

PSY 511.001 Fall 2020 Syllabus

Foundations of Cognitive and Affective Neuroscience

Instructor

Rick O. Gilmore, Ph.D. Professor of Psychology 114 Moore Building

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Meeting Location and Time

Thursdays, 2:30 PM - 5:30 PM, 267 Willard Building Course 15677 Link to Zoom sessions

Syllabus

You can find a PDF version of the syllabus at <https://psu-psychology.github.io/psy-511-scan-fdns-2020/psy-511-2020-fall-gilmore-syllabus.pdf>. Note that the web version is the most up-to-date one.

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

Thursday, August 27

- Topics
 - Structure of the course
 - The connectome and beyond
 - Does neuroscience need behavior? Does behavioral science need the brain?
 - Read/Watch
 - Swanson, L. W., & Lichtman, J. W. (2016). From Cajal to Connectome and Beyond. *Annual Review of Neuroscience*, 39, 197–216. <https://doi.org/10.1146/annurev-neuro-071714-033954>. PDF. Annotable PDF
 - 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. <https://dx.doi.org/10.1016/j.neuron.2016.12.041>. pdf. Annotable PDF
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Week 2

Thursday, September 3

- Topics
 - Methods in neuroscience
 - Read/Watch
 - Mendoza-Halliday, D. (2019). Neuroscience methods tutorial. <https://youtu.be/iHthMSN65bA>.
 - Cognitive Psychology and Cognitive Neuroscience/Behavioural and Neuroscience Methods. 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 <https://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 <https://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 <https://dx.doi.org/10.1146/annurev-neuro-071013-014111>.
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Week 3

Thursday, September 10

- Topics
 - Cellular neuroscience (anatomy)
 - Cellular neuroscience (resting potential)

- Read/Watch
 - BW¹ 2:36-51.
 - Zeng, H., & Sanes, J. R. (2017). Neuronal cell-type classification: challenges, opportunities and the path forward. *Nature Reviews Neuroscience*. Retrieved from <https://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 <https://dx.doi.org/10.1016/j.tins.2015.07.006>.
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Week 4

Thursday, September 17

- Topics
 - Cellular neuroscience (action potential, and synaptic transmission)
 - Read/Watch
 - Read BW 3:61-78.
 - Read BW 3:78-92.
 - **Quiz 1.** Take home. Due at start of class on Thursday, September 24, 2020.
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Week 5

Thursday, September 24

- Topics
 - Neurochemistry.
 - Read/Watch
 - Read BW: 4:95-100.
 - Read BW 4:101-130.
 - **Quiz 1 due.** Bring your copy to class or email it to me.
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Week 6

Thursday, October 1

- Topic
 - Hormones
 - Brain/gut connection

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

- Read/Watch
 - Read BW 5:125-154.
 - Read BW 5:131-159.
 - (Optional) 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 <https://dx.doi.org/10.1016/j.tins.2016.09.002>.
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Week 7

Thursday, October 8

- Topics
 - Evolution of the nervous system
 - Development of the human brain
 - Reading
 - Read BW 6 & 7.
 - 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 <https://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 <https://dx.doi.org/10.1016/j.tins.2017.06.003>.
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Week 8

Thursday, October 15

- Topics
 - Perception.
 - Read/Watch
 - Read BW 8:230-241.
 - Hubel, D. H. (1982). Exploration of the primary visual cortex, 1955-78. *Nature*, 299(5883), 515–524. <https://www.ncbi.nlm.nih.gov/pubmed/6750409>.
 - 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 <https://www.sciencedirect.com/science/article/pii/S0166223616300480>.
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Week 9

Thursday, October 22

- Topics
 - Action.
 - Read/Watch
 - Read BW 10: 301:335, 11: 341:368.
 - Nielsen, J. B. (2016). Human spinal motor control. *Annual Review of Neuroscience*, 39, 81–101. Retrieved from <https://dx.doi.org/10.1146/annurev-neuro-070815-013913>
 - 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 <https://dx.doi.org/10.1146/annurev-neuro-062111-150509>.
 - **Quiz 2** distributed. Due at start of class on October 29, 2020.
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Week 10

Thursday, October 29

- 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 <https://dx.doi.org/10.1146/annurev-neuro-071013-013847>.
 - **Quiz 2** due.
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Week 11

