

Psychology 461 - Neuroplasticity

ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəyəm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.

When: Tuesdays, Thursdays 11-12:30

Where: DMCBH Rudy Theatre

Instructor: Liisa Galea, Ph.D.

Centre for Brain Health

Department of Psychology

Office: DMCBH 3403

Phone: 604- 822-6536

Email: liisa.galea@ubc.ca (please allow 48 h for email enquires)

Office hours: Tuesdays 1230-100 or Thursday 1230-1.

Teaching Assistant: Tanvi Puri

Centre for Brain Health, 3rd floor,

Office hour: Wednesday at 2:00PM or by appt.

Please email 24h ahead of time so that Tanvi can reserve a room (likely in 3402C)

tanvi.puri@psych.ubc.ca

Textbook: No textbook. We will be reading and reviewing various journal publications that are available for you on CANVAS (and under Library Course Reserves) and are listed below.

Course outlines, lectures available on Canvas: <https://canvas.ubc.ca/>

Please note that while the lecture slides will be available in some cases the complete lectures may not be available until 24 h after the class.

Furthermore, more resources are available for you at: <http://guides.library.ubc.ca/psyc460>

This website was created to help you find research on your topic for your presentation and research grant.

Course description: This course is designed to introduce students to the field of hippocampal neuroplasticity with a focus on the ability of the hippocampus to undergo changes across the lifespan and how this may relate to behaviour. The lectures will focus on the hippocampus, arguably the structure of the brain that shows the most dramatic plasticity across the lifespan. Most of the course will be devoted to neurogenesis within the hippocampus but also will include topics such as changes in dendritic morphology, volume changes, with an emphasis on how sex, stress, aging, and disease can alter plasticity of the hippocampus and how this may be related to behaviour.

Policy on Missed Tests and Extensions:

'For course policies regarding in-term academic concessions, please refer to the relevant UBC calendar entry: <http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0>.'

Policy on Late Assignments/Talks: Proposal (Topics and Aims, Full proposal) will be deducted 10% per day if the deadline is missed. There is no possibility to make up for a missed quiz (but please see extra credit. Once you have accepted a date for your talk it is your responsibility to make every effort to make this date.

Evaluation:

| | | |
|---|-----|---------------------------|
| Midterm | 25% | October 24, 2019 |
| Participation | 10% | |
| Talk | 25% | (Oct 31 – Nov 30) |
| Research Proposal - Topic & Aims | 5% | November 1, 2019 11 pm |
| Research Proposal – Full proposal | 25% | November 22, 2019 11 pm |
| Quizzes based on readings and student talks | 10% | Fridays by 11pm on Canvas |

Midterm: Material from both the lectures and the papers will be on the exam. You will be responsible for reading the materials in the articles in the order shown on the schedule that follows. The midterm will consist of short answer and long answer questions. This class is in a discussion seminar format particularly for the second half of the term. You must come to each class prepared to discuss the readings. The readings are assigned below for the first half of the course. When you arrive for midterm you must have your **student card**. Please place your student card on the right-hand corner of your desk prior to the beginning of the exam and leave it there until someone has checked off your name or has your signature. Be sure to arrive on time since no additional time is given to students who arrive late. Sample questions will be posted on CANVAS.

Participation: Participation will include peer evaluations of talks which will be done via CANVAS) and performance during the breakout sessions during Sept/Oct. Questions posted to the presenters on Canvas and/or in classes will also be counted towards participation credit but must be posted within 24 h of the talks to be counted.

Extra Credit can be obtained by attending Neuroscience Colloquia on Fridays at 11AM in the Rudy Theatre, each lecture is worth 0.5%, for a maximum of 2%. To use this for credit please prepare a written statement of 50-100 words describing the content and what you liked about the topic. These can be submitted on CANVAS up until November 29th at 11PM.

Talk: Each student will be required to give a presentation (10 min). A list of papers/topics listed on CANVAS, we will draw for names/topics in a random order during the second-third week of classes. The talks will begin the class right after the midterm. Please practice your talks ahead of time (more than once!) as this is essential for determining how long your talk is but better yet is an important factor in creating a good talk. A marking rubric is available on Canvas. Better talks will include supplemental papers as the papers below are meant to guide your talk.

Quizzes: will be conducted after the readings each week and after the student talks and will be available via Canvas.

Research Proposal: On a topic of your choice (to be approved by the TA or Instructor) dealing with neuroplasticity and behaviour the topic should be the same topic as your talk. Start with a

literature review (up to 3 pages), provide two objectives with hypotheses for proposed research to continue in this area, and a brief outline of experiments designed to answer the objectives. The topic should be a topic examining an area of neuroplasticity and behaviour. Behaviour must be a core part of the proposal. Five pages written maximum, 1.5 line spacing, plus unlimited references and figures. 12pt Arial, 2 cm margins. Marks will be based on overall clarity (10), scientific premise of the questions asked (10), objectives (20), literature review (30), experiments proposed (20), references (5), figures (5). A sample grant is available on CANVAS.

