PSY 511 Fall 2019 Syllabus

Foundations of Cognitive and Affective Neuroscience

PSY 511.001, Fall 2019

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, 444 Moore August 28 - December 13, 2019 Course 15384

Syllabus

You can find a PDF version of the syllabus at https://psu-psychology.github.io/psy-511-scan-fdns-2019/psy-511-2019-fall-gilmore-syllabus.pdf.

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 28

NO CLASS

Fri, Aug 30

- Topics
  - Structure of the course, Read BW[1] 1:1-21.
  - 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

Week 2

Wed, Sep 4

- Topics
  - Methods in neuroscience, Read BW 2:51-57, 3:88-92.
- Materials
  - Lecture notes | HTML slides
  - https://en.wikibooks.org/wiki/Cognitive_Psychology_and_Cognitive_Neuroscience/Behavioural_and_Neuroscience_Methods
  - Methods outline
  - (Optional) 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
  - (Optional) 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
  - (Optional) 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.

[1] BW refers to the *Behavioral Neuroscience* text by Breedlove and Watson.

Fri, Sep 6

- Topics
  - Neuroanatomy. Read BW 2:36-51.
- Materials
  - Lecture notes | HTML slides

Week 3

Wed, Sep 11

- Topics
  - Neuroanatomy. Read BW 2:36-51.
- Materials
  - Lecture notes | HTML slides

Fri, Sep 13

- Topics
  - Wrap-up on neuroanatomy
- Materials
  - Neuranatomy outline | HTML |

Week 4

Wed, Sep 18

- Topics
  - **Neuroanatomy Lab**.
- Materials
  - Neuranatomy lab handout

Fri, Sep 20

- Topics
  - Cellular neuroanatomy. Read BW 2:24-35.
- 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
  - Cellular outline | HTML |

Week 5

Wed, Sep 25

- Topics
  - **Quiz 1**. | Download |. Due at start of class on Friday, September 27, 2019.
  - Neurophysiology. Read BW 3:61-78.
- Materials
  - Cellular outline | HTML |

Fri, Sep 27

- **Quiz 1 due**. Bring your copy to class.
- Topics
  - Neural communication. Read BW 3:78-92.
  - Neurochemistry. Read BW: 4:95-100.
- Materials
  - Cellular outline | HTML |
  - Chemical communication outline | HTML |

Week 6

Wed, Oct 2

- Topics
  - Neurochemistry II. Read BW 4:101-130.
- Materials
  - Chemical communication outline HTML

4:00 pm Mark Blumberg (University of Iowa) Neuroscience Seminar

Fri, Oct 4

- Topic
  - Hormones. 5:125-154. Read BW 5:131-159.
  - 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
  - Chemical communication outline | HTML |

Week 7

Wed, Oct 9

- Topics
  - Planning session for student symposium

Fri, Oct 11

- 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
  - Evo/devo outline | HTML |

Week 8

Wed, Oct 16

- Topics
  - Brain development.
- Materials
  - Evo/devo outline | HTML |

Fri, Oct 18

- Topics
  - Perception. Read BW 8:230-241.
- 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
  - Perception outline HTML

Week 9

Wed, Oct 23

- Topics
  - Perception and Action. Read BW 10: 301:335, 11: 341:368.
- 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
  - Perception outline | HTML |

Fri, Oct 25

- 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
  - Perception outline | HTML, Action outline HTML |

Week 10

Wed, Oct 30

- Topics
  - **Quiz 2** distributed. | Download |. Due at start of class on Friday, November 1, 2019.
  - Cognition & language. Read BW 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
  - Cognition & language outline | HTML |

Fri, Nov 1

- Topics
  - Learning & memory. Read BW 17.
- 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 | PDF slides

Week 11

Wed, Nov 6

- Topic
  - Emotion. Read BW 15.
- Materials
  - Lecture notes | HTML slides | PDF 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

Fri, Nov 8

- Topics
  - Fear, stress, & reward. Read BW 15.
- Materials
  - Lecture notes | HTML slides | PDF 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 13

- 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 | PDF

Fri, Nov 15

- 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 | PDF

Week 13

Wed, Nov 20

- Topics
  - Networks all the way down
  - **Quiz 3**. | Download |. Due at start of class on **Friday, November 22, 2019**.
- 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.
- Materials
  - Lecture notes | HTML slides | PDF

Fri, Nov 22

- 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
- Materials
  - Lecture notes | HTML slides

Thanksgiving Break, November 19 - 23, 2018

Week 14

Wed, Nov 27

- Topics
  - Prep for student symposium

Fri, Nov 29

- Topics
  - Prep for student symposium

Week 15

Wed, Dec 3

- Topics
  - Prep for student symposium

Fri, Dec 5

- Topics
  - Student symposium

Week 16

Wed, Dec 11

- Topics
  - Student symposium

Wed, Dec 13

- Topics
  - Frontiers in cognitive and affective neuroscience

Week 17

Wed, Dec 18

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

Evaluation

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

Component	Points	% of Grade
Quizzes	10 pts * 3 quizzes = 30	30
Symposium presentation	40 pts	40
Paper	30 pts	30
TOTAL	**100**	**100**

Grading Scheme

Points	Percent	Grade
100+	100+	A+
94-100	94-99	A
90-93	90-93	A-
87-89	87-89	B+
84-86	84-86	B
80-83	80-83	B-
77-79	77-79	C+
70-76	70-76	C
60-69	60-69	D
<59	<59	F

Student symposium presentation

We will plan and host a student symposium with individual and group presentations at the end of the semester.

Resource write-up

Please write-up a review of i) one of the references you discuss in your symposium presentation or ii) another paper of your choosing in the style of a *Neuron* "Preview" or a *Nature* "Research Highlights" paper (example).

Your review should be 2,000-2,500 words (6-10 pp in length) and is due by **noon on Wednesday, December 18, 2019**.

Do's

- Put your last name and first name in the file name of your submitted paper. `gilmore-rick-psy-511-2018-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. Make sure to add page numbers.
- Unpack and define all acronyms when you first mention them. Define or explain technical terms and concepts.
- 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.
- Run spell-check on your paper before you submit. I also suggest reading your paper out loud as a way to catch run-on sentences, awkward phrasing, and odd word choices.

Resources

Text

Breedlove, S. M. & Watson, N.V. (2018). *Behavioral Neuroscience (8th ed.)*. Sunderland, MA: Sinauer.

Web sites

- Course home page: http://psu-psych.github.io/psy-511-scan-fdns-2019
- 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