

Syllabus
RESEARCH PRACTICUM IN BEHAVIORAL NEUROSCIENCE
Psychology 4481 – Fall 2014

Lectures: W 12:00-2:30 in McGuinn 303

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Course Description

This course will introduce students to research methods used in behavioral neuroscience. We will read and discuss a variety of methods that researchers use to determine the underlying brain circuitry and mechanisms of observable behaviors. Students will learn how to pose and test behavioral neuroscience research questions, conduct and write a literature review, analyze data, and write a research paper in APA style.

Course Prerequisites

PS120/PSYC1120: Introduction to Behavioral Statistics and Research I and PS285/PSYC2285: Behavioral Neuroscience. It is assumed that all students have a basic knowledge of the nervous system.

Course Website

The course website is accessible via Canvas (<https://bc.edu/lms>). Lectures will be posted onto the course website *after* the lecture has been delivered. Readings for lectures will be posted *at least* 1 week in advance.

Readings

A course pack and journal articles (reviews and primary articles) will be assigned. The course pack is available at the BC bookstore. The journal articles will be posted on the course website, and are also available through the electronic journal offerings of O’Neill Library, or PubMed (www.pubmed.gov). An important aspect of this course is to provide an opportunity for you to analyze, critique, and discuss primary research articles. Please read the assignments and be prepared to discuss them in class.

1. Course Pack: N. R. Carlson: “Methods & Strategies of Research”, Chapter 5 of Physiology of Behavior (2013), 11th Edition, Pearson.
2. Journal Articles will be assigned and posted on blackboard at least one week in advance.

Final averages will be graded as follows:

| | | | | | | | |
|----|--------|----|-------|----|-------|----|-------|
| A | 93-100 | B | 83-86 | C | 73-76 | D | 63-66 |
| A- | 90-92 | B- | 80-82 | C- | 70-72 | D- | 60-62 |
| B+ | 87-89 | C+ | 77-79 | D+ | 67-69 | F | <60 |

Course Requirements & Grading

Attendance/Class Participation (25%)

Given that this is a small discussion-based course that only meets once a week, attendance is critical. For each class you will receive 1pt for attending, and 1pt for making at least one significant contribution to the day's discussion.

Assignments/Exams

1. *Journal Article Presentation & Discussion Leading (20%)*

Each student will be responsible for the in-class presentation and discussion of a primary journal article. This article must utilize one of the methods that was introduced during the previous week's class. No more than half of this ~30min presentation should be reviewing the article; a majority of the time should be spent leading a class discussion about the methods the authors used (e.g. Why was this method used? Did the method sufficiently answer the posed question? Would another method be able to answer the question? What would a follow-up experiment look-like?). Articles must be approved by the TF at least 1 week in advance* of the presentation (so they may be posted on Canvas), and students are encouraged to consult with the TF regarding their presentation and ideas for leading the discussion.

2. *Literature Review (10%)*

Each student will write a literature review on a topic of their choosing. The literature review can be on any behavioral neuroscience topic the student finds interesting. This review should be 5-7 pages long, and cite ≥ 10 primary sources (reviews may be cited, but will not count toward this total). These papers will be returned with comments, and will serve as the basis of the Introduction section of the final paper. Literature review topics must be approved in advance* by the TF, and students are encouraged to consult with the TF about ideas.

3. *Final Paper + Paper Presentation (25%)*

In the final paper, students will expand upon their literature review and propose a hypothesis and novel experiment that would add to the field. This 10-15 page paper will be structured similar to a journal article with Introduction, Methods, and Discussion sections. Hypotheses must be approved in advance by the TF*, and students are encouraged to consult with the TF about ideas. Each student will give a ~15min in-class presentation about their paper (10min talk + 5min for questions).

4. *Final Exam (10%)*

The final exam will consist of 2 essays. Students will be given hypotheses and be asked to design experiments to test them using the methods they learned about during the semester.

5. *Other misc. small assignments (10%)*

Periodically throughout the semester there will be some additional small assignments. These are typically completed during class (e.g. in-class activities and turning in your data from computer lab days).

