PSY 511 Fall 2018 Syllabus

Foundations of Cognitive and Affective Neuroscience

PSY 511.001, Fall 2018

Instructor

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http://www.personal.psu.edu/rog1 http://gilmore-lab.github.io http://databrary.org

Meeting Location and Time

Wed & Fri 2:30-3:45 pm, 114 Keller August 20 - December 7, 2018 Course 15128

About the course

The first scientific psychologists were physiologists fascinated by the possibility of understanding the mind by studying the brain. In this course, we will explore the historical roots and contemporary challenges associated with the study of biological approaches to complex adaptive behavior. In doing so, we will read and examine critically primary source readings that discuss basic patterns and processes of brain structure and function. The goal is to provide students with a basic foundation of knowledge about the structures and functions of the nervous system that can provide the basis for future study.

This course is one of two required courses for the Specialization in Cognitive and Affective Neuroscience (SCAN).

Prerequisites

Undergraduate coursework in neuroscience or physiological psychology such as the equivalents of PSYCH 260 or BIO 469/470.

Schedule

Week 1

Wed, Aug 22

- Topics
  - Structure of the course
  - Does neuroscience need behavior? Does behavioral science need the brain?
  - Methods in neuroscience

- Readings
  - (recommended) Krakauer, J. W., Ghazanfar, A. A., Gomez-Marin, A., MacIver, M. A., & Poeppel, D. (2017). Neuroscience needs behavior: Correcting a reductionist bias. Neuron, 93(3), 480–490. Retrieved from http://dx.doi.org/10.1016/j.neuron.2016.12.041
  - https://en.wikibooks.org/wiki/Cognitive_Psychology_and_Cognitive_Neuroscience/Behavioural_and_Neuroscience_Methods.
- Materials
  - Lecture notes | HTML slides
  - More on MRI physics

Fri, Aug 24

- Topics
  - Methods in neuroscience
- Materials
  - https://en.wikibooks.org/wiki/Cognitive_Psychology_and_Cognitive_Neuroscience/Behavioural_and_Neuroscience_Methods
  - Cohen, M. X. (2017). Where Does EEG Come From and What Does It Mean? *Trends in Neurosciences*, *40*(4), 208–218. Retrieved from http://dx.doi.org/10.1016/j.tins.2017.02.004
  - Logothetis, N. K., Pauls, J., Augath, M., Trinath, T., & Oeltermann, A. (2001). Neurophysiological investigation of the basis of the fMRI signal. *Nature*, *412*(6843), 150–157. Retrieved January 20, 2016, from http://www.nature.com/nature/journal/v412/n6843/abs/412150a0.html
  - Hillman, E. M. C. (2014). Coupling mechanism and significance of the BOLD signal: a status report. *Annual Review of Neuroscience*, *37*, 161–181. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-071013-014111.

Week 2

Wed, Aug 29

- Topics
  - Neuroanatomy. Read BW 2:34-49.
- Materials
- Lecture notes | HTML slides

Fri, Aug 31

- Topics
  - Neuroanatomy. Read BW 2:34-49.
- Materials
- Lecture notes | HTML slides

Week 3

Wed, Sep 5

- Topics
  - Wrap-up on neuroanatomy
  - **Neuroanatomy Lab**.
- Materials
  - Lecture notes | HTML slides
  - Anatomy lab handout

Fri, Sep 7

- Topics
  - **Neuroanatomy Lab**.

Week 4

Wed, Sep 12

- Topics
  - Cellular neuroanatomy. Read BW 2:23-33.
- Reading
  - Zeng, H., & Sanes, J. R. (2017). Neuronal cell-type classification: challenges, opportunities and the path forward. *Nature Reviews Neuroscience*. Retrieved from http://dx.doi.org/10.1038/nrn.2017.85.
  - Oliveira, J. F., Sardinha, V. M., Guerra-Gomes, S., Araque, A., & Sousa, N. (2015). Do stars govern our actions? Astrocyte involvement in rodent behavior. *Trends in Neurosciences*, *38*(9), 535–549. Retrieved from http://dx.doi.org/10.1016/j.tins.2015.07.006
- Materials
  - Lecture notes | HTML slides

Fri, Sep 14

- Topics
  - **Quiz 1**. | Download |. Due at start of class on Friday, September 20, 2018.
  - Neurophysiology. Read BW 3:57-73.
- Materials
  - Lecture notes | HTML slides

Week 5

Wed, Sep 19

NO CLASS

Fri, Sep 20

- Topics
  - Neural communication. Read BW 3:55-89.
  - Neurochemistry. Read BW: 4:107-124.
- Materials
  - Lecture notes | HTML slides