Thursday, November 5

- Topics
 - Learning & memory. Read BW 17.
 - Read/Watch
 - 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 <https://dx.doi.org/10.1146/annurev-neuro-061010-113720>.
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Week 12

Thursday, November 12

- Topics
 - Fear, stress, & reward.
 - Read/Watch
 - Read BW 15.
 - 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 <https://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 <https://dx.doi.org/10.1146/annurev-neuro-070815-014106>
 - Musazzi, L., Tornese, P., Sala, N., & Popoli, M. (2017). Acute or chronic? A stressful question. *Trends in Neurosciences*. Retrieved from <https://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 <https://dx.doi.org/10.1146/annurev-neuro-072116-031109>.
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Week 13

Thursday, November 19

- Topics
 - Disorder and Disease.
 - Read/Watch
 - Read BW 16.
 - 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 <https://dx.doi.org/10.1016/j.tins.2017.04.003>.
 - Pawlusi, 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 <https://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 <https://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 <https://dx.doi.org/10.1146/annurev-neuro-071714-033821>.
 - **Quiz 3** distributed. Due at start of class on **Thursday, December 3, 2019**.
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Thanksgiving Break, November 23 - 27, 2020

Week 14

Thursday, December 3

- Topics
 - Networks all the way down
 - Read/Watch
 - Bullmore, E., & Sporns, O. (2009). Complex brain networks: graph theoretical analysis of structural and functional systems. *Nature Reviews Neuroscience*, 10(3), 186–198. <https://doi.org/10.1038/nrn2575>.
 - Raichle, M. E. (2015). The brain's default mode network. *Annual Review of Neuroscience*, 38, 433–447. Retrieved from <https://dx.doi.org/10.1146/annurev-neuro-071013-014030>.
 - Jonas, E., & Kording, K. P. (2017). Could a Neuroscientist Understand a Microprocessor? *PLoS Computational Biology*, 13(1), e1005268. <https://doi.org/10.1371/journal.pcbi.1005268>.
 - Quiz 3 due.
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Week 15

Thursday, December 10

- Topics
 - Reproducibility in neuroscience
 - Readings
 - Kass, R. (2020). Exaggerated Claims Undermine Science by Ignoring the Scientific Method. <https://youtu.be/PwCyyvSDkUCY>
 - Botvinik-Nezer, R., et al. (2020). “Variability in the analysis of a single neuroimaging dataset by many teams.” *Nature* 582(7810): 84-88. <https://doi.org/10.1038/s41586-020-2314-9>.
 - 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 <https://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 <https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002506>.
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Week 16

Tuesday, December 16, 2020

- Final papers due
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Evaluation

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

Component	Points	% of Grade
Quizzes	10 pts * 3 quizzes = 30	33.3
Participation	15 wks * 2 pts/wk = 30	33.3
Paper	30 pts	33.3
TOTAL	90	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

Paper

Please write a critical review in the style of a [Behavioral and Brain Sciences (BBS)]<https://www.cambridge.org/core/journals/behavioral-and-brain-sciences>) commentary. The target of your review could be a published article in BBS or an article published in another journal. Examine some existing BBS papers in your areas of interest to see how authors choose to structure their commentaries. Typically, a BBS commentary is restricted to 1,000 words, but you have latitude to write up to 2,500 words.

Do's

- Always put your last name and first name in the file name of all documents you submit. For example, `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.
- 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-2020>
- 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

Resources

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- *Neuron* Brainview

Data repositories

- OpenNeuro
- OpenfMRI

Policies

Academic Integrity

Penn State defines academic integrity as the pursuit of scholarly activity in an open, honest and responsible manner. All students should act with personal integrity, respect others dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts (Faculty Senate Policy 49-20). Sanctions for academic misconduct can include a grade of F for the course as well as other penalties.

Students are responsible for maintaining academic integrity. Violations include cheating on exams, talking to others during exams, looking at another student's test materials or answers during an exam, removing exams from the classroom without consent from the instructor, plagiarizing (do not copy from someone else!), and dishonesty in any aspect of course participation.

When you complete assignments, remember the **ABCs** to avoid plagiarism: **A**lways place copied information within quotation marks, include information about the quoted or paraphrased source in a **B**ibliography, and **C**ite the source in the body (in the text) of your paper immediately after the quoted or paraphrased information. When in doubt, cite in the text and include the source in a bibliography.

