

## Psychology 461 - Neuroplasticity

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

**Where:** Buchanan D217

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

**Teaching Assistant:** Steven Wainwright Rm 3512 Kenny, Office hour: by appt.  
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**Textbook:** No textbook. We will be reading and reviewing various journal publications that are available for you on Connect 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- 2014 Neuroplasticity and Behaviour <https://www.facebook.com/groups/316203705187094/> – where you can post comments and questions or interesting papers. 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 14, 2014
Participation	10%	
Talk	25%	Talks will be scheduled from Oct 16- Nov 27th
Essay	25%	November 18, 2014 @ 12 pm
Quizzes	10%	

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. Thus it is strongly advised that you have done the readings BEFORE the lectures.

Talk + Essay - Each student will be required to give a presentation (~15 min – the time will ultimately be decided once the class list is finalised) and a research paper on the same topic. 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. The essays on your topic are due Nov 18, 2014. The essay should be no more than 10 double-spaced pages in length (Arial 11 pt font), with at least 10 references and will be written on the same topic as your talk. There will be 3-5 talks per class. A marking scheme for the talk and essay is available online through Connect. 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 6 and 20).

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**

<b>Week of:</b>	<b>Topic/Readings</b>
Sept 9	Bad Science and How to review and read research articles. Introduction to the hippocampus: Where and what  Volume changes in the hippocampus: depression, stress, memory capacity and aging
Sept 16-18	Dendritic morphology, spines changes: in response to stress, aging and memory
Sept 23/27	Neurogenesis: New neurons in the adult hippocampus: where and how
Sept 30/Oct 9	The what and why of neurogenesis in the hippocampus of adults. Neurogenesis in the hippocampus as it is related to memory and emotional regulation.
Oct 2/7	Cell Adhesion Molecules – S. Wainwright

**Oct 14 Midterm**

**November 6 & 18 – 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.

Galea LA, Wainwright SR, Roes MM, Duarte-Guterman P, Chow C, Hamson DK. Sex, hormones, and neurogenesis in the hippocampus: Hormonal modulation of neurogenesis and potential functional implications. *J Neuroendocrinol*. 2013 Jul 3. doi: 10.1111/jne.12070. [Epub ahead of print]

**Week 5: Cell adhesion molecules:**

Review:

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

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.

Research paper:

Muller D, Wang C, Skibo G, Toni N, Cremer H, Calaora V, Rougon G, Kiss JZ. PSA-NCAM is required for activity-induced synaptic plasticity. *Neuron*. 1996 Sep;17(3):413-22.

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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 (cocaine) and neuroplasticity (cortical neuroplasticity).

Endocannabinoids and neuroplasticity

THC and neuroplasticity

Spine shape and experience

Early life adversity

Androgens

Estrogens

Aging

Exercising your mind – cognitive training (Park DC, Bischof GN. The aging mind: neuroplasticity in response to cognitive training. *Dialogues Clin Neurosci*. 2013 Mar;15(1):109-19.)

Alzheimer's Disease

Depression

SAD

Postpartum depression  
 Bipolar Disorder  
 Song learning in birds – open vs closed learners  
 Sex changing fish  
 Schizophrenia  
 Obsessive compulsive disorder  
 learning and memory  
 memory acquisition  
 Stress and conditioning – Spines, conditioned fear  
 LTP and learning  
 LTD and learning  
 Paired pulse inhibition  
 Developmental vs. adult plasticity  
 Epigenetics and plasticity  
 Adolescent stress and plasticity (Barha et al., 2010)  
 Stress  
 Exercise and plasticity  
 Elite sports and brain morphology (Schlaffke et al., 2013)  
 Musicians and plasticity (Gärtner H, Minnerop M, Pieperhoff P, Schleicher A, Zilles K, Altenmüller E, Amunts K. Brain morphometry shows effects of long-term musical practice in middle-aged keyboard players. *Front Psychol.* 2013 Sep 23;4:636. doi: 10.3389/fpsyg.2013.00636.)  
 Video games and plasticity (Latham AJ, Patston LL, Tippett LJ. The virtual brain: 30 years of video-game play and cognitive abilities. *Front Psychol.* 2013 Sep 13;4:629. Review.)  
  
 Gambling (Cortical thickness abnormalities in late adolescence with online gaming addiction. Yuan K, Cheng P, Dong T, Bi Y, Xing L, Yu D, Zhao L, Dong M, von Deneen KM, Liu Y, Qin W, Tian J. *PLoS One.* 2013;8(1):e53055.)  
  
 Zatorre RJ, Fields RD, Johansen-Berg H. Plasticity in gray and white: neuroimaging changes in brain structure during learning. *Nat Neurosci.* 2012 Mar 18;15(4):528-36  
  
 Vance DE, Kaur J, Fazeli PL, Talley MH, Yuen HK, Kitchin B, Lin F. Neuroplasticity and successful cognitive aging: a brief overview for nursing. *J Neurosci Nurs.* 2012 Aug;44(4):218-27. doi: 10.1097/JNN.0b013e3182527571.