

**PSYCH 3J03: Visual Neuroscience  
Course Syllabus**

*\*If you require this information in an alternate/accessible format, please contact Dr. Piskuric at (905) 525-9140 ext. 21331.*

|                       |  |
|-----------------------|--|
| <b>Instructor</b>     | Nikol Piskuric, Ph.D.  |
| <b>Office</b>         | Department of Psychology, Neuroscience & Behaviour, PC 108   |
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| <b>Office hours</b>   | By appointment.  |
| <b>Course Website</b> | Avenue to Learn ( <a href="http://avenue.mcmaster.ca">avenue.mcmaster.ca</a> ) Please check this site regularly for notifications and updates.   |
| <b>TA</b>             | Amanda Beers ( <a href="mailto:beersam@mcmaster.ca">beersam@mcmaster.ca</a> )  |

**Course Aim**

This course discusses visual neuroscience from the level of the cell (e.g., photoreceptor transduction) to the system (e.g., perceptual processing of faces and motion). Focus will be placed on primary research articles that have contributed to advances in the field.

**Intended Learning Outcomes**

By the end of this course, students should be able to:

1. Describe the mechanisms underlying visual transduction, processing, and perception.
2. Discuss some major experiments that contributed to our understanding of visual neuroscience.
3. Be able to read data from graphs, and create graphs to represent data.
4. Use critical thinking skills to solve novel problems related to visual neuroscience.
5. Interpret and summarize research articles related to visual neuroscience, and explain their basic scientific significance in an oral presentation format.
6. Work cooperatively and effectively in a group.

**Course Format**

This course consists of one 3-hr seminar per week, Wednesdays from 19:00 – 22:00 in ETB 235. Seminars will consist of lectures, in-class activities, and group presentations.

**Prerequisites**

PNB 2XA3 or PSYCH 2E03; and one of BIOLOGY 3P03, LIFE SCI 2C03, PNB 2XB3, PSYCH 2D03, 2F03, 2N03, 2NF3; and registration in Level III or IV of an Honours program; or PSYCH 2E03 and ISCI 2A18

**Courseware**

It is highly recommended that you purchase the PSYCH 3J03 courseware from *The Campus Store* (~\$40). The courseware contains 9 chapters from 3 textbooks that will be discussed throughout the course.

| <b>Course Assessment</b> | <b>(%)</b> |  |
|--------------------------|------------|--|
| Participation            | <b>10</b>  |  |
| Group presentation 1     | <b>10</b>  |  |
| Group presentation 2     | <b>15</b>  |  |
| In-class exercises       | <b>15</b>  | e.g. 5 x 3% each (best 5 of 8)                     |
| Mid-term                 | <b>20</b>  | 2 hours; multiple choice, short and long answer    |
| Final Exam               | <b>30</b>  | Cumulative; multiple choice, short and long answer |

### Group presentations

In groups of 3 (to be decided in the first day of class), you will give two, 30-minute oral presentation based on primary research articles. Research articles will be assigned two weeks prior to your presentation, so that all groups have an equal amount of preparation time. Please see the grading rubric on Avenue for details about grade breakdown. (*Note: this rubric is subject to modification.*) All members of a group will receive the same grade unless there is a major concern raised by one of the group members; in such cases, a group member's grade may be adjusted as per the discretion of the Instructor.

### In-class exercises

In-class exercises are short problem sets that you will work on during class time. The problems are based on weekly required readings/videos. You will work in groups of 3 to answer the problems, and one copy of the group's answer will be submitted to the TA for grading. Approximately 8 in-class exercises will be submitted; your best 5 grades will be used towards calculating your final grade.

### Participation

Participation will be based on your contributions to *lectures, discussions, and student presentations*. Full marks will be awarded for *relevant, constructive, and thoughtful* contributions.

### Midterm

The midterm examination is a 2-hr test written in-class on **Wednesday, October 28<sup>th</sup>**. The test will begin at 19:00 sharp and end at 21:00. ***There will be no make-up exam for students who miss the midterm.*** For those students who acquire the appropriate missed work documentation, the weight of the midterm will be reallocated to the final exam.

### Seeking Help

Please ask the course Instructor or TA for help at any time if you need it. As a learner, it is your responsibility to recognize when you need help and then ask for it.

### Student Services

Several services are available on campus to assist students. You are encouraged to visit the **Student Wellness Centre** (<http://wellness.mcmaster.ca>) for mental and/or physical health related issues, the **Student Accessibility Centre** (<http://sas.mcmaster.ca>) for academic or disability-related needs, and the **Student Success Centre** (<http://studentsuccess.mcmaster.ca>) for academic counseling, tutoring, and other academic and career support.

