

# NROC64: Sensorimotor Systems

## I) Course information

Course number: NROC64H3 S

Tuesdays: 3-5 pm  
Place: HL 001

Prerequisites: (BIOB30H &) NROB60H, exclusion (but not equivalent): PSY290H

## II) Instructor:

Dr. Matthias Niemeier  
1265 Military Trail SW550  
e-mail: psyb51@utsc.utoronto.ca  
Office Hours: Wednesdays 2:30-3:30pm

## III) Teaching Assistants:

Teddy Cheung, Annabel Fan, & Lawrence Guo

## IV) Blurb

A focus on the mechanisms by which the nervous system processes sensory information and controls movement. The topics include sensory transduction and the physiology for sensory systems (visual, somatosensory, auditory, vestibular). Both spinal and central mechanisms of motor control are also covered.

## V) Course readings (required)

### Textbook

**Title:** Neurophysiology. A Conceptual Approach  
**Authors:** R. Carpenter & B. Reddi  
**Publisher:** Hodder Arnold  
**ISBN:** 978-1-4441-13517-6

### Additional readings

There will be additional readings. These readings are selected chapters from textbooks, and scientific articles. The latter are mainly research articles that report on a piece of scientific work. The idea behind these readings is that you have a chance to practice reading scientific articles. Being able to do so is an absolute must in many professional areas, inside and outside the university. Because this is a skill there is no other way to learn it but to practice.

## VI) Web pages

### Course Web Site: Quercus

Here you will find the syllabus, and announcements. Also, I will put the lecture slides on that page.

Please check on a regular basis for announcements.

## VII) Evaluation

### 5% Quizzes

Format: 10 true/false questions during lectures 2-12, top 8 quizzes will be counted

<b>10%</b>	<b>Thought paper 1</b>	Written assignment, 2 pages, double-spaced
<b>5%</b>	<b>Thought paper 1</b>	Resubmission including revisions
<b>10%</b>	<b>Thought paper 2</b>	Written assignment, 2 pages, double-spaced
<b>5%</b>	<b>Thought paper 2</b>	Resubmission including revisions
<b>20%</b>	<b>Mid-term test</b>	Format: short answer questions. 60 minutes.
<b>45%</b>	<b>Final Term test</b>	120 minutes. Same format as the mid-term

**Quizzes** are meant to encourage you to read and prepare the material for a given lecture ahead of time and properly prepare the facts for the respective lecture. Given this objective, it follows that there is no opportunity to make up for missed quizzes. That said, only the top 8 quizzes will be counted, i.e., missing a quiz wouldn't impact your grade. The material tested in the quizzes comes from the readings for the respective week. Quizzes will consist of 10 yes/no or true/false questions about reading material of the respective lecture. Quizzes will take the first 5-10 min of each lecture. If you have scores for more than 8 quizzes I'll pick your top 8 scores.

The **mid-term test** and the **final exam** will be equivalent in format and will have short-answer questions only. Short answer questions are more suitable for measuring conceptual understanding of material, beyond memorizing and recognizing facts.

Material on the exams will include lecture material and text readings. Although the topics covered will overlap, different things may be emphasized in class than in the book or other readings. I recommend reading all the materials and I do urge you to attend all classes. If you miss a class, please make sure to have someone take notes for you. Lectures will not be recorded, and please do not tape the lectures.

It is important that students can demonstrate their intellectual command of the subject matter of this course *in its entirety* at the end of the term. Consequently, it is essential that the final exam provide a comprehensive (cumulative) assessment of the course. Given the stress that cumulative final exams produce, students will have the opportunity to take one term test to gain an interim assessment of their ongoing command of the course material. The term test will be one hour long and will be held in class. The mid-term test (20%) will cover Weeks 1 to 5. The final exam (45%) will cover the course in its entirety. There will be one question for each lecture.

