Neuroanatomy & Neurophysiology (PNB 2XB3)  

Fall Semester, 2020  

Thursdays, 7:00 – 10:00 PM

Following an introduction to the organization of the nervous system, this course describes the electrical and chemical properties of the fundamental unit of the nervous system, the neuron, and how neurons communicate with one another. It then surveys the physiology and functional anatomy of touch, vision, audition, vestibular sensation, movement, and memory. Both the normal functioning and particular pathologies of these systems are discussed. The course also surveys important neuroscience investigative techniques. Students complete in-class pop quizzes, weekly homework assignments, a midterm test, and a comprehensive final exam.

Instructor  
Dr. Daniel Goldreich, goldrd@mcmaster.ca  
Office hour: Wednesday, 4:30 - 5:20 PM, Zoom

Lecture Format  
Lectures will take place live using an online platform. The video-recorded lecture will be posted afterwards on Avenue for students to review.

Objectives  
Upon successful completion of this course, students will understand the:

- structure and subdivisions of the nervous system.
- organizing principles of functional neuroanatomy, such as contralaterality, topography, and bilateral symmetry.
- scales of the nervous system, such as the numbers and sizes of neurons, and the density of sensory receptors.
- electrochemical properties of the fundamental unit of the nervous system, the neuron.
- mechanisms underlying electrical impulse (action potential) formation and conduction.
- electrochemical events that occur at the site of inter-neuronal communication, the synapse.
- fundamental neurophysiological processes of the sensory systems, such as transduction and adaptation.
- pathways for touch and pain/temperature sensation, from the skin to the somatosensory cortex.
- biochemistry of phototransduction and adaptation in photoreceptors, and neural retinal circuitry.
- central visual pathways, including the retino-geniculo-cortical pathway, and how these contribute to visual perception.
- anatomy of audition, and mechanisms of acousto-electric transduction and sound localization.
- mechanisms of vestibular transduction, central vestibular pathways, and the etiology of common vestibular disorders.
- lower and upper motor control circuits, and the etiology of common motor pathologies.
brain areas involved in memory acquisition and storage, and associated memory pathologies.
mechanisms of synaptic plasticity thought to underlie several forms of learning and memory.
mechanisms of early neural development and neural circuity formation.
important histological, electrophysiological, and imaging techniques used to study the nervous system.

Required Materials
- Calculator: McMaster standard calculator (Casio FX-991). Students should bring their McMaster standard calculator to each class, the midterm test, and the final exam. No other calculator is permitted.

Evaluation
The student's course percentage score is a weighted average of the following five items:

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pop quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm Test</td>
<td>30%</td>
</tr>
<tr>
<td>Comprehensive Final Exam</td>
<td>40%</td>
</tr>
</tbody>
</table>

These item weightings are nonnegotiable and will not be modified at the request of the student.

Pop Quizzes
- The quizzes are in-class exercises designed to encourage critical thinking about neuroscience.
- Unless otherwise specified by the instructor, students are forbidden during the quizzes from using any material (e.g., textbook, notes) or any electronic device for assistance, with the exception of the McMaster Standard calculator (Casio FX-991). The instructor will announce whether a calculator is permitted for a pop quiz.
- At least one quiz will be given during each class period.
- Each quiz is marked as correct or incorrect (no partial marks).
- The student's quiz score for each class period will be the total number of quizzes answered correctly divided by the total number given, expressed as a percentage.

Homework Assignments
- Each homework assignment is due on Avenue prior to the start of the class period. Late homework submissions will not be accepted.
- Students are encouraged to type their answers whenever possible.
- Students are encouraged to study with a partner or in a group when attempting to answer the assignment questions. However, students must write their own assignment answers and
must submit their assignments individually. Copying part or all of another student's assignment is strictly prohibited and will result in a failing grade on the assignment.