*Failure to pick a paper 1 week in advance or turn in your topic/hypothesis by the deadline will reduce that assignment's grade by 3% (1 grade partial; i.e. A \rightarrow A-, A- \rightarrow B+, B+ \rightarrow B, etc.).

Late Work & Absences

Assignments turned in late will be penalized 10% (1 full letter grade) for each day late. Late work may be submitted to the TF's mailbox in the psychology main office in McGuinn 300 (note: the main office's typical hours are Mon-Fri, 9am-5pm) or through email attachment. Late work may be accepted with reduced or no penalty for instances of medical or family emergency (see below). In these instances only, an extension may be granted on a case-to-case basis.

It is the responsibility of each student to contact the TF and request to be excused for any unavoidable situation necessitating absence from class. All requests for excusals must be accompanied by documentation that your absence is necessary. In cases of absence due to medical or family emergency, the student or a member of his or her family should communicate with the Dean's office to obtain an excused absence which should be forwarded to the TF. In cases of absence due to a BC-affiliated program (e.g. sports, clubs, mission trips), a letter or e-mail from the program advisor/office should be sent to the TF.

Learning disabilities

If you are a student with a documented disability seeking reasonable accommodations in this course, please contact Kathy Duggan, (617) 552-8093, dugganka@bc.edu, at the Connors Family Learning Center regarding learning disabilities and ADHD, or Paulette Durrett, (617) 552-3470, paulette.durrett@bc.edu, in the Disability Services Office regarding all other types of disabilities, including temporary disabilities. Advance notice and appropriate documentation are required for accommodations.

Academic Integrity & APA Resources

Boston College values the academic integrity of its students and faculty. Please review the academic integrity policy of BC at: <http://www.bc.edu/schools/cas/polisci/integrity.html>.

As stated in BC's academic integrity policy: “[p]lagiarism is the act of taking the words, ideas, data, illustrations, or statements of another person or source, and presenting them as one's own. Each student is responsible for learning and using proper methods of paraphrasing and footnoting, quotation, and other forms of citation, to ensure that the original author, speaker, illustrator, or source of the material used is clearly acknowledged”.

All written work (papers and presentations) is expected to be the student's own, and should follow APA formatting. The following are useful guides for APA style scientific writing:

<http://www.apastyle.org/>

<http://owl.english.purdue.edu/owl/resource/560/01/>

<http://www.nature.com/scitable/topicpage/effective-writing-13815989>

Publication Manual of the APA, 6th Edition; ISBN: 1433805618

Victoria E. McMillan's: Writing papers in the biological sciences

BC's Guide to Citing: <http://libguides.bc.edu/citation>

RESEARCH PRACTICUM IN BEHAVIORAL NEUROSCIENCE: SCHEDULE

| DATE | PLAN |
|--------------------------------------|--|
| 9/3/14 | Course Outline & Goals Lecture: Intro to BN |
| 9/10/14 | <i>Meet in O'Neill 246</i> Lecture: Observing Behavior Behavioral Scoring Lab |
| 9/17/14 | Paper topic due by 11:59pm ACF Tour (Higgins 1900, 12:00-12:30pm) Lecture: Surgery & Tissue Acquisition (McGuinn 303, 12:45-2:30pm) |
| 9/24/14 | Student Presentation(s): Behavioral Studies Library Session (12:45pm, O'Neill 307) |
| 10/1/14 | Lecture: Neurochemical Methods Wet Lab Tour |
| 10/8/14 | Student Presentation(s): Autoradiography or Microdialysis Lecture: Mapping Neural Pathways |
| 10/15/14 | Literature review due by 11:59pm Student Presentations(s): Anterograde or Retrograde Tracing Lecture: Recording Neural Activity |
| 10/22/14 | <i>Meet in O'Neill 246</i> Student Presentations(s): Fos Image Analysis Lab |
| 10/29/14 | Student Presentations(s): Electrophysiological Recordings Lecture: Disrupting & Stimulating Neural Activity |
| 11/5/14 | Hypothesis for final paper due by 11:59pm Student Presentations(s): Lesions or Stimulation Lecture: Psychopharmacological Manipulations |
| 11/12/14 | Student Presentations(s): Pharmacological Agonism or Antagonism Lecture: New Methods: Optogenetics & DREADDs |
| 11/19/14 | Student Presentation(s): Optogenetics or DREADDs Lecture: Genetic Methods (Guest Lecturer: Dr. Sindy Cole) |
| 11/26/14 | <i>No Class: Thanksgiving Break</i> |
| 12/3/14 | Final paper draft due by noon (12:00pm) Peer editing/paper conferencing |
| 12/10/14 | Final paper due by noon (12:00pm) Final Paper Presentations |
| Tuesday, 12/16/14 12:30pm | Final Exam |