### Missed Work Policy

**For absences from classes lasting up to 3 days due to a medical or personal reason:**

Using the *McMaster Student Absence Form (MSAF)* on-line self-reporting tool, undergraduate students may report absences lasting up to **3** days and may also request relief for missed academic work worth less than **25%** of the final grade. The submission of medical documentation is normally not required. Students may use this tool to submit a maximum of **one** request for relief of missed academic work per term. Students must **immediately (within 2 days of the missed work)** follow up with their course instructors regarding the nature of the relief. Failure to do so may negate the opportunity for relief. ***The MSAF tool cannot be used to apply for relief for any final examination or its equivalent.***

**Students who (1) are absent for more than 3 days, (2) wish to submit more than one request for relief of missed academic work per term, (3) are absent for reasons other than a medical situation, or (4) missed work worth 25% or more of their grade, cannot use the**

**MSAF tool to request relief.** They MUST report to their Faculty Office to discuss their situation and may be required to provide appropriate supporting documentation.

**For absences from classes lasting more than 3 days, for work worth 25% or more, or for the reporting of more than one request for relief per term:** If the reason was medical, the approved McMaster University Medical Form covering the relevant dates must be submitted. The student must be seen by a doctor at the earliest possible date, **normally on or before the date of the missed work** and the doctor must verify the duration of the illness. Relief will not be considered for minor illnesses. If the reason is non-medical, appropriate documentation with verifiable origin covering the relevant dates must be submitted, normally within five working days. In some circumstances, students may be advised to submit a *Petition for Special Consideration (Form A)* seeking relief for missed academic work. In deciding whether or not to grant a petition, adequacy of the supporting documentation, including the timing in relation to the due date of the missed work and the degree of the student's incapacitation, may be taken into account. If the petition is approved the Faculty Office will notify the instructor(s) recommending relief. The student must contact the instructor promptly to discuss the appropriate relief. Failure to do so may negate the opportunity for relief. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work.

#### **Notice of changes to course structure**

The university reserves the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes. The professor reserves the right to change any and all course requirements if the need should arise. Any change in the course requirements will be posted on the webpage, and the details will be announced in class. Any concerns about announced changes should be addressed with the professor as soon as the changes are announced

#### **Academic Dishonesty**

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means, and can result in serious consequences for a student such as the grade of zero on an exam or assignment, loss of course credit with a notation on the student's transcript that reads "*Grade of F assigned for academic dishonesty*", and/or suspension or expulsion from McMaster University. It is your responsibility to understand what constitutes academic dishonesty. For example, plagiarism, improper collaboration, copying and/or use of unauthorized aids in tests and examinations (i.e. cheating) are just a few forms of academic dishonesty. For more information on academic integrity and the various kinds of academic dishonesty, please refer to McMaster's Academic Integrity Policy located at <http://www.mcmaster.ca/academicintegrity>.

#### **Grades**

Grades obtained in PSYCH 3J03 will be converted according to the following scheme.

|                |    |    |               |    |   |
|----------------|----|----|---------------|----|---|
| <b>90-100%</b> | A+ | 12 | <b>63-66%</b> | C  | 5 |
| <b>85-89%</b>  | A  | 11 | <b>60-62%</b> | C- | 4 |
| <b>80-84%</b>  | A- | 10 | <b>57-59%</b> | D+ | 3 |
| <b>77-79%</b>  | B+ | 9  | <b>53-56%</b> | D  | 2 |
| <b>73-76%</b>  | B  | 8  | <b>50-52%</b> | D- | 1 |
| <b>70-72%</b>  | B- | 7  | <b>0-49%</b>  | F  | 0 |
| <b>67-69%</b>  | C+ | 6  |               |    |   |

