

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

Syllabus

You can find a PDF version of the syllabus [here](#).

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, Read BW¹ 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-Marín, 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 | PDF
 - More on MRI physics

Fri, Aug 24

- Topics
 - Methods in neuroscience, Read BW² 2:51-57, 3:88-92.
- Materials
 - Lecture notes | HTML slides | PDF
 - https://en.wikibooks.org/wiki/Cognitive_Psychology_and_Cognitive_Neuroscience/Behavioural_and_Neuroscience_Methods
 - (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>.

Week 2

Wed, Aug 29

- Topics
 - Neuroanatomy. Read BW³ 2:36-51.
- Materials
 - Lecture notes | HTML slides | PDF

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

²BW refers to the Behavioral Neuroscience text by Breedlove and Watson.

³BW refers to the Behavioral Neuroscience text by Breedlove and Watson.

Fri, Aug 31

- Topics
 - Neuroanatomy. Read BW⁴ 2:36-51.
 - Materials
 - Lecture notes | HTML slides | PDF
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Week 3

Wed, Sep 5

- Topics
 - Wrap-up on neuroanatomy
- Materials
 - Lecture notes | HTML slides | PDF

Fri, Sep 7

- Topics
 - **Neuroanatomy Lab.**
 - Materials
 - Neuroanatomy lab handout
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Week 4

Wed, Sep 12

- 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
 - Lecture notes | HTML slides | PDF

⁴BW refers to the Behavioral Neuroscience text by Breedlove and Watson.

Fri, Sep 14

- Topics
 - **Quiz 1.** | Download |. Due at start of class on Friday, September 21, 2018.
 - Neurophysiology. Read BW 3:61-78.
 - Materials
 - Lecture notes | HTML slides | PDF
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Week 5

Wed, Sep 19

NO CLASS

Fri, Sep 21

- Quiz-01 due. Submit here.
 - Topics
 - Neural communication. Read BW 3:78-92.
 - Neurochemistry. Read BW: 4:95-100.
 - Materials
 - Lecture notes | HTML slides | PDF
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Week 6

Wed, Sep 26

- Topics
 - Neurochemistry II. Read BW 4:101-130.
- Materials
 - Lecture notes | HTML slides | PDF

Fri, Sep 28

- 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
 - Lecture notes | HTML slides | PDF
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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 | PDF

Fri, Oct 5

NO CLASS

Week 8

Wed, Oct 10

- Topics
 - Brain development.
- Materials
 - Lecture notes | HTML slides | PDF

Fri, Oct 12

- 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
 - Lecture notes | HTML slides
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Week 9

Wed, Oct 17

- 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
 - Lecture notes | HTML slides | PDF

Fri, Oct 19

- Topics
 - Action II
 - **Quiz 2** distributed. | Download |. Due at start of class on Friday, October 26, 2018.
 - 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 | PDF slides
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Week 10

Wed, Oct 24

- Topics
 - 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
 - Lecture notes | HTML slides | PDF slides

Fri, Oct 26

- Topics
 - Learning & memory. Read BW 17.
 - Reading
 - Squire, L. R., & Zola-Morgan, J. T. (1991). 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
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Week 11

Wed, Oct 31

- 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 2

- 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>
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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 | PDF

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 | PDF
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Week 13

Wed, Nov 14

- Topics
 - Networks all the way down
- 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 16

- Topics
 - Reproducibility in neuroscience
 - **Quiz 3.** | Download |. Due at start of class on **Friday, November 30, 2018.**
 - 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
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Thanksgiving Break, November 19 - 23, 2018

Week 14

Wed, Nov 28

- Topics
 - Prep for student presentations

Fri, Nov 30

- Topics
 - Prep for student presentations
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Week 15

Wed, Dec 5

- Topics
 - Student presentation Group A
 - * Measuring brain & behavior: Kelley, Anna, Alison, Lauren, Rhea
 - Shaffer, F., McCraty, R., & Zerr, C. L. (2014). A healthy heart is not a metronome: an integrative review of the heart's anatomy and heart rate variability. *Frontiers in Psychology*, *5*, 1040. Retrieved from <http://dx.doi.org/10.3389/fpsyg.2014.01040>. | PDF |.

- Holmes, A. J., & MacDonald, A. W. III. (accepted). Concepts and principles of clinical functional magnetic resonance imaging. In A. G. C. Wright & M. N. Hallquist (Eds.), *Handbook of Research Methods in Clinical Psychology*. Cambridge, UK: Cambridge University Press. | PDF |.
- Student presentation Group B
 - * Development, aging, & plasticity: Liz, Michael, Lia, Chloe, & Nate
 - Brody, G. H., Gray, J. C., Yu, T., Barton, A. W., Beach, S. R. H., Galván, A., MacKillop, J., et al. (2017). Protective prevention effects on the association of poverty With brain development. *JAMA Pediatrics*, *171*(1), 46–52. jamanetwork.com. Retrieved from <http://dx.doi.org/10.1001/jamapediatrics.2016.2988>. | PDF |.
 - Blakemore, S.-J., Burnett, S., & Dahl, R. E. (2010). The role of puberty in the developing adolescent brain. *Human Brain Mapping*, *31*(6), 926–933. Wiley Online Library. Retrieved from <http://dx.doi.org/10.1002/hbm.21052>. | PDF |.

Fri, Dec 7

- Topics
 - Student presentation Group C
 - * Cognition & Emotion: Austen, Brandon, Shane, & Natalia
 - Olf, M., Langeland, W., & Gersons, B. P. R. (2005). Effects of appraisal and coping on the neuroendocrine response to extreme stress. *Neuroscience and Biobehavioral Reviews*, *29*(3), 457–467. Elsevier. Retrieved from <http://dx.doi.org/10.1016/j.neubiorev.2004.12.006>. | PDF |.
 - Etkin, A., Büchel, C., & Gross, J. J. (2015). The neural bases of emotion regulation. *Nature Reviews Neuroscience*, *16*(11), 693–700. nature.com. Retrieved from <http://dx.doi.org/10.1038/nrn4044>. | PDF |.
 - Gee, D. G., Humphreys, K. L., Flannery, J., Goff, B., Telzer, E. H., Shapiro, M., Hare, T. A., et al. (2013). A developmental shift from positive to negative connectivity in human amygdala–prefrontal circuitry. *The Journal of Neuroscience: The Official journal of the Society for Neuroscience*, *33*(10), 4584–4593. Society for Neuroscience. Retrieved December 5, 2018, from <http://www.jneurosci.org/content/33/10/4584.short>.
 - Student presentation Group D
 - * Neurodegeneration & disorder: Kaitlin, Sam, Daryl, & Emily
 - Wajda, D. A., & Sosnoff, J. J. (2015). Cognitive-motor interference in multiple sclerosis: A systematic review of evidence, correlates, and consequences. *BioMed Research International*, 2015, 720856. hindawi.com. Retrieved from <http://dx.doi.org/10.1155/2015/720856>. | PDF |.
 - Bobholz, J. & Gremley, S. (2011). Multiple sclerosis and other demyelinating disorders. 10.1007/978-0-387-76978-3_20. | PDF |.

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

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

Class participation

Class participation points are awarded for attendance and participation in class discussions. In addition, there may be points awarded for certain additional [assignments]([assignments.html]).

Group presentation

Additional details about the rubric for scoring the group presentation will be given at a later date.

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 12, 2018**.

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-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

Talks

- PSU Neuroscience Seminar Series calendar