PSYC4481: RESEARCH PRACTICUM IN BEHAVIORAL NEUROSCIENCE

READING & REFERENCE LIST FOR LECTURES COURSEPACK (CARLSON) & JOURNAL ARTICLES

9/3/14: Intro to BN

- Carlson, p.131

9/10/14: Observing Behavior/Behavioral Scoring Lab

- --none-- (research your assigned behavioral paradigm)
- Additional references:
 - Teegarden, S. (2013). Behavioral Phenotyping in Rats and Mice. *Materials and Methods*. DOI: <http://dx.doi.org/10.13070/mm.en.2.122>
 - Fonio, E., Golani, I., & Benjamini, Y. (2012). Measuring behavior of animal models: faults and remedies. *Nature methods*, 9(12), 1167-1170.

9/17/14: ACF Tour, Surgery & Tissue Acquisition

- Carlson, p.134-136: Stereotaxic Surgery (Stereotaxic Atlas & Apparatus), Histological Methods (Fixation & Sectioning)
- Use of Animals in Biomedical Research: Understanding the Issues. AALAS Brochure 08-00007.
- Additional references:
 - Barthold, S. W., Bayne, K. A., & Davis, M. A. (2011). Guide for the care and use of laboratory animals.
 - Fodstad, H., Hariz, M., & Ljunggren, B. (1991). History of Clarke's stereotactic instrument. *Stereotactic and functional neurosurgery*, 57(3), 130-140.
 - Krieg, W. J. (1946). Accurate placement of minute lesions in the brain of the albino rat. *Quarterly bulletin. Northwestern University (Evanston, Ill.). Medical School*, 20(2), 199.

9/24/14: Library Session

- --none--

10/1/14: Neurochemical Methods

- Carlson, p.136-139, 156-159: Histological Methods (Staining, Microscopy), Neurochemical Methods
- Excerpt from: Beltz, B. S., & Burd, G. D. (1989). *Immunocytochemical techniques: principles and practice*. Blackwell Scientific Publications.
- Nandi, P., & Lunte, S. M. (2009). Recent trends in microdialysis sampling integrated with conventional and microanalytical systems for monitoring biological events: a review. *Analytica chimica acta*, 651(1), 1-14. **pp1-6**

- Additional references:
 - Conn, P. Michael. Ed. *Methods in Neurosciences*. Vol. 4: Electrophysiology and Microinjection. Chapters 9: *In vivo* Voltammetry. San Diego: Academic Press Inc.
 - Kuhar, M. J., De Souza, E. B., & Unnerstall, J. R. (1986). Receptor Mapping by Autoradiography and Other Methods. *Annual review of neuroscience*, 9(1), 27-59. pp27-43
 - Westerink, B. H. (1995). Brain microdialysis and its application for the study of animal behaviour. *Behavioural brain research*, 70(2), 103-124. pp103-110