Week 6

Wed, Sep 26

- Topics
  - Neurochemistry II. Read BW: 4:107-124.
- Materials
  - Lecture notes | HTML slides

Fri, Sep 28

- Topic
  - Hormones. 5:125-154.
  - Brain/gut connection
- Reading
  - Sarkar, A., Lehto, S. M., Harty, S., Dinan, T. G., Cryan, J. F., & Burnet, P. W. J. (2016). Psychobiotics and the manipulation of bacteria-gut-brain signals. *Trends in Neurosciences*, *39*(11), 763–781. Retrieved from http://dx.doi.org/10.1016/j.tins.2016.09.002
- Materials
  - Lecture notes | HTML slides

Week 7

Wed, Oct 3

- Topics
  - Evolution & Development. Read BW 6 & 7.
- Reading
  - Optional Hofman 2014.
  - Rakic, P. (2009). Evolution of the neocortex: a perspective from developmental biology. Nature Reviews Neuroscience, 10(10), 724–735. Retrieved October 5, 2015, from http://www.nature.com/nrn/journal/v10/n10/abs/nrn2719.html.
  - Cao, M., Huang, H., & He, Y. (2017). Developmental connectomics from infancy through early childhood. *Trends in Neurosciences*, *40*(8), 494–506. Retrieved from http://dx.doi.org/10.1016/j.tins.2017.06.003
- Materials
  - Lecture notes | HTML slides

Fri, Oct 5

NO CLASS

Week 8

Wed, Oct 10

- Topics
  - Perception. Read BW 8:223-247.
- Materials
  - Lecture notes | HTML slides

Fri, Oct 12

- Topics
  - Perception. Read BW 8:223-247.
- Reading
  - Murray, M. M., Lewkowicz, D. J., Amedi, A., & Wallace, M. T. (2016). Multisensory Processes: A Balancing Act across the Lifespan. *Trends in Neurosciences*, *39*(8), 567–579. Retrieved July 28, 2016, from http://www.sciencedirect.com/science/article/pii/S0166223616300480
- Materials
  - Lecture notes | HTML slides

Week 9

Wed, Oct 17

- Topics
  - Action
  - **Quiz 2** distributed. | Download |. Due at start of class on Wednesday, October 24, 2018.
- Reading
  - Nielsen, J. B. (2016). Human Spinal Motor Control. *Annual Review of Neuroscience*, *39*, 81–101. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-070815-013913
- Materials
  - Lecture notes | HTML slides

Fri, Oct 19

- Topics
  - Action II
- Reading
  - Shenoy, K. V., Sahani, M., & Churchland, M. M. (2013). Cortical control of arm movements: A dynamical systems perspective. *Annual Review of Neuroscience*, *36*, 337–359. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-062111-150509.
- Materials
  - Lecture notes | HTML slides

Week 10

Wed, Oct 24

- Topics
  - Language. Read BW 17, 18, 19.
- Reading
  - Hagoort, P., & Indefrey, P. (2014). The neurobiology of language beyond single words. *Annual Review of Neuroscience*, *37*, 347–362. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-071013-013847.
- Materials
  - Lecture notes | HTML slides

Fri, Oct 26

- Topics
  - Learning & memory
- Reading
  - Squire, L. R., & Wixted, J. T. (2011). The cognitive neuroscience of human memory since H.M. *Annual Review of Neuroscience*, *34*, 259–288. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-061010-113720.
- Materials
  - Lecture notes | HTML slides

Week 11

Wed, Oct 31

- Topic
  - Emotion. Read BW 15.
- Materials
  - Lecture notes | HTML slides
- Readings + Pellman, B. A., & Kim, J. J. (2016). What Can Ethobehavioral Studies Tell Us about the Brain's Fear System? *Trends in Neurosciences*, *39*(6), 420–431. Retrieved from http://dx.doi.org/10.1016/j.tins.2016.04.001 + Hu, H. (2016). Reward and Aversion. *Annual Review of Neuroscience*, *39*, 297–324. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-070815-014106

Wed, Nov 2

- Topics
  - Fear, stress, & reward
- Materials
  - Lecture notes | HTML slides
- Readings
  - Musazzi, L., Tornese, P., Sala, N., & Popoli, M. (2017). Acute or Chronic? A Stressful Question. *Trends in Neurosciences*. Retrieved from http://dx.doi.org/10.1016/j.tins.2017.07.002
  - Watabe-Uchida, M., Eshel, N., & Uchida, N. (2017). Neural Circuitry of Reward Prediction Error. *Annual Review of Neuroscience*, *40*, 373–394. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-072116-031109

