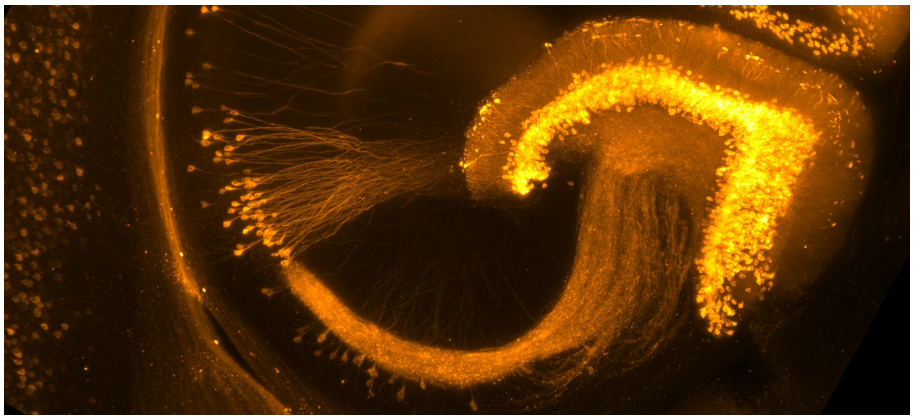
BIOD07H3: Advanced Topics and Methods in Neural Circuit Analysis (Winter 2020) Course Syllabus

Instructor: Dr. Tod Thiele TA: Nick Guilbeault



This course will cover the latest approaches for understanding how neural circuits in the brain extract sensory information from the environment and ultimately use this information for the production and guidance of behaviour. The last decade has seen an explosion in the tools neuroscientists have at their disposal to dissect neural circuit function. These include methods to record and alter the activity of thousands of neurons at once as well as approaches to determine the intricate wiring architecture of circuits. We will explore all of these methods in the context of current cutting-edge research conducted in a variety of invertebrate and vertebrate model systems aimed at unravelling the mysteries of neural circuit function.

Course Aims

1. Gain an advanced understanding of how neural circuits function in a variety of brain regions
2. Understand the latest technologies used to analyze neural circuit function
3. Learn to critically read and write about primary literature related to neural circuit research. This includes identifying hypotheses, understanding complex figures and identifying weakness in the literature.
4. Enhance communication and discussion skills through lecture interactions and group presentations
5. Develop independent thinking and ideas through the development of a grant proposal

Lectures: Wednesdays 12 – 2 pm, Room AA 209

Prerequisites: BIOC32H3 or NROC34H3 or NROC64H3 or NROC69H3

Textbook: There is no text book for this course. Course readings will be assigned throughout the course and uploaded onto the course page. You must read these before each class.

Course e-mail: tod.thiele@utoronto.ca

Office hours: Dr. Thiele will hold office hours on Mondays from 2 - 4 pm in SW534 (knock loudly).

Teaching Assistant: Nick Guilbeault will mark the midterms, critiques, grant proposal and one exam question. Please contact Nick for questions regarding marking of either of these assignments by email: nicholas.guilbeault@mail.utoronto.ca

Other Contact and Communication Information: Course announcements, communications and lecture outlines will be available on Quercus. Lectures will be posted by 11 pm the day before lectures. Course readings will be uploaded onto the course page at least one week prior to class. Except on weekends, emails will be answered within 48 hours of receiving them. For questions that require longer answers, please try and attend office hours, or arrange an alternative appointment with Dr. Thiele. When the same questions are asked more than once, these will be posted as frequently asked questions on Quercus.

Course Outline Summary (Subject to change)

Lecture	Date	Lecture Topic
1	Jan 8	Course structure and neural circuit background material
2	Jan 15	- How to find, present and critique research articles: Information for student seminar presentations, evaluation of research articles and written assignment - Analysis of behaviour lecture - Example paper presentation
3	Jan 22	Expression of transgenes in the nervous system + student seminars
4	Jan 29	Measuring neural activity using electrophysiology + student seminars
5	Feb 5	Measuring neural activity using optical approaches + student seminars
6	Feb 12	Non-optical approaches to manipulate neural activity, Grant proposal information + student seminars
	Feb 19	Reading Week
7	Feb 26	**MIDTERM**
8	March 4	Optical approaches to manipulate neural activity + student seminars
9	March 11	Methods to determine neural circuit architectures using light microscopy + student seminars
10	March 18	Methods to determine neural circuit architectures using electron microscopy + student seminars
11	March 25	Computational approaches for understanding neural circuit function + student seminars
12	April 1	TBD + student seminars (**Grant proposal due**)

Marking scheme (see below for detailed information on assignments)

- Two research article critiques (7.5% each, 15% total)
- Group presentation (15%)
- Midterm (25%) – 2 hours
- Written assignment (Grant Proposal) (20%)
- Final exam (25%) - 2.5 hours