10/8/14: Mapping Neural Pathways

- Carlson, p.139-142: Tracing Neural Connections
- Oztas, E. (2003). Neuronal tracing. *Neuroanatomy*, 2, 2-5.
- Kuypers, H. G. J. M., & Ugolini, G. (1990). Viruses as transneuronal tracers. *Trends in neurosciences*, 13(2), 71-75.
- Additional references:
 - Köbbert, C., Apps, R., Bechmann, I., Lanciego, J. L., Mey, J., & Thanos, S. (2000). Current concepts in neuroanatomical tracing. *Progress in neurobiology*, 62(4), 327-351. pp327-334
 - Lanciego, J. L., & Wouterlood, F. G. (2011). A half century of experimental neuroanatomical tracing. *Journal of chemical neuroanatomy*, 42(3), 157-183.
 - Song, C. K., Enquist, L. W., & Bartness, T. J. (2005). New developments in tracing neural circuits with herpesviruses. *Virus research*, 111(2), 235-249.

10/15/14: Recording Neural Activity

- Carlson, p.146-151: Recording Neural Activity
- Curran, T., & Morgan, J. I. (2004). Fos: An immediate-early transcription factor in neurons. *Journal of neurobiology*, 26(3), 403-412.
- Additional references:
 - Verkhatsky, A., Krishtal, O. A., & Petersen, O. H. (2006). From Galvani to patch clamp: the development of electrophysiology. *Pflügers Archiv*, 453(3), 233-247.
 - Humphrey, D. R., & Schmidt, E. M. (1991). Extracellular single-unit recording methods. In *Neurophysiological Techniques* (pp. 1-64). Humana Press.
 - Guzowski, J. F., Timlin, J. A., Roysam, B., McNaughton, B. L., Worley, P. F., & Barnes, C. A. (2005). Mapping behaviorally relevant neural circuits with immediate-early gene expression. *Current opinion in neurobiology*, 15(5), 599-606.
 - Sheng, M., & Greenberg, M. E. (1990). The regulation and function of c-fos and other immediate early genes in the nervous system. *Neuron*, 4(4), 477-485.

10/22/14: Image Analysis Lab

- --none--

10/29/14: Disrupting & Stimulating Neural Activity

- Carlson p.132-134, 151-153: Experimental Ablation, Stimulating Neural Activity
- Wiley, R. G., & Lappi, D. A. (Eds.). (2005). *Molecular neurosurgery with targeted toxins*. Chapters 1-3. Totowa, NJ. Humana Press. pp1-6
- Additional references:
 - Conn, P. Michael. Ed. *Methods in Neurosciences*. Vol. 7: Lesions & Transplantations. Chapters 2, 7 & 16. San Diego: Academic Press Inc.
 - Lomber, S. G. (1999). The advantages and limitations of permanent or reversible deactivation techniques in the assessment of neural function. *Journal of neuroscience methods*, 86(2), 109-117.

11/5/14: Psychopharmacological Manipulations

- --none--

11/12/14: Optogenetics & DREADDs

- Carlson, p. 153-154: Optogenetic Methods
- Aston-Jones, G., & Deisseroth, K. (2013). Recent advances in optogenetics and pharmacogenetics. *Brain research*, 1511, 1-5.
- Additional references:
 - Deisseroth, K. (2010). Optogenetics. *Nature methods*, 8(1), 26-29.
 - Ferguson, S. M., & Neumaier, J. F. (2012). Grateful DREADDs: Engineered Receptors Reveal How Neural Circuits Regulate Behavior. *Neuropsychopharmacology*, 37(1), 296-297.
 - Tye, K. M., & Deisseroth, K. (2012). Optogenetic investigation of neural circuits underlying brain disease in animal models. *Nature Reviews Neuroscience*, 13(4), 251-266. pp.251-257
 - Rogan, S. C., & Roth, B. L. (2011). Remote control of neuronal signaling. *Pharmacological Reviews*, 63(2), 291-315.

11/14/14: Genetic Methods

- Carlson, p. 160-162: Genetic Methods
- Meaney, M. J., & Ferguson-Smith, A. C. (2010). Epigenetic regulation of the neural transcriptome: the meaning of the marks. *Nature neuroscience*, 13(11), 1313-1318.