

## Psychology 461 - Neuroplasticity

**When:** Tuesdays, Thursdays 2-3:30

**Where:** Buchanan D217 ( please note class may moved to a classroom in CBH)

**Instructor:** Liisa Galea, Ph.D.  
 Centre for Brain Health  
 Department of Psychology  
 Office: CBH 3550/ Kenny 3523  
 Phone: 822-6536  
 Email: [liisa.galea@ubc.ca](mailto:liisa.galea@ubc.ca) (please allow 24 h for email enquires)  
 Office hours: **by appt.**

**Teaching Assistant:** Rand Mahmoud Centre for Brain Health 3<sup>rd</sup> flr, Office hour: by appt. [rand.mahmoud@psych.ubc.ca](mailto:rand.mahmoud@psych.ubc.ca)

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

Course outlines, lectures available on Connect: <http://elearning.ubc.ca/connect/> and you can join us on Facebook: UBC PSYC 461- 2016

<https://www.facebook.com/groups/970969613022725/> – where you can post comments, questions, your presentations or interesting papers/news articles based on topics related to 461. Please note that while the lecture slides will be available in some cases the complete lectures may not be available until 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 opinion piece (essay).

**Course description:** This course is designed to introduce students to the field of neuroplasticity the ability of the brain to undergo changes across the lifespan. The lectures will focus on the hippocampus, arguably the structure of the brain that shows the most dramatic plasticity across the lifespan. Topics will include: neurogenesis, changes in dendritic morphology, volume changes to brain nuclei, with an emphasis on how sex, stress, aging, exercise, hormones and early life adversity alter the ability of the brain to be plastic.

### **Policy on Missed Tests and Extensions:**

**Course policies:** Classes of this size add certain constraints on the way in which I must teach the course. One such constraint is that there will be no (for emphasis let us repeat the word NO) make up exams in this course. This means that if you miss an exam you will simply lose the number of points associated with it. Your grade will therefore be computed as if that particular entry was a zero. The only exceptions to this are validated medical excuses. Such excuses must be in the form of a written note from

your doctor or from student health, attesting to the fact that on the day of the exam you were too ill to be expected to function reasonably. Please note, that although the Student Health Service will provide such validations for December and Final exams, they will not provide these for midterms, hence in the event of a missed midterm your medical excuse must be obtained from a private physician. If you should have a personal or psychological trauma and miss an examination, a written letter of explanation from your psychiatrist, psychologist, or student counsellor must accompany such an excuse. A letter from the attending physician or clergyman must validate exams missed due to a death in the family. In the absence of such written verification you will not be excused. All medical excuses must be personally presented to the professor as soon as you are able to return to class for a make up to be scheduled. Make-up exams will consist of an oral exam to be conducted in the presence of the professor and the teaching assistant.

If you submit medical documentation make sure it contains the statement "*This student was unable to write the test (or submit term work by the last day of classes, if applicable) on (date) for medical reasons*". If not then marks will be deducted or you will have an assigned mark of zero. You are advised to see your physician within one day of the missed test. Many physicians will not provide documentation retroactively.

**Evaluation:**

Midterm	30%	October 18, 2016
Participation	5%	
Talk	25%	Talks will be scheduled from Oct 25- Dec1
Critiques	30%	Sept 27, Oct 27 and Nov 27, 2016 @ 12 pm
Quizzes	10%	TBD during talks on Connect

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. 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.

Talk - Each student will be required to give a presentation (10 min – the time will ultimately be decided once the class list is finalised). A list of topics is tentatively listed on the next few pages, we will draw for names/topics in a random order during the second 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. Quizzes will be conducted during the student talks and will be available via Connect. NB there is a limited time to do these quizzes as they will only be available for 24 h to complete but you will be notified of these dates ( around Nov 7 and Dec 1). There will be 4-5 talks per class.