Summary:

- The first midterm (20%) will cover Part I (Weeks 1-5).
  - A cumulative final exam (45%) will cover all Parts (Weeks 1-5, 7-12)
- = 20% [Part I] + 25% [Part II] = 45%.

However, if your performance on the final exam with respect to Part I is greater than your performance on the term test, then I will let your performance on that part of the final exam assume a weight of 40% and your term test grade will not count. In other words, if you can improve from the term test to the final exam, then the term test will be nothing but a practice test. However, there is one condition: your mid-term grade needs to be 40% or better for this rule to apply. That is, it will be imperative to prepare for the midterm.

Here the formalized rules:

Mid-term = MID

Final Part I = FIN1

Final Part II = FIN2

If FIN1 better than MID **and** if MID = 40% or better, then FIN1 weighs 40%, MID weighs 0% of total grade.

If MID better than FIN1 **or** if MID less than 40%, then MID weighs 20%, FIN1 weighs 20% of total grade.

FIN2 always weighs 25%.

**Missing mid-term.** Under exceptional circumstances students may miss a mid-term test. All students citing a documented reason for missed term work are instructed to bring their documentation to the Departmental Assistant Keely Hicks (SW420B) for tracking purposes. Valid reasons are: a verified illness, a serious family emergency or religious observances (invalid reasons: vacations, time conflicts with other courses, or with work schedules). In most instances you will need to provide documentation for your valid reason. For example, with respect to absences due to illness, you will need to provide a valid UTSC Medical Certificate. It is your responsibility to make sure that medical certificates are

- filled out completely and sufficiently,
- filled out by an expert (medical doctor, counselor etc. – see top of the certificate)
- filled out on the day of the exam,
- submitted to Keely within 3 business days of the mid-term.

**Final Exam Policies & Procedures.** The scheduling of final exams and the granting of petitions to defer final exams are matters that fall entirely within the jurisdiction of the Registrar's Office. If you have any concerns relating to your final exam attendance, please contact the Registrar.

**Thought papers.** There will be 2 written assignments, called 'thought papers'. Each of them will be 2 pages long, double-spaced. The idea is to write about one of your own ideas about one research paper. Format is as follows

- 1 paragraph Introduction beginning with a 2-3 sentence long summary of the article (perhaps preceded by a more general statement about the concept that is investigated etc. – 'bigger picture') about one research article (see marked below). The Introduction needs to end with a thesis statement.
- It follows about 1, 2, 3 paragraphs on your own thought about the article. Focus on one thought only.
- Conclusions: 1 paragraph. Summarize what you've been talking about

More information about the t-papers will be posted on Quercus. This includes a document on how to write the written assignment and 2 sample papers. Submission is by Turnitin. Late submissions mean a deduction of 10% of the thought paper grade per late day. Please make sure you write a genuine paper. We will feed the papers into Turnitin.

Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting

plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com website.

### Help With Writing

If you would like help with academic writing, the following resources are available to you:

- The Centre for Teaching and Learning (AC312) Writing Centre offers students one-to-one appointments and supplementary materials to help improve upon their writing skills. <http://ctl.utsc.utoronto.ca/home/> <http://ctl.utsc.utoronto.ca/twc/>
- The English Language Development Centre offers support and specialized writing programs for students who do not speak English as their primary language. <http://ctl.utsc.utoronto.ca/eld/>
- Advice on academic writing <http://www.writing.utoronto.ca/advice>

### Literature Searches

Students can use the following resources when conducting literature searches to find relevant articles for their presentation and final essay:

The UTSC Library (AC235)

<http://www.library.utoronto.ca/utsc/>

PubMed

<http://www.ncbi.nlm.nih.gov/pubmed>

PsychINFO

<http://www.apa.org/pubs/databases/psycinfo/index.aspx>

Google Scholar

<http://scholar.google.ca/>

**Difficulties with the course:** Please talk to me if you are having difficulties with the course. The earlier the better. I will try my best and be happy to help. Please note, that as per university policy it is not possible to negotiate better grades for other reasons than merit.