Course Assignments

Research articles critiques (7.5% each): Further instructions for research article critiques will be given in week 2. During the course, students will submit 2 critiques of a research article using the template provided on Quercus. One critique must be submitted by Feb 19th and one by April 1st. Critiques should be a minimum of 2 pages and a maximum of 4 pages, times new roman font, double spaced, size 12 font. Research articles to be critiqued will be on Quercus. A hard copy of each critique must be submitted at the beginning of lecture the week after the topic you chose. For example, if you chose to critique a paper related to "Expression of transgenes in the nervous system" your critique hardcopy must be handed in at the beginning of lecture on Jan 29th. **Critiques must also be submitted using Turnitin:** https://q.utoronto.ca/courses/46670/pages/student-turnitin

***Note:** Due to reading week**,** if you choose "Non-optical approaches to manipulate neural activity" you must turn in you critique online by 12 pm on February 19. You must also turn in a hardcopy on Feb 26.

***You cannot critique a paper you use for your group presentation.**

Group presentation (15%): During lecture 2, Nick will present a research article in seminar format. This will act as a guide for subsequent student seminar presentations, although creativity and individuality of your presentations is strongly encouraged!

From week 3 onwards, groups of 4 - 5 students (depending on class size) will present a 50 minute seminar on 2 research articles. These research articles have been chosen already by Dr Thiele, and will be uploaded onto Quercus. Presentations for each research article should be 20 minutes with only 5-8 minutes should be spent on the introduction. 5 minutes will be given for questions after each article presentation. Information presented in student seminars is eligible for inclusion on the exams. More information on the format of seminar presentations will be given during lecture 2.

You must organize yourselves into teams and designate one member to email Nick with your topic choices. Provide 3 ranked choices. **Topics will be given on a first come, first serve basis so organize quickly**. Student presentations will happen the week after I present a topic. For example, if you are presenting on the "Analysis of behaviour" you present on Jan 22nd.

Grant Proposal (20%): On February 12th, detailed information will be given about the Grant Proposal assignment. In order to complete the assignment, students will need to acquire research articles independently. The grant can explore any aspect of neural circuit function using one or more of the approaches covered in lecture.

Assignments must include a title page, an abstract summarizing the proposal, an introduction describing the background, objectives, aims, experimental outlines, expected outlines, caveats and a reference list.

Articles must be cited throughout the text (e.g. Author 1991; Author et al. 1995; Author and Author 1998). The reference list (bibliography) must be on a separate page and have the following format (e.g. Gamelin FX, Baquet G, Berthoin S, Thevenet D, Nourry C, Nottin S, Bosquet L (2009) Effect of high intensity intermittent training on heart rate variability in prepubescent children. Eur J Appl Physiol 105:731-738).

The proposal must be times new roman, double-spaced and 8-10 pages in length (excluding the title page and bibliography).

A hard copy of the assignment must be submitted in class on April 1st. Hard copies must be single-sided with page numbers included on the bottom, stapled in the top left hand corner. Assignments must also be submitted electronically using Turnitin.

Midterm (25%):
On February 26th the midterm will be held in class (2 hours). The exam will have a combination of multiple choice, short answer and essay style questions. More details to follow.

Final Exam (2.5 hours; 25%):
The final exam will be cumulative and consist of written questions with no multiple choice. More information on the format of the exam will be given during the final two lectures.

Absence in exams and other assessments: Failure to attend the final exam or midterm will result in no mark for that portion of the course. Failure to hand in assignments on time will also result in a zero for that given assignment unless a medical certificate is presented. If assignments are to be submitted late, please contact Dr. Thiele no more than 24 hours after the deadline for that assignment to let him know of your illness. Late assignments will only be accepted if they are accompanied by a medical certificate. A make-up midterm exam will only be administered for students who present a medical certificate within two days of the test. Certificates will be verified. Students who miss the final exam must petition.

Other Important Information

Academic Integrity: Please refer to http://www.governingcouncil.utoronto.ca/policies/behaveac for the University of Toronto's Code of Behaviour on Academic Matters. Potential offences include, but are not limited to:
In Tests and Exams: to use or possess an unauthorized aid or to look at the answers of another student's exam; misrepresentation of identity.
Medical Notes and other Official Documentation: Falsification or alteration of documentation required by the University.

Access*Ability* Information: Please let me and/or AccessAbility services know if you require any accommodations to ensure that you achieve your learning goals in this course. AccessAbility services is located in AA142 (tel: 416-287-7560; email: ability@utsc.utoronto.ca), where you can arrange appointments to assess and accommodate your specific needs. Enquiries are confidential.

Turnitin statement: "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 web site."