Week 12

Wed, Nov 7

- Topics
  - Disorder and Disease. Read BW 16.
- Reading
  - Hunt, M. J., Kopell, N. J., Traub, R. D., & Whittington, M. A. (2017). Aberrant Network Activity in Schizophrenia. *Trends in Neurosciences*, *40*(6), 371–382. Retrieved from http://dx.doi.org/10.1016/j.tins.2017.04.003
- Materials
  - Lecture notes | HTML slides
  - Student presentation planning matrix. | HTML slides |

Fri, Nov 9

- Topics
  - Disorder and Disease. Read BW 16.
- Reading
  - Pawluski, J. L., Lonstein, J. S., & Fleming, A. S. (2017). The Neurobiology of Postpartum Anxiety and Depression. *Trends in Neurosciences*, *40*(2), 106–120. Retrieved from http://dx.doi.org/10.1016/j.tins.2016.11.009
  - Namkung, H., Kim, S.-H., & Sawa, A. (2017). The Insula: An Underestimated Brain Area in Clinical Neuroscience, Psychiatry, and Neurology. *Trends in Neurosciences*, *40*(4), 200–207. Retrieved from http://dx.doi.org/10.1016/j.tins.2017.02.002
  - Volk, L., Chiu, S.-L., Sharma, K., & Huganir, R. L. (2015). Glutamate synapses in human cognitive disorders. *Annual Review of Neuroscience*, *38*, 127–149. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-071714-033821
- Materials
  - Lecture notes | HTML slides

Week 13

Wed, Nov 14

- Topics
  - Networks all the way down
  - **Quiz 3**. | Download |. Due at start of class on Wednesday, November 28, 2018.
- Supplemental Materials
  - Swanson, L. W., & Lichtman, J. W. (2016). From Cajal to Connectome and Beyond. *Annual Review of Neuroscience*, *39*, 197–216. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-071714-033954
  - Raichle, M. E. (2015). The brain's default mode network. *Annual Review of Neuroscience*, *38*, 433–447. Retrieved from http://dx.doi.org/10.1146/annurev-neuro-071013-014030.

Fri, Nov 16

- Topics
  - Reproducibility in neuroscience
- Readings
  - Gilmore, R. O., Diaz, M. T., Wyble, B. A., & Yarkoni, T. (2017). Progress toward openness, transparency, and reproducibility in cognitive neuroscience. *Annals of the New York Academy of Sciences*. Retrieved from http://dx.doi.org/10.1111/nyas.13325
  - Gorgolewski, K. J., & Poldrack, R. A. (2016). A practical guide for improving transparency and reproducibility in neuroimaging research. *PLoS Biology*, *14*(7), e1002506. Retrieved October 2, 2016, from http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002506

Thanksgiving Break, November 19 - 23, 2018

Week 14

Wed, Nov 28

- Topics
  - Prep for student presentations

Fri, Nov 30

- Topics
  - Prep for student presentations

Week 15

Wed, Dec 5

- Topics
  - Student presentation Group A
  - Student presentation Group B

Fri, Dec 7

- Topics
  - Student presentation Group C
  - Student presentation Group D

Week 16

Wed, Dec 12

- Resource write-up/review papers due by **noon**.

Evaluation

PSY 511 course performance will be evaluated based on the following scheme:

Component	Points	% of Grade
Class participation	2 pts/class * 15 weeks = 30	30
Quizzes	10 pts * 3 quizzes = 30	30
Group presentation	20 pts	20
Paper write-up	20 pts	20
TOTAL	**100**	**100**

Group presentation

Resource write-up

Please write-up a review of i) one of the references you discuss in your group presentation or ii) another paper of your choosing in the style of a *Neuron* "Preview" or a *Nature* "Research Highlights" paper (examples). Your review should be 2,000-2,500 words (6-10 pp in length) and is due by **noon on Wednesday, December 13, 2017**.

Do's

- Put your last name and first name in the file name of your submitted paper. `gilmore-rick-psy-511-2017-final-paper.docx` works fine.
- Submit your paper as a MS Word document or as a Google drive document that I can comment on using the track changes feature.
- Include a cover page and title.
- Include all end-of-paper citations in a format that is convenient to you and easy to extract from your reference manager.
- Include author-date citations in the text, even if the article type (e.g., a newspaper or magazine) would not typically use them.
- Use double-spacing.

Resources

Text

Breedlove, S. M. & Watson, N.V. (2013). *Biological Psychology: An introduction to behavioral and cognitive neuroscience (7th ed.)*. Sunderland, MA: Sinauer.

Web sites

- Course home page: http://psu-psych.github.io/psy-511-scan-fdns-2017

- Interactive Human Brain Atlas: http://www.med.harvard.edu/aanlib/cases/caseNA/pb9.htm
- Neurosynth (fMRI meta-analysis): http://neurosynth.org
- *Neuron* Brainview

Data repositories

- OpenNeuro
- OpenfMRI