- Points will be deducted for correct but irrelevant statements in students' answers.
- The relative point value of each question will be indicated on the homework assignment. The score for the entire homework assignment will always be reported on a 0-to-100% scale. For example, suppose an assignment has three questions, worth 10, 10, and 20 points. If a student earns half credit on the first question, full credit on the second, and half credit on the third, then the student's score will be 5 + 10 + 10 = 25, and the score will be reported as 62.5% (i.e., 25 / 40).
- At the end of the term, the student's lowest homework assignment score will be dropped. The average of the student's remaining homework assignment scores will then be calculated. This is the student's course homework score.

Midterm Test and Final Exam
- The midterm test and final exam contain some questions that require a calculator. Only the McMaster standard calculator is allowed.
- Any material covered in class (lectures and brain teasers) and in homework assignments may appear on the test or exam; questions based on this material will account for at least 90% of the points. In addition, some questions may be drawn from material in the assigned textbook chapters that is not covered in class or homework. These questions will be worth no more than 10% of the exam's points.
- Points will be deducted for correct but irrelevant statements in students' answers.
- The test and exam are given a mark on a scale from 0 - 100%.
- The midterm test includes material from all course topics covered prior to the test.
- The final exam is comprehensive; it includes material from all course topics.
- This course may use proctoring software for tests/exams. This software may require you to turn on your video camera, present identification, monitor and record your computer activities and lockdown your browser during the exam. This software may be required to be installed before the exam begins. If you have questions about whether this software will be used, or concerns about the use of this software, please contact the course instructor.

Course Percentage Score Calculation Formula
- Students' course percentage scores will be calculated according to the formula: Course percentage score = (course pop quiz score)(0.10) + (course homework score)(0.20) + (midterm test score)(0.30) + (final exam score)(0.40).
- Students' letter grades will be determined from their course percentage scores, as follows: A+ (90-100), A (85-89), A- (80-84), B+ (77-79), B (73-76), B- (70-72), C+ (67-69), C (63-66), C- (60-62), D+ (57-59), D (53-56), D- (50-52), F (0-49).
**Weekly Schedule**

Before each class, the instructor will post the majority of the slides to be shown in lecture. For your convenience, the slides will be posted in three PDF formats: Small (4 slides per page), Lined (3 slides per page, with lines on the right for taking notes), and Large (1 full-size slide per page).

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Date</th>
<th>Topic and Slides</th>
<th>Reading</th>
<th>Assignment Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept. 10</td>
<td>The Nervous System and the Resting Neuron</td>
<td>Chs. 1, 2, Appendix A1-A20</td>
<td></td>
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<tr>
<td>2</td>
<td>Sept. 17</td>
<td>The Action Potential</td>
<td>Chs. 2, 3, 4</td>
<td>Assignment 1</td>
</tr>
<tr>
<td>3</td>
<td>Sept. 24</td>
<td>Action Potential Conduction and Synaptic Transmission</td>
<td>Chs. 4, 5, 6 (p. 114-130)</td>
<td>Assignment 2</td>
</tr>
<tr>
<td>4</td>
<td>Oct. 1</td>
<td>Somatosensory System</td>
<td>Chs. 9, 10</td>
<td>Assignment 3</td>
</tr>
<tr>
<td>5</td>
<td>Oct. 8</td>
<td>Eye and Retina</td>
<td>Ch. 11</td>
<td></td>
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<tr>
<td>6</td>
<td>Oct. 15</td>
<td>Midterm Break (Reading Week)</td>
<td>Midterm Test Review Guide</td>
<td></td>
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<tr>
<td>7</td>
<td>Oct. 22</td>
<td>Midterm Test (2 hours)</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>Oct. 29</td>
<td>Central Vision</td>
<td>Chs. 12, 25 (p. 576 - 585)</td>
<td>Assignment 4</td>
</tr>
<tr>
<td>9</td>
<td>Nov. 5</td>
<td>Auditory System</td>
<td>Ch. 13</td>
<td>Assignment 5</td>
</tr>
<tr>
<td>10</td>
<td>Nov. 12</td>
<td>Vestibular and Motor Systems</td>
<td>Chs. 14, 16, 17</td>
<td>Assignment 6</td>
</tr>
<tr>
<td>11</td>
<td>Nov. 19</td>
<td>Synaptic Plasticity and Memory</td>
<td>Chs. 8, 30</td>
<td>Assignment 7</td>
</tr>
<tr>
<td>12</td>
<td>Nov. 26</td>
<td>Neural Development</td>
<td>Chs. 22, 23, 25</td>
<td>Assignment 8</td>
</tr>
<tr>
<td>13</td>
<td>Dec. 3</td>
<td>Neuroscience Cup course review</td>
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<tr>
<td>TBA</td>
<td>Final Exam (2.5 hours; comprehensive)</td>
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Note: The course schedule may be modified during the semester, at the discretion of the instructor. Any modifications will be made directly to the table above and announced in class.
Policies