Late, missed or make-up assignments

Exams Make-up exams may be permitted under unusual circumstances such as (a) an interview for graduate school or a job, (b) illness, (c) religious observance, (d) the death of a family member, or (e) any other event recognized by the university as a valid excuse for absence from class.

If you must miss class on the day an exam is scheduled, you must do the following:

1. Contact the TA or the instructor by telephone, email, or in person in advance of the exam. Twenty-four hours notice is expected. If you do not contact the TA or instructor in advance, it is possible that you may not be able to schedule a make-up exam.
2. Arrange with the TA or instructor to take a make-up exam as soon as possible, but no later than one (1) week following the date of the scheduled exam. It is your responsibility, not the TA's or the instructor's to schedule an approved make-up exam in a timely way.

Quizzes No make-up quizzes will be given except under unusual circumstances. You may ask for a copy of the quiz for studying purposes, however.

Accommodation for persons with disabilities Penn State welcomes students with disabilities into the University's educational programs. Please refer to the information provided by Student Disability Resources (SDR) at <http://equity.psu.edu/student-disability-resources/> for information about the procedures required to obtain reasonable accommodations in this course. Students should discuss SDR-approved accommodations with their instructor as early in the semester as possible, even if they have taken another course with the instructor. Please note: students are not required to provide their instructor with information about the nature of their condition.

Penn State students are also welcome to contact other units for assistance with personal concerns that interfere with academic progress, including: Counseling and Psychological Services (CAPS; <http://studentaffairs.psu.edu/counseling/>), the Office of Student Affairs (<http://studentaffairs.psu.edu/>), Career Services (<http://studentaffairs.psu.edu/career/>), the Center for Women Students (<http://studentaffairs.psu.edu/womenscenter/>), the LGBTQA Student Resource Center (<http://studentaffairs.psu.edu/lgbtqa/>), the Office of Sexual Misconduct Prevention and Response (<http://titleix.psu.edu/>), Penn State Educational Equity (<http://equity.psu.edu/>), the Multicultural Resource Center (<http://equity.psu.edu/mrc/>), and University Health Services (<http://studentaffairs.psu.edu/health/>).

Nondiscrimination Statement

The Pennsylvania State University is committed to equal access to programs, facilities, admission and employment for all persons. It is the policy of the University to maintain an environment free of harassment and free of discrimination against any person because of age, race, color, ancestry, national origin, religion, creed, service in the uniformed services (as defined in state and federal law), veteran status, sex, sexual orientation, marital or family status, pregnancy, pregnancy-related conditions, physical or mental disability, gender, perceived gender, gender identity, genetic information or political ideas. Discriminatory conduct and harassment, as well as sexual misconduct and relationship violence, violates the dignity of individuals, impedes the realization of the University's educational mission, and will not be tolerated.

Direct all inquiries regarding the nondiscrimination policy to:

Dr. Kenneth Lehrman III Vice Provost for Affirmative Action Affirmative Action Office The Pennsylvania State University 328 Boucke Building University Park, PA 16802-5901 Email: kfl2@psu.edu Tel (814) 863-0471

Diversity Statement

This classroom is a place where you will be treated with respect. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Penn State is committed to creating an educational environment which is free from intolerance directed toward individuals or groups and strives to create and maintain an environment that fosters respect for others as stated in Policy AD29 Statement on Intolerance.

Mandated Reporting Statement

Penn State's policies require me, as a faculty member, to share information about incidents of sex-based discrimination and harassment (discrimination, harassment, sexual harassment, sexual misconduct, dating violence, domestic violence, stalking, and retaliation) with Penn State's Title IX coordinator or deputy coordinators, regardless of whether the incidents are stated to me in person or shared by students as part of their coursework. For more information regarding the University's policies and procedures for responding to reports of sexual or gender-based harassment or misconduct, please visit <http://titleix.psu.edu>.

Additionally, I am required to make a report on any reasonable suspicion of child abuse in accordance with the Pennsylvania Child Protective Services Law.

COVID safety information

Students experiencing any illness and especially COVID-19 related symptoms should not attend class in person. Those students are strongly encouraged to contact a health care provider and their instructor as soon as possible to discuss reasonable accommodations.

