn about the theory and methodology of several histochemical procedures that permit assessments of neural structure and/or function at different levels of analysis, including neuronal morphology, and gene and protein expression. As a major component of the laboratory exercises, students will learn how to analyze sets of tissue sections that have been prepared using the different different histochemical procedures.

***COURSE MATERIALS***

1. All students are required to purchase the following (available at UTSC bookstore):

Paxinos, G. & Watson, C. "The Rat Brain in Stereotaxic Coordinates: Compact 6<sup>th</sup> Edition", Academic Press, 2008.

2. All students are required to purchase a USB key for download of image files.

3. Assigned readings will be posted as PDF files on the intranet or be available on short-term loan in the library.

## ***COURSE COMPONENTS AND EVALUATION***

### **Summary of Evaluation:**

	<u>Percent of final grade</u>
Laboratories (4 in total)	40% (10% each)
Term Tests	30% (15% each)
Final exam	30%

### **Description of course components:**

#### ***1. Laboratories:***

Students will be required to complete 4 laboratory assignments over the course of the term. In Labs 1 and 2, students will become familiar with how to use the rat brain atlas as a tool for performing stereotaxic surgery (Lab 1) and guiding tissue sectioning (Lab 2). In Lab 3, students will work with image sets of neurons that have been traced from tissues processed with Golgi-Cox stain, and will learn how to use a computer software program (“ImageJ”) to analyze various attributes of cell morphology. In Lab 4, students will work with sets of autoradiographs obtained from tissue sections processed for in situ hybridization, and learn how to perform densitometry to determine levels of gene expression in specified brain regions.

Each laboratory will consist of a set of exercises that students will be required to complete. PDF files containing the background and instructions necessary to complete the exercises will be posted on the intranet; in addition, students will be given in-class instruction on all components of these assignments.

*Please note:* For Labs 1 and 2 (scheduled for Weeks 3 and 4), the class will be divided into two groups. Group 1 will receive instruction on and carry out Lab 1 in Week 3 and Lab 2 in Week 4; Group 2 will do the labs in the reverse order. Prof Erb will oversee Lab 1 for both groups, and Sarah Johnson will oversee Lab 2 for both groups. Please pay careful attention to what group you are in, and the room assignments corresponding to the two labs (see schedule below).

#### ***2. Term Tests:***

Two term tests will be given during class time (Feb 9, Mar 23). The tests will consist of multiple choice and short answer questions. Questions will include those with a focus on theory, as well as application and problem-solving.

#### ***4. Final Exam:***

The final exam will be scheduled during the exam period and, like the term tests, consist of multiple choice and short answer questions with a focus on theory, application, and problem-solving. *The final will be cumulative.*

### ***OVERVIEW OF LECTURE, LAB, AND TUTORIAL SCHEDULE:***

The following table presents the schedule of lectures, labs, and tutorials, as they will occur over the course of the term, and the due dates for assignments. There are a number of items to be noted in reviewing this schedule:

- Lectures and labs are scheduled for Wednesdays, and tutorials are scheduled for Thursdays.
- Locations for the various lectures, labs, and tutorials will change from week to week. The location for each class is indicated in red on the schedule. *Please be sure to consult the schedule each week before coming to class, so that you arrive at the right place at the right time!*
- Tutorials will sometimes be used to provide additional opportunities for students to work on their assignments, with T.A. support; other times, the tutorial hour will be required to complete in-class components of the laboratory assignments.
- All laboratory assignments are due at the start of the tutorial hour indicated in the schedule below.

**LECTURE, LAB, AND TUTORIAL SCHEDULE:**

<b>Week</b>	<b>Lecture/Lab Content (WED)</b>	<b>To Do for WED:</b>	<b>Tutorial (THURS)</b>	<b>Due in tutorial:</b>
<p><b>1</b> Jan 12/13 (W: SE Th: SJ)</p>	<p><b><i>Overview</i></b> -Course structure, content, objectives, and methods of evaluation</p> <p><b><u>Lecture</u></b> <b><i>Overview of methods in behavioural neuroscience:</i></b> Relating neuroanatomy and neurochemistry to function</p> <p><b><i>Location: SW-316</i></b></p>		<p>No class scheduled</p>	
<p><b>2</b> Jan 19/20 (W: SE Th: SJ)</p>	<p><b><u>Lecture</u></b> <b><i>Introduction to the brain atlas</i></b></p> <p><b><i>Location: SW-316</i></b></p>	<p>Read Preface of the “<i>Rat Brain in Stereotaxic Coordinates</i>” and become familiar with the layout of the atlas.</p> <p>Read Chapters 4 and 6 of “<i>Methods of Behaviour Analysis in Neuroscience</i>” (on short-term loan in library).</p>	<p>Description of course materials and their distribution</p> <p>Review of using the brain atlas</p> <p><b><i>Location: SW-316</i></b></p>	