## VIII) Schedule

This schedule is subject to changes as we go along, please see intranet for updates. Bear = chapter from Bear textbook, Carp = chapter from Carpenter textbook, AR = additional reading(s)

Lecture	Title	Readings
<i>----- Senses -----</i>		
Week 1	Introduction, Vision 1	Carp7: optics, accommodation, acuity
Week 2	Vision 2	Carp7: retina, visual pathway; visual cortex; AR1
Week 3	Skin, proprioception, vestibular system; Multisensory perception	Carp4; Carp5; AR2
<i>--- Muscles &amp; sensorimotor control ---</i>		
Week 4	Muscle physiology; Motor systems	Bear13 (muscle physiology only); Carp9: p.189-191 (not "Direct feedback")

Week 5	Motor systems cont'd	Carp9: p.191-end; AR3
<b>Week 6</b>	<b>MID TERM (in class, no lecture)</b>	
Week 7	Local motor control	Carp10
----- <i>Sensorimotor systems</i> ----		
Week 8	Oculomotor system, VOR	Tutis Vilis' webpage; AR4
Week 9	Spatial stability	AR5
Week 10	Posture	Carp11; AR6
Week 11	Higher motor functions, cerebellum, BG	Carp12
Week 12	Pointing, reaching and grasping; joint actions	AR7

### Additional readings:

AR1 Jeong, S. K., Xu, Y. (2016). Behaviorally relevant abstract object identity representation in the human parietal cortex. *J Neurosci* 36:1607-1619.  
+ Freud, E., Plaut, D. C., Behrmann, M. (2016). 'What' is happening in the dorsal visual pathway. *TICS* 20:773-784. **Only read:** "Two Cortical Visual Pathways" **and study** Figure 1 and its figure caption.

AR2 Wallace MT, Perrault TJ, Hairston WD, Stein BE (2004). Visual experience is necessary for the development of multisensory integration. *J Neurosci*, 24(43):9580-4.

AR3 Frost, A., Niemeier, M. (2015). Suppression and reversal of motion perception around the time of the saccade. *Front Syst Neurosci*, 31:9:143

AR4 Goldberg ME (2000). Control of gaze. In: Kandell & Schwartz. *Principles of Neuroscience*. MIT

AR5 Wurtz RH, McAlonan K, Cavanaugh J, Berman RA (2011). Thalamic pathways for active vision. *Trends Cogn Sci*, 15(4):177-84.

AR6 Karnath HO, Ferber S, Dichgans J (2000). The origin of contraversive pushing: evidence for a second graviceptive system in humans. *Neurology*, 14, 55(9):1298-304.

AR7 Vesia M, Crawford JD (2012). Specialization of reach function in human posterior parietal cortex. *Exp Brain Res*, 221(1):1-18.

### IX) AccessAbility Statement

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. I will work with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or [ability@utsc.utoronto.ca](mailto:ability@utsc.utoronto.ca).

### X) Academic Integrity Statement

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>) outlines the

behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to: IN PAPERS AND ASSIGNMENTS: Using someone else's ideas or words without appropriate acknowledgement. Submitting your own work in more than one course without the permission of the instructor. Making up sources or facts. Obtaining or providing unauthorized assistance on any assignment. ON TESTS AND EXAMS: Using or possessing unauthorized aids. Looking at someone else's answers during an exam or test. Misrepresenting your identity. IN ACADEMIC WORK: Falsifying institutional documents or grades. Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes. All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see <http://www.utoronto.ca/academicintegrity/resourcesforstudents.html>).

### **XI) Missed Term Work due to Medical Illness or Other Emergency:**

All students citing a documented reason for missed term work must submit their request for accommodations **within three (3) business days** of the deadline for the missed work.