Copyright Policy
In this course you will have access to material that is subject to copyright laws. This includes (but is not limited to) the course textbook and all resources developed by the instructor, such as quizzes, assignments, tests, class notes, lecture slides, and recordings. You are not allowed under any circumstance to share or redistribute this material in any printed or electronic form without the explicit written consent of the copyright holder. It is prohibited to post any of this course material to any internet site except the Avenue website for this course. Prohibited sites include, but are not limited to, course repositories, social networks, and any websites other than the course Avenue website.

Recording
Photographs and video recordings are strictly prohibited. The instructor will post an authorized video recording to Avenue following each lecture.

Email
In any email you send to the instructor or any teaching team member, please write "PNB 2XB3" in the subject line and send your email from your McMaster email address. Your email should concern logistical course issues only (e.g., to request an appointment, to ask for clarification regarding the due date of an assignment, etc.). Please do not email us with neuroscience questions; we will not answer such questions by email. Instead, specific neuroscience questions should be asked in the study sessions or in class. In addition, you are encouraged to ask questions on the Synapse discussion forum, where other students can help to answer them.

Assignment Submission
Homework assignments must be submitted on Avenue before 7:00 PM on the day of lecture. You are encouraged to type your assignment answers, but legible handwritten answers are also acceptable. Late submissions will not be accepted.

Missed Work
Please see the university policy statement concerning missed work. Students who are absent for no more than three days may report their absence, once per term, without documentation, using the McMaster Student Absence Form (MSAF). Please note that the MSAF may not be used for term work worth 25% or more of the course grade, nor can it be used for the final examination. This means that the MSAF cannot be used for the midterm test or the final exam in this course. Absences of more than three days must be reported to the student's Faculty/Program office, with documentation, and relief from course work may not necessarily be granted. A mark of zero will automatically be entered for all missed work until the instructor receives notification from the MSAF system or the student's Faculty Office and is contacted by the student to discuss how to remedy the missed work situation. It is the student's responsibility to learn all material that the student has missed for any reason. This can be done by reading the posted lecture notes and assigned textbook chapters, by consulting with classmates, and by attending office hours.
McMaster University Statement on Inclusivity and Academic Integrity
The University values integrity, inclusiveness and teamwork, and strives to support the personal and collective growth of the McMaster student community. These values are foundational to ensuring that campus environments – both in-person and virtual – are conducive to personal wellbeing and academic success.

As a McMaster student, you have the right to experience and the responsibility to demonstrate respectful and dignified interactions within all of our living, learning and working communities. Expectations are described in Code of Student Rights & Responsibilities, and additional helpful information can be found here.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms. Additional information about the Code and netiquette can be found here.

As a student, you are expected to behave honestly and ethically at all times. According to McMaster University's Academic Integrity Policy, you are engaging in academic dishonesty if you "knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage" (Academic Integrity Policy, p. 6). This behaviour can result in serious consequences, such as a grade of zero on an assignment, loss of credit with a notation on the transcript that reads “Grade of F assigned for academic dishonesty," and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. The following are just three forms of academic dishonesty:
1. Plagiarism.
2. Improper collaboration.
3. Copying or using unauthorized aids in tests and examinations.

For more information on academic dishonesty and academic integrity, please read the Academic Integrity Policy: http://www.mcmaster.ca/academicintegrity