Critiques: Instructions: 1. Begin by explaining the problem the paper is attacking, and why it is interesting and important. Summarize the background to the paper; cite

previous research where relevant, explaining what questions the prior work left unanswered and why additional work was necessary. If a specific hypothesis is proposed by the authors state what it is, and explain the reasoning behind it. 2. Briefly describe the methods the authors used to do the research. 3. Briefly describe the main findings of the paper as they relate to the questions/hypotheses raised in section 4. Discuss the strengths and weaknesses of the paper as you see them. Were the techniques adequate? Are the results conclusive or are there other interpretations? Are there other experiments or controls that could or should have been done? 5. Are there other papers in the literature that report contradictory findings? If so, what factors do you think may explain the discrepancy? 6. Suggest what new experiments could be done, based on the paper's findings. Other general instructions: Number the sections as listed above (1-6), use 1 inch margins, and 12 point font. The word limit is strictly 1000 words for each critique (excluding references). The commentary articles (News and Views) published in Nature and Nature Neuroscience are a good style model for critiques as they are concise and addressed to a non-expert audience. However you should aim to be more critical in your comments than those articles usually are.

Quizzes will be conducted during the student talks, based on the content of the talks, and will be available via Connect. NB there is a limited time to do these quizzes as they will only be available for 24 h to complete but you will be notified of these dates ( around Nov 15 and Dec 1).

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. On days when there is an examination there will be no lecture. Be sure to arrive on time since no additional time is given to students who arrive late.

### **TENTATIVE LECTURE TOPICS**

#### **Week of:**

#### **Topic/Readings**

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|------------|--|
| Sept 9, 13 | Bad Science and How to review and read research articles.<br>Introduction to the hippocampus: Where and what<br><br>Volume changes in the hippocampus: depression, stress, memory capacity and aging |
| Sept 15/20 | Dendritic morphology, spines changes: in response to stress, aging and memory  |
| Sept 22-29 | Neurogenesis: New neurons in the adult hippocampus: where and how  |
| Oct 4-6    | The what and why of neurogenesis in the hippocampus of adults.<br>Neurogenesis in the hippocampus as it is related to memory and emotional regulation.   |

Oct 13 Cell Adhesion Molecules – Guest Lecturers S. Wainwright/R. Mahmoud

**Oct 18 Midterm**

**November 15 & 29 – No CLASS**

**Tentative LECTURE Readings**

Reference article ( not required 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.

Bad Science by Bob Goldacre – Chapters 4 and 11 (not required but great fun to read)

**Week 1: Anatomy of the hippocampus:**

*Volume changes in hippocampus*

Review:

Roth TC 2nd, Brodin A, Smulders TV, LaDage LD, Pravosudov VV. Is bigger always better? A critical appraisal of the use of volumetric analysis in the study of the hippocampus. *Philos Trans R Soc Lond B Biol Sci*. 2010 Mar 27;365(1542):915-31. doi: 10.1098/rstb.2009.0208.

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.

Research paper: 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 2: Spines, Dendritic Morphology changes in the hippocampus**

Review:

Sorra KE, Harris KM. Overview on the structure, composition, function, development, and plasticity of hippocampal dendritic spines. *Hippocampus*. 2000;10(5):501-11.

- Leuner B, Gould E. Structural plasticity and hippocampal function. *Annu Rev Psychol*. 2010;61:111-40, C1-3.

Research paper:

Watanabe Y, Gould E, McEwen BS. Stress induces atrophy of apical dendrites of hippocampal CA3 pyramidal neurons. *Brain Res*. 1992 Aug 21;588(2):341-5.

Pawluski, J.L., and Galea, L.A.M. (2006). Hippocampal morphology is differentially affected by reproductive experience. *Journal of Neurobiology*. 66, 71-81

**Week 3:** *Neurogenesis in the hippocampus: where and what*

Research papers:

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 Sep;56(2):337-44.

Zhao C, Teng EM, Summers RG Jr, Ming GL, Gage FH. Distinct morphological stages of dentate granule neuron maturation in the adult mouse hippocampus. *J Neurosci*. 2006 Jan 4;26(1):3-11.