**List of Topics**

| Wk | Date  | Topic  | Readings  |
|----|-------|--|---|
| 1  | 9/9   | Structure of the eye and organization of the retina; neuroscience review         | <ul style="list-style-type: none"> <li>Wiesel, T. N. &amp; Raviola, E. (1977) Myopia and eye enlargement after neonatal lid fusion in monkeys. <i>Nature</i>, 266: 66-68.</li> <li><i>Video</i>: iBio seminar on Creating Effective Presentations by Susan McConnell, a Stanford neuroscientist<br/><a href="http://www.ibiology.org/ibioseminars/techniques/susan-mcconnell-part-1.html">http://www.ibiology.org/ibioseminars/techniques/susan-mcconnell-part-1.html</a>)</li> </ul>   |
| 2  | 9/16  | Phototransduction  | <ul style="list-style-type: none"> <li>Nicholls Ch. 20 1<sup>st</sup> half</li> <li>Altman, J. (1985) <i>New visions in photoreception</i>. <i>Nature</i>. 313: 264-265.</li> <li>Berson, D. M., Dunn, F. A., and Takao, M. (2002) Phototransduction by retinal ganglion cells that set the circadian clock. <i>Science</i>, 295: 1070–1073.</li> <li>Hartong, D.T. et al. (2006) Retinitis pigmentosa. <i>Lancet</i>, 368: 1795-1809. (<i>supplementary</i>)</li> </ul>  |
| 3  | 9/23  | Synaptic organization of the retina (incl. ribbon synapses, gap junctions, ERGs) | <ul style="list-style-type: none"> <li>Nicholls Ch. 20 2<sup>nd</sup> half</li> <li>Bloomfield, S.A. &amp; Volgyi, B. (2009) The diverse functional roles and regulation of neuronal gap junctions in the retina. <i>Nat. Rev. Neurosci.</i>, 10: 495-506.</li> <li>Matthews, G. &amp; Fuchs, P. (2010) The diverse roles of ribbon synapses in sensory neurotransmission. <i>Nat. Rev. Neurosci.</i>, 11: 812-822. (<i>*only the sections pertaining to the retina</i>)</li> <li>Wassle, H., (2004) Parallel Processing in the Mammalian Retina. <i>Nat. Rev. Neurosci.</i>, 5:1-11. (<i>supplementary</i>)</li> </ul> |
| 4  | 9/30  | Central visual pathways; receptive fields of LGN and cortical cells              | <ul style="list-style-type: none"> <li>Nicholls Chapter 2</li> <li>Kuffler, S. W. (1953) Discharge patterns and functional organization of the mammalian retina. <i>J. Neurophysiol.</i>, 16: 37–68. (<i>supplementary</i>)</li> </ul>  |
| 5  | 10/7  | Retinotopic map, ocular dominance columns and orientation columns in V1          | <ul style="list-style-type: none"> <li>Nicholls Chapter 3</li> <li>Hubel, D. H., and Wiesel, T. N. (1968) Receptive fields and functional architecture of monkey striate cortex. <i>J. Physiol.</i>, 195: 215–243.</li> <li>Ohki, K. et al. (2006) Orientation pinwheels. <i>Nature</i>. 442, 925-928.</li> </ul>   |
|    | 10/14 | <b>Reading week – no class</b>   |   |
| 6  | 10/21 | Colour vision; glial cells in the retina   | <ul style="list-style-type: none"> <li><i>Chaudhuri Ch. 11</i></li> <li>Jacobs, G. H. &amp; de Valois, R. L. (1965) Chromatic opponent cells in squirrel monkey lateral geniculate nucleus. <i>Nature</i>, 206, 487-489.</li> <li>Reichenbach, A. &amp; Bringmann, A. (2013) New functions of Muller cells. <i>Glia</i>, 61: 651-578. (<i>Time permitting</i>)</li> </ul>   |
| 7  | 10/28 | <b>In-class midterm 7:00 – 9:00 pm</b>   |   |
| 8  | 11/4  | Intermediate- and high-level visual processing                                   | <ul style="list-style-type: none"> <li>Nicholls Ch. 23 (Constructing Perception)</li> <li>Kandel Ch. 28 (High-Level Processing)</li> </ul>  |
| 9  | 11/11 | Depth perception and stereopsis  | <ul style="list-style-type: none"> <li>Chaudhuri Ch. 12 (Depth Perception and Stereopsis)</li> </ul>  |
| 10 | 11/18 | Superior colliculus and eye movements  | <ul style="list-style-type: none"> <li>Kandel Ch. 39 (The Control of Gaze)</li> </ul>   |

|    |       |                 |  |
|----|-------|-----------------|--|
| 11 | 11/25 | <b>Topic</b>    | Development of the visual system   |
|    |       | <b>Readings</b> | <ul style="list-style-type: none"><li>• Grafstein, B. (2006) Roger Sperry: pioneer of neuronal specificity. <i>J. Neurophysiol.</i>, 96: 2827-2829.</li><li>• Sperry, R. W. (1944) Optic nerve regeneration with return of vision in anurans. <i>J. Neurophysiol.</i>, 7:57-69. (<i>supplementary</i>)</li><li>• Wong, R. et al. (1995) Spontaneous retinal waves in developing retina. <i>Nature</i>, 374: 716-718.</li><li>• Cang J., et al. (2005) Development of precise maps in visual cortex requires patterned spontaneous activity in the retina. <i>Neuron</i>. 48(5): 797-809.</li></ul> |
| 12 | 12/2  | <b>Topic</b>    | Plasticity in the visual system  |
|    |       | <b>Readings</b> | <ul style="list-style-type: none"><li>• Kandel Ch. 56 (Experience and the Refinement of Synaptic Connections)</li><li>• Daw, N.W. (2009) The foundations of development and deprivation in the visual system. <i>J. Physiol.</i>, 587(12):2769-2773.</li></ul>   |