UNIVERSITY POLICIES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on the [UBC Senate website](#).

REFERENCE reading:

Amaral, D.G. & Witter, M.P. (1989). The three-dimensional organization of the hippocampal formation: a review of anatomical data. *Neuroscience*, 31, 571-591.

Good overall primer on the Hippocampus:

Knierim, James J. (2015). The hippocampus. *Current Biology*, Volume 25, Issue 23, R1116 - R1121.

TENTATIVE LECTURE TOPICS

Week of:

Topic/Readings

Sept 5 Introduction to Course: Bad Science, and Neuroscience Needs Behavior

SEPT 10 – NO CLASS

Sept 12,17 Introduction to the hippocampus: Where and what
Grey Matter Volume changes in the hippocampus

Sept 19, 24 Dendritic morphology, spines changes: in response to stress, aging and memory

Sept 26 Neurogenesis in the adult hippocampus: where, how, what and why as it is related to memory and emotional regulation

Oct 3 Talk choices and Breakout sessions: Reading and critiquing scientific literature (see required paper to read)

Oct 8 Neurogenesis in the adult hippocampus: where, how, what and why as it is related to memory and emotional regulation.

Oct 10 Guest Lecture

Oct 15-22 Neurogenesis in the adult hippocampus: where, how, what and why as it is related to memory and emotional regulation.

Oct 24 Midterm

Oct 29- Nov 29 Student Presentations

NOV 14 NO CLASS

LECTURE Readings

Week 1 [Sept 2]: Hippocampus: Introduction and basic anatomy

GOALS: Why behaviour is an important consideration in Neuroscience, what does the Hippocampus do

- 1) Why we need to consider behaviour in neuroscience: Krakauer, John W. et al. 2017. Neuroscience Needs Behavior: Correcting a Reductionist Bias. Neuron, Volume 93, 480 – 490
- 2) Knierim, James J. (2015). The hippocampus. Current Biology, Volume 25, Issue 23, R1116 - R1121.
- 3) Bad Science by Bob Goldacre (not required reading but fun): Chapter 11

Week 2 [Sept 12-17]: Volume of the hippocampus: Relation to Disease, Aging, and Learning

GOALS: What are considerations for determining volume differences, does volume matter for behaviour?

- 4) Fotuhi M, Do D, Jack C. Modifiable factors that alter the size of the hippocampus with ageing. Nat Rev Neurol. 2012 Mar 13;8(4):189-202.
- 5) Maguire EA, Gadian DG, Johnsrude IS, Good CD, Ashburner J, Frackowiak RS, Frith CD. Navigation-related structural change in the hippocampi of taxi drivers. Proc Natl Acad Sci U S A. 2000 Apr 11;97(8):4398-403.

Week 3 [Sept 19-24]: Spines, Dendritic Morphology in the hippocampus: Relation to Disease, Aging and Learning

GOAL: Description of possible structural changes in the hippocampus and how do they relate to behaviour.

- 6) Sorra KE, Harris KM. Overview on the structure, composition, function, development, and plasticity of hippocampal dendritic spines. *Hippocampus*. 2000;10(5):501-11.
- 7) Berry KP, Nedivi E. Spine Dynamics: Are They All the Same? *Neuron*. 2017 Sep 27;96(1):43-55. doi: 10.1016/j.neuron.2017.08.008.

Week 5 [Sept 26, Oct 8]: Introduction to Neurogenesis in the hippocampus

GOAL: What, where and timeline of neurogenesis in the hippocampus?

- 8) Cameron HA, Woolley CS, McEwen BS, Gould E. Differentiation of newly born neurons and glia in the dentate gyrus of the adult rat. *Neuroscience*. 1993;56(2):337-44.

Oct 3: Talk Choices and Practice papers

Be prepared to critique in class:

Katalin Molnár, Szabolcs Kéri. Bigger is better and worse: On the intricate relationship between hippocampal size and memory *Neuropsychologia* 56 (2014) 73–78

Oct 10: Guest Lecture

Week 6 [Oct15, 17]: Neurogenesis in the hippocampus: Relation to Learning

GOAL: How is neurogenesis in the hippocampus related to learning/memory?

- 9) Opendak M, Gould E. Adult neurogenesis: a substrate for experience-dependent change. *Trends Cogn Sci*. 2015 Mar;19(3):151-61
- 10) Kee N, Teixeira CM, Wang AH, Frankland PW. Preferential incorporation of adult-generated granule cells into spatial memory networks in the dentate gyrus. *Nat Neurosci*. 2007 Mar;10(3):355-62

Week 7 [Oct 22,24]: Neurogenesis in the hippocampus: Relation to Disease and Aging

GOAL: How is neurogenesis in the hippocampus related to stress?

