

NROC64: Sensory and Motor Systems

I) Course information

Course number: NROC64H3 S

Fridays: 11 - 2 pm

Place: SW 319

Prerequisites: (BIOB30H &) NROB60H

II) Instructor:

Dr. Matthias Niemeier
1265 Military Trail SW550
phone: 416-287-7466
e-mail: niemeier@utsc.utoronto.ca
Office Hours: Fridays, 2-3 pm.

III) Teaching Assistants:

Jiaqing Chen, Adam Frost & Ada Le

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 sensory physiology for each of the sensory systems (olfactory, visual, somatosensory, auditory, gustatory) and models of sensory processing. Both spinal and central mechanisms of motor control are also covered.

V) Course readings (required)

Textbook 1

Title: Neuroscience. Exploring the Brain, 3rd Edition

Authors: M. F. Bear, B. W. Connors & M. A. Paradiso

Publisher: Lippincott, Williams & Wilkins

ISBN: 978-0-7817-6003-4

Required Chapters from Textbook 2 can be purchased from the UofT Bookstore

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 which are scientific articles, mostly 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: BlackBoard

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

- 40% Mid-term test.** Format: short answer questions. Two hours.
- 10% Thought paper 1.** Written assignment, 2 pages, double-spaced
- 10% Thought paper 2.** Same format as t-paper 1
- 40% Final Term test.** Two hours. Same format as the mid-term.

The **mid-term test** and **final exam** will be equivalent in format and will have short-answer questions only. There will be no multiple-choice questions. Short answer questions are more suitable for measuring conceptual understanding of material, beyond memorizing and recognizing facts. Furthermore, short-answer questions will help you work on your written communication skills. I will provide similar practice questions for you to get an intuition of what these questions will be about and whether you are able to answer them. In addition, I recommend to form **study groups** and test one another with similar questions. It is very helpful to meet with others and practice for exams. It is not uncommon to hear from students that felt they 'kind of' knew a topic/concept or got the gist of it but when they were asked to explain they couldn't do it. Or they feel they implied the correct answer but it wasn't clear to me or our TAs. If problems with SAQs show up during a study group meeting, great: you know what needs a bit more work, a visit of my office hours might be good too; let's work together to make sure you are doing well on the exams!

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. Therefore, 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 taped.

Missing the mid-term: If you miss the mid-term exam you will be asked to provide documentation for why you missed it, and I need to **receive your documentation within one week of the mid-term** because only then I can properly arrange for a make-up test. Documentation has to meet usual standards, e.g., for medical reasons I will ask for the official UTSC medical certificate form. Also, I will ask forms to be filled in by experts. That is, **for medical reasons you will need an M.D. to fill in your form**, for psychological reasons you will need an M.D., a clinical psychologist or counsellor etc. ***The format of the make-up test will be similar to the mid-term but because in the meantime there was more time to study I will include a question about the next lecture as well to be fair to everyone.*** Should you miss the make-up test, I will need timely submitted documentation for the reason as well. In that case I will arrange for a 30-min oral exam to give you an opportunity to make up for the missed tests.

If you miss the final exam, you are asked to petition to write the test through the Registrar's office, usually one term later.

Written assignments. 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 BlackBoard. This includes a document on how to write the written assignment and 2 sample papers. Submission is by email. Details will be announced later. Late submissions mean a deduction of 10% per late day. Please make sure you write a genuine article. We will feed the papers into Turn It In.

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.

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 am 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)

Lec	Dates	Topic	Readings
1	05-Sep	Introduction, Chemical senses	Bear8, AR1
2	12-Sep	The Eye, Visual pathways	Bear9, Bear10, AR2
3	19-Sep	Central visual system	Bear10, AR3
4	26-Sep	The auditory system, The vestibular system	Bear11, AR4
	26-Sep	Thought paper 1 due at 23:59	AR1
5	03-Oct	The somatic sensory system	Bear12, AR5
6	10-Oct	Spinal control of movement	Bear13, AR6
	17-Oct	-----Reading week, no class-----	
	24-Oct	Mid-term in class	Bear8-13, AR1-6
7	02-Nov	Motor systems	Carp9, AR7
	~04-Nov	Make-up mid-term	Bear8-13, Carp9, AR1-7
8	07-Nov	Posture; Multisensory perception	Carp11, AR8
9	14-Nov	Oculomotor system; Spatial constancy	AR9a-c
	14-Nov	Thought paper 2 due at 23:59	AR9c
10	21-Nov	Higher motor control, Reaching & grasping	Carp12, AR10
11	28-Nov	Attention & consciousness	Bear21, AR11
	TBA	Final exam	post mid + lect. 6

Additional readings (AR):

- 1) Bushdid C, Magnasco MO, Vosshall LB, Keller A (2014). Humans can discriminate more than 1 trillion olfactory stimuli. *Science* 343, 1370-1372. (supplementary material online).
- 2) Asari H, Meister M (2012). Divergence of visual channels in the inner retina. *Nat Neurosci* 15:1581-9.
- 3) Rao RPN, Ballard DH (1999). Predictive coding in the visual cortex: a functional interpretation of some extra-classical receptive-field effects. *Nat Neurosci* 2:79-87.
- 4) Mammano F, Ashmore JF (1993). Reverse transduction measured in the isolated cochlea by laser Michelson interferometry. *Nature* 365, 838-41.
- 5) Blankenburg F, Ruff CC, Deichmann R, Rees G, Driver J (2006). The cutaneous rabbit illusion affects human primary sensory cortex somatotopically. *PLoS Biology* 4(3):e69.
- 6) tba
- 7) Hermosillo R, Ritterband-Rosenbaum A, van Donkelaar P (2011). Predicting future sensorimotor states influences current temporal decision making. *J Neurosci* 31:10019-10022.
- 8) Avillac M, Deneve S, Olivier E, Pouget A, Duhamel JR (2005). Reference frames for representing visual and tactile locations in parietal cortex. *Nat Neurosci* 8:941-949.
- 9a) Goldberg ME (2000). Control of gaze. In: Kandell & Schwartz. *Principles of Neuroscience*. MIT
- 9b) Lynch JC (2009). Oculomotor control: Anatomical pathways. *Encyc Neurosci*. 17-23.
- 9c) Ibbotson MR, Crowder NA, Cloherty SL, Price NSC, Mustari MJ (2008). Saccadic modulation of neural responses: possible roles in saccadic suppression, enhancement, and time compression. *J Neurosci* 8(43):10952–10960.
- 10) Wu HG, Miyamoto YR, Gonzalez Castro LN, Ölveczky BP, Smith MA (2014). Temporal structure of motor variability is dynamically regulated and predicts motor learning ability. *Nat Neurosci* 17:312-321. (supplementary material online)
- 11) Blanke O, Mohr C, Michel CM, Pascual-Leone A, Brugger P, Seeck M, Landis T, Thut G (2005). Linking out-of-body experience and self processing to mental own-body imagery at the temporoparietal junction. *J Neurosci* 25:550-557.

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.

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) webOption

No online section will be available.

XII) Course Policies

For other academic regulations please also refer to the UTSC calendar.