Students must submit **BOTH** of the following:

- (1.) A completed **Request for Missed Term Work Accommodations form** (<http://uoft.me/PSY-MTW>), and
- (2.) **Appropriate documentation** to verify your illness or emergency, as described below.

#### **Appropriate documentation:**

For missed **TERM TESTS** due to **ILLNESS**:

- Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with an **original** copy of the official UTSC Verification of Illness Form ([uoft.me/UTSC-Verification-Of-Illness-Form](http://uoft.me/UTSC-Verification-Of-Illness-Form)) or an **original** copy of the record of visitation to a hospital emergency room. Forms are to be completed in full, clearly indicating the start date, anticipated end date, and severity of illness. The physician's registration number and business stamp are required.

For missed **ASSIGNMENTS** due to **ILLNESS**:

- Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with a **hardcopy** of the Self-Declaration of Student Illness Form ([uoft.me/PSY-self-declare-form](http://uoft.me/PSY-self-declare-form)).

For missed term tests or assignments in **OTHER CIRCUMSTANCES**:

Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with:

- In the case of a **death of a family member or friend**, please provide a copy of a death certificate.
- In the case of a **disability-related concern**, if your desired accommodation is within the scope of your Accommodation Letter, please attach a copy of your letter. If your desired accommodation is outside the scope of your Accommodation Letter (ex. if your letter says "extensions of up to 7 days" but you need more time than that) you will need to meet with your consultant at

- AccessAbility Services and have them email Keely Hicks ([keely.hicks@utoronto.ca](mailto:keely.hicks@utoronto.ca)) detailing the accommodations required.
- For U of T Varsity **athletic commitments**, an email from your coach or varsity administrator should be sent directly to Keely Hicks ([keely.hicks@utoronto.ca](mailto:keely.hicks@utoronto.ca)) **well in advance** of the missed work, detailing the dates and nature of the commitment.
  - For **religious accommodations**, please email ([keely.hicks@utoronto.ca](mailto:keely.hicks@utoronto.ca)) **well in advance** of the missed work.

Documents covering the following situations are NOT acceptable: medical prescriptions, personal travel, weddings/personal/work commitments.

**Procedure:**

Submit your (1.) [request form](#) and (2.) [medical/self-declaration](#)/other documents in person **WITHIN 3 BUSINESS DAYS** of the missed term test or assignment.

**Submit to:** Keely Hicks, Room SW420B, Monday – Friday, 9 AM – 4 PM

Exceptions to the documentation deadline will only be made under exceptional circumstances. If you are unable to meet this deadline, you must email Keely Hicks ([keely.hicks@utoronto.ca](mailto:keely.hicks@utoronto.ca)) **within the three business day window** to explain when you will be able to bring your documents in person. Attach scans of your documentation.

Within approximately one week, you will receive an email response from your instructor detailing the accommodations to be made (if any). **You are responsible for checking your official U of T email and Quercus course announcements daily, as accommodations may be time-critical.**

Completion of this form does NOT guarantee that accommodations will be made. The course instructor reserves the right to decide what accommodations (if any) will be made. Failure to adhere to any aspect of this policy may result in a denial of your request for accommodation.

**Instructors cannot accept term work after April 12, 2019.** Beyond this date, you would need to file a petition with the Registrar's Office to have your term work accepted (<https://www.utoronto.ca/registrar/term-work>).

Note that this policy applies only to missed assignments and term tests. Missed final exams are handled by the Registrar's Office (<http://www.utoronto.ca/registrar/missing-examination>).

---

**XII) webOption**

No online section will be available.

**XIII) For Your Health**

The Health and Wellness Centre (SL270, 416-287-7065) provides diagnostic, treatment and referral services for all illnesses ranging from the medical to psychological to health promotion. The professional staff of physicians, nurses and counselors provides personal advice and assistance with family issues, eating disorders, depression, stress, drug and alcohol abuse, relationship issues, a positive space for gender/sexuality issues, and more.

<http://www.utsc.utoronto.ca/wellness>