- 11) Review: Mahmoud R, Wainwright SR, Galea LA. Sex hormones and adult hippocampal neurogenesis: Regulation, implications, and potential mechanisms. *Front Neuroendocrinol*. 2016 Apr; 41:129-52.
- 12) Epp JR, Beasley CL, Galea LA. Increased hippocampal neurogenesis and p21 expression in depression: dependent on antidepressants, sex, age, and antipsychotic exposure. *Neuropsychopharmacology*. 2013 Oct;38(11):2297-306.

Psychology Department's Position on Academic Misconduct

Cheating, plagiarism, and other forms of academic misconduct are very serious concerns of the University, and the Department of Psychology has taken steps to alleviate them. In the

first place, the Department has implemented software that, can reliably detect cheating on multiple-choice exams by analyzing the patterns of students' responses. In addition, the Department subscribes to *TurnItIn*--a service designed to detect and deter plagiarism. All materials (term papers, lab reports, etc.) that students submit for grading will be scanned and compared to over 5 billion pages of content located on the Internet or in TurnItIn's own proprietary databases. The results of these comparisons are compiled into customized "Originality Reports" containing several, sensitive measures of plagiarism; instructors receive copies of these reports for every student in their class.

In all cases of suspected academic misconduct, the parties involved will be pursued to the fullest extent dictated by the guidelines of the University. Strong evidence of cheating or plagiarism may result in a zero credit for the work in question. According to the University Act (section 61), the President of UBC has the right to impose harsher penalties including (but not limited to) a failing grade for the course, suspension from the University, cancellation of scholarships, or a notation added to a student's transcript.

All graded work in this course, unless otherwise specified, is to be original work done independently by individuals. **Do** use **PubMed** (first choice) on the Library's website at <http://www.library.ubc.ca>. and try our guide specially designed for Psyc 460/461 <http://guides.library.ubc.ca/psyc460>

If you have any questions as to whether or not what you are doing is even a borderline case of academic misconduct, please consult your instructor. For details on pertinent University policies and procedures, please see Chapter 5 in the UBC Calendar (<http://students.ubc.ca/calendar>).

The University accommodates students with disabilities who have registered with the **Disability Resource Centre**. The University accommodates students whose religious obligations conflict with attendance, submitting assignments, or completing scheduled tests and examinations. Please let your instructor know in advance, preferably in the first week of class, if you will require any accommodation on these grounds. Students who plan to be absent for varsity athletics, family obligations, or other similar commitments, cannot assume they will be accommodated, and should discuss their commitments with the instructor before the drop date.

Students have the right to view their marked examinations with their TA, providing they apply to do so within a month of receiving their final grades. This review is for pedagogic purposes. The examination remains the property of the university.

Faculties, departments and schools reserve the right to scale grades in order to maintain equity among sections and conformity to university, faculty, department or school norms. Students should therefore note that an unofficial grade given by an instructor might be changed by the faculty, department or school. Grades are not official until they appear on a student's academic record.

Psychology Department's Policy on Grade Distributions and Scaling

In order to reduce grade inflation and maintain equity across multiple course sections, all psychology courses are required to comply with departmental norms regarding grade distributions. According to departmental norms, the mean grade in a 300-level class is 70 for a good class, 68 for an average class, and 66 for a weak class, with a standard deviation of 13). The corresponding figures for 100- and 200-level Psychology courses are 67, 65, and 63,

with a standard deviation of 14. **Scaling** is likely to be used in order to comply with these norms; grades may be scaled up or down as necessary by the professor or department.

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Further information about academic regulations, course withdrawal dates and credits can be found in the University Calendar. You are encouraged to read this material. If you run into trouble and need information about studying, preparing for exams, note taking or time management, free workshops and advice are available from the Student Resources Centre, which can be reached through the School and College Liaison Office at 822-4319 and from Student Success, <http://www.students.ubc.ca/success/>.

TENTATIVE TOPICS FOR STUDENT LECTURES

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|--------------------------------------|-----------------------------------|
| Neurogenesis in other regions | Adolescent stress and plasticity |
| Olfactory neurogenesis | Microbiome |
| Cocaine | Exercise and plasticity |
| Cannabinoids | Elite sports and brain morphology |
| Alcohol and Neurogenesis | Musicians and plasticity |
| Endocannabinoids and neuroplasticity | Video games and plasticity |
| Pregnancy | Gambling |
| Postpartum | Stroke |
| Postpartum Depression | Glia and plasticity |
| Social behaviour and Neurogenesis | Inflammation |
| Sexual behaviour and Neurogenesis | Multiple Sclerosis |
| Early life adversity | Chronic Pain |
| Androgens | Microglia |
| Estrogens | Sleep |
| Aging | Obesity |
| Cognitive training (Luminosity?) | Diabetes |
| Alzheimer's Disease | Cell adhesion molecules |
| Mild Cognitive Impairment | |
| Depression | |
| Circadian Rhythms | |
| Bipolar Disorder | |
| Sex changing fish | |
| Schizophrenia | |
| Obsessive compulsive disorder | |
| LTP and learning | |
| LTD and learning | |
| Paired pulse inhibition | |
| Autism | |
| Epigenetics and plasticity | |

Chemotherapy
Oxytocin