**Week 4** *Neurogenesis in the hippocampus: why*

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

Review:

Leuner B, Gould E. Structural plasticity and hippocampal function. *Annu Rev Psychol*. 2010;61:111-40, C1-3.

Mahmoud R, Wainwright SR, Galea LA. Sex hormones and adult hippocampal neurogenesis: Regulation, implications, and potential mechanisms. *Front Neuroendocrinol*. 2016 Apr;41:129-52.

**Week 5:** *Cell adhesion molecules and Microglia:*

Review:

Dalva MB, McClelland AC, Kayser MS. Cell adhesion molecules: signalling functions at the synapse. *Nat Rev Neurosci*. 2007 Mar;8(3):206-20

Sakurai T. The role of cell adhesion molecules in brain wiring and neuropsychiatric disorders. *Mol Cell Neurosci*. 2016 Aug 22. pii: S1044-7431(16)30121-X. doi: 10.1016/j.mcn.2016.08.005. [Epub ahead of print]

Wainwright SR, Galea LA. The neural plasticity theory of depression: assessing the roles of adult neurogenesis and PSA-NCAM within the hippocampus. *Neural Plast*. 2013;2013:805497. doi: 10.1155/2013/805497. Epub 2013 Apr 9.

Wu Y, Dissing-Olesen L, MacVicar BA, Stevens B. Microglia: Dynamic Mediators of Synapse Development and Plasticity. *Trends Immunol*. 2015 Oct;36(10):605-13. doi: 10.1016/j.it.2015.08.008.

Research paper:

Wainwright SR, Barha CK, Hamson DK, Epp JR, Chow C, Lieblich SE, Rutishauser U, Galea LA. Enzymatic Depletion of the Polysialic Acid Moiety Associated with the Neural Cell Adhesion Molecule Inhibits Antidepressant Efficacy. *Neuropsychopharmacology*. 2016 May;41(6):1670-80. doi: 10.1038/npp.2015.337.

### **Critique Papers:**

**Sept 27:** Travis SG, Coupland NJ, Hegadoren K, Silverstone PH, Huang Y, Carter R, Fujiwara E, Seres P, Malykhin NV. Effects of cortisol on hippocampal subfields volumes and memory performance in healthy control subjects and patients with major depressive disorder. *J Affect Disord*. 2016 Sep 1;201:34-41. doi: 10.1016/j.jad.2016.04.049. Epub 2016 Apr 25.

**Oct 27:** Roth TC 2nd, Stocker K, Mauck R. Morphological changes in hippocampal cytoarchitecture as a function of spatial treatment in birds. *Dev Neurobiol*. 2016 Jun 21. doi: 10.1002/dneu.22413.

**Nov 27:** Epp JR, Silva Mera R, Köhler S, Josselyn SA, Frankland PW. Neurogenesis-mediated forgetting minimizes proactive interference. *Nat Commun*. 2016 Feb 26;7:10838. doi: 10.1038/ncomms10838.

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### **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 **not** use Google/Yahoo/MSN Search/etc. to find articles for assignments in this course. **Do** use **PubMed** (first choice) on the Library's

website at <http://www.library.ubc.ca>. and try our new 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>).

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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.

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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.

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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.

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### **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/>.

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*TENTATIVE TOPICS FOR STUDENT LECTURES*

Drugs of abuse  
Endocannabinoids and neuroplasticity  
Maternal deprivation  
Early life adversity  
Androgens  
Estrogens  
Aging  
Cognitive training (Luminosity?)  
Alzheimer's Disease  
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  
Adolescent stress and plasticity (Barha et al., 2010)  
Microbiome  
Exercise and plasticity  
Elite sports and brain morphology (Schlaffke et al., 2013)  
Musicians and plasticity  
Video games and plasticity  
Gambling  
Stroke  
Glia and plasticity  
Inflammation  
Multiple Sclerosis  
Chronic Pain  
Microglia  
Social Behaviour – (naked mole rats)  
Sleep  
Obesity  
Diabetes  
Chemotherapy  
Oxytocin