<p><b>*3/4</b> Jan 26/27 and Feb 2/3 (W/Th: SE/SJ)</p>	<p><b><u>Lecture and Lab 1</u></b> <b><i>Stereotaxy</i></b></p> <p><b><u>Lecture and Lab 2</u></b> <b><i>Tissue Sectioning</i></b></p> <p><b><i>Locations: SW-148 (Lab 1); SW-316/ SW-229 (Lab 2)</i></b></p>	<p>Read Labs 1 and 2</p> <p>Review Preface of the “<i>Rat Brain in Stereotaxic Coordinates</i>” (in preparation for both labs)</p> <p>Read Chapters 4, 15, and 16 from “<i>Neuroscience Methods: A Guide for Advanced Students</i>” (in preparation for lecture on “Stereotaxy” and Lab 1)</p> <p><b>All Chapters are available in the library, on short-term loan.</b></p>	<p>Completion of in-class components of Labs 1 and 2</p> <p><b><i>Locations: SW-148 (Lab 1); SW-316/SW-229 (Lab 2)</i></b></p>	
<p><b>5</b> Feb 9/10</p>	<p><b><i>TEST 1</i></b></p>		<p>Additional time for Labs 1 and 2 with T.A. support</p>	

<p><b>6</b> Feb 16/17 (W: SE; Th: SJ)</p>	<p><b><u>Lecture</u></b> <b><i>Cell morphology (Golgi Cox Staining)</i></b></p> <p><i>Location: SW-316</i></p>	<p>Read Pannese E. (1999) The Golgi Stain: invention, diffusion and impact on neurosciences. <i>J Hist Neurosci.</i> Aug;8(2):132-40 (a pdf will be posted on the intranet).</p> <p>Read two original research articles (TBA; will be posted as pdf's on the intranet)</p>	<p>T.A. support and submission of assignments</p> <p><i>Location: SW-148</i></p>	<p>Labs 1 and 2</p>
<p><b>7</b> READING WEEK  Feb 23</p>	<p>NO CLASS SCHEDULED</p>		<p>NO CLASS SCHEDULED</p>	
<p><b>8</b> Mar 2 (SJ)</p>	<p><b><u>Lab 3</u></b> <b><i>Cell Morphology</i></b></p> <p><i>Location: SW-316</i></p>	<p>Read Lab 3</p>	<p>T.A. support for Lab 3</p> <p><i>Location: SW-316</i></p>	

<p><b>9</b> Mar 9/10 (W: SE; Th: SJ)</p>	<p><b><u>Lecture</u></b> <b><i>Gene expression (in situ hybridization)</i></b></p> <p><b><i>Location: SW-316</i></b></p>	<p>Read Chapter 27 from “<i>Neuroscience Methods: A Guide for Advanced Students</i>” (available on short-term loan in the library)</p> <p>Read 2 original research articles (TBA; will be posted as pdf’s on the intranet).</p>	<p>T.A. support and submission of assignments</p> <p><b><i>Location: SW-148</i></b></p>	<p>Lab 3</p>
<p><b>10</b> Mar 16/17 (SJ)</p>	<p><b><u>Lab 5</u></b> <b><i>Gene expression</i></b></p> <p><b><i>Location: SW-316</i></b></p>	<p>Read Lab 4 and prepare to begin in class.</p>	<p>T.A. support for Lab 4</p> <p><b><i>Location: SW-316</i></b></p>	
<p><b>11</b> Mar 23/24</p>	<p><b><i>TEST 2</i></b></p> <p><b><i>Location: SW-316</i></b></p>			

<p><b>12</b> Mar 30/31 (W: SE; Th: SJ)</p>	<p><b><u>Lecture</u></b> <b><i>Protein expression (immunocytochemistry)</i></b></p> <p><b><i>Location: SW-316</i></b></p>	<p>Read Chapter 19 from “<i>Neuroscience Methods: A Guide for Advanced Students</i>” (available on short-term loan in the library)</p> <p>Read 2 original research articles (TBA; will be posted as pdf’s on the intranet).</p>	<p>T.A. support and submission of assignments</p> <p><b><i>Location: SW-148</i></b></p>	<p>Lab 4</p>
<p><b>13</b> Apr 6/7 (W: Guest [TBA]; Th: SJ)</p>	<p><b><u>Lecture</u></b> <b><i>Genetic engineering techniques in behavioural neuroscience</i></b></p> <p><b><i>Location: MW-262</i></b></p>	<p>Assigned Readings (TBA)</p>	<p>T.A. support</p> <p><b><i>Location: SW-148</i></b></p>	