Students should remain at least six feet away from others in our classroom. Policies require all of us to wear masks appropriately to cover our mouths and noses while we are in our classroom. Students who do not want to distance themselves appropriately or wear a mask during class may not attend class in person. Attending this class without wearing a mask properly constitutes a classroom disruption, a violation of several articles of the student Code of Conduct (<https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct>), and a violation of policy AD 57 (<https://policy.psu.edu/policies/ad57>). Anyone in the classroom who is not wearing a mask appropriately will be asked to do so or to leave. I am required to end class if anyone refuses this request. Failure to comply may result in a conduct violation. Students who believe they should be granted a health or safety exception to this policy should consult with Student Disability Resources about reasonable accommodations and present their accommodation letter to me if an exception is granted.

Zoom

I will be using Zoom and recording lectures to allow students who are unable to attend class in person to participate.

While you are on Zoom, keep in mind that this is a classroom environment and others should be treated with respect. Please keep your microphone muted unless you want to ask a question or interact with someone. If your microphone is not muted, the entire class will be able to hear what is going on in your environment. Also, as an instructor, I personally like to see people's faces. Also, as a participant, I am more involved when I have my camera on. I realize, however, that there are many reasons why you might not want to turn on your camera such as poor internet connection, joining via phone, or other privacy concerns. It is your choice as to whether you would like to have the camera on or not.

Note that video and audio recordings of class lectures will be part of the classroom activity. The video and audio recording is used for educational use/purposes and only may be made available to all students presently enrolled in the class. For purposes where the recordings will be used in future class session/lectures, any type of identifying information will be adequately removed.

Values

Penn State Principles

The Pennsylvania State University is a community dedicated to personal and academic excellence. The Penn State Principles were developed to embody the values that we hope our students, faculty, staff, administration, and alumni possess. At the same time, the University is strongly committed to freedom of expression. Consequently, these Principles do not constitute University policy and are not intended to interfere in any way with an individual's academic or personal freedoms. We hope, however, that individuals will voluntarily endorse these common principles, thereby contributing to the traditions and scholarly heritage left by those who preceded them, and will thus leave Penn State a better place for those who follow.

I will respect the dignity of all individuals within the Penn State community. The University is committed to creating and maintaining an educational environment that respects the right of all individuals to participate fully in the community. Actions motivated by hate, prejudice, or intolerance violate this principle. I will not engage in any behaviors that compromise or demean the dignity of individuals or groups, including intimidation, stalking, harassment, discrimination, taunting, ridiculing, insulting, or acts of violence. I will demonstrate respect for others by striving to learn from differences between people, ideas, and opinions and by avoiding behaviors that inhibit the ability of other community members to feel safe or welcome as they pursue their academic goals.

I will practice academic integrity. Academic integrity is a basic guiding principle for all academic activity at Penn State University, allowing the pursuit of scholarly activity in an open, honest, and responsible manner. In accordance with the University Code of Conduct, I will practice integrity in regard to all academic assignments. I will not engage in or tolerate acts of falsification, misrepresentation or deception because such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

I will demonstrate social and personal responsibility. The University is a community that promotes learning; any behaviors that are inconsistent with that goal are unacceptable. Irresponsible behaviors, including alcohol or drug abuse and the use of violence against people or property, undermine the educational climate by threatening the physical and mental health of members of the community. I will exercise personal responsibility for my actions and I will make sure that my actions do not interfere with the academic and social environment of the University. I will maintain a high standard of behavior by adhering to the Code of Conduct and respecting the rights of others.

I will be responsible for my own academic progress and agree to comply with all University policies. The University allows students to identify and achieve their academic goals by providing the information needed to plan the chosen program of study and the necessary educational opportunities, but students assume final responsibility for course scheduling, program planning, and the successful completion of graduation requirements. I will be responsible for seeking the academic and career information needed to meet my educational goals by becoming knowledgeable about the relevant policies, procedures, and rules of the University and academic program, by consulting and meeting with my adviser, and by successfully completing all of the requirements for graduation.

Penn State Values

Integrity: We act with integrity and honesty in accordance with the highest academic, professional, and ethical standards.

Respect: We respect and honor the dignity of each person, embrace civil discourse, and foster a diverse and inclusive community.

Responsibility: We act responsibly, and we are accountable for our decisions, actions, and their consequences.

Discovery: We seek and create new knowledge and understanding, and foster creativity and innovation, for the benefit of our communities, society, and the environment.

Excellence: We strive for excellence in all our endeavors as individuals, an institution, and a leader in higher education.

Community: We work together for the betterment of our University, the communities we serve, and the world.