

Behavioral Neuroimmunology

Where/When

TBD

Instructor

Marisa Spann, PhD, MPH (mns2125@cumc.columbia.edu)

Office Hours

TBD

Prerequisites

This course is open to advanced undergraduate students who have taken UN2430 (Cognitive Neuroscience), UN2450 (Behavioral Neuroscience), UN1010 (Mind, Brain, & Behavior) or an equivalent introductory course in neuroscience or cognitive psychology. Instructor permission is required prior to registration.

Course Description

In this course we will examine and discuss some of the multiple interactions among the nervous, immune, and endocrine systems, and the consequences of these interactions for health and behavior, using both the human and animal literatures. Topics include the role of the immune system in neural circuit formation and function, cognition and emotion, neuroendocrine-immune interactions during stress, and the effects of infection, stress, or toxin exposure during critical life stages on health vs. disease throughout the lifespan. We will consider current events related to COVID19 in these topics as well. The critical role of the immune system in brain development and the potential role of early-life inflammatory events in the etiology of psychopathology (autism, schizophrenia), allergies and autoimmunity, and neurodegenerative conditions (Parkinson's, Alzheimer's) will be highlighted.

This course is a weekly seminar, with each meeting divided into a brief introductory lecture followed by a student presentation and discussion of weekly assigned readings. Grading will be based on attendance and general participation (25%), a weekly reading response posted to Courseworks (25%), a presentation of a piece of primary literature (article) required for one session (25%) and an 5-6-page final paper and summary presentation (25%) in which each student is expected to explore one topic from the semester that has peaked their interest in more depth. Details on all of these elements are given below.

Course Goals

1. **Appreciate** the history and philosophical origins of the fields of Behavioral Neuroscience and Neuroimmunology, and how the two have merged to become a single discipline (*Behavioral Neuroimmunology*, a.k.a. *Psycho-Neuro- Immunology (PNI)*).
2. **Describe** the structure and function of the immune system at a basic level, and some of the many interactions among the nervous, endocrine, and immune systems.
3. **Evaluate** how these interactions may inform current issues in medicine and mental health.
4. **Formulate** hypotheses about behavioral-neuroimmune relationships and critically analyze the claims made by others about these relationships.
5. **Develop** your skills of presentation, communication, and analysis.

Requirements/Grading

Attendance and Participation: A large portion of each class will be devoted to discussion of the day's topic and the associated primary literature. Therefore, it is crucial that everyone come prepared having reviewed the required readings PRIOR to class, as well as having considered them in light of the learning objectives I have outlined in the syllabus for that seminar meeting. Attendance and participation are required and will count towards 25% of the final grade. Good participation will reflect both thoughtful listening to other students' comments as well as consistent contribution to the day's discussion. Discussion contributions should reflect that the student has reviewed the readings prior to class. One absence is permitted, but must be communicated to the instructor prior to the beginning of class or be accompanied by an official Dean's excuse or it will be considered unexcused.

Weekly Reading Response: In order to stimulate discussion, a thoughtful response to the weekly readings is required. This response should be between ½ to 1 page in length and posted to the Courseworks Discussion Board 24-hours prior to the start of class. Thoughtful responses, including those that comment on or critique the week's primary literature or compare and contrast the topic with another topic from the course, will receive full credit and count towards 25% of the final grade. Feedback will be provided on the first response to help guide students towards what is expected in this regard.

Presentation: Beginning with the fourth class period, each week one or more students will present a primary literature article of their choosing related to the class topic (a list of potential articles will also be posted on courseworks). During the class, the student presentations will follow the mini introductory lecture to the day's topic given by the instructor. The goal of the presentation will be to provide background and justification for the study, discuss the experimental design (clarifying the methodological details), the results and conclusions, especially with regard to the bigger picture questions being addressed both in the particular class as well as the course as a whole. The student should come prepared with some questions to stimulate discussion on his/her particular article(s) but the instructor will lead the larger class discussion for the day. It is required that all students schedule a time to meet with the instructor at least 2 days prior to their presentation to discuss the article(s). This presentation will count towards 25% of the final grade.

Final Paper and Summary Presentation: Students are asked to pick a topic from the semester to research and write about in more detail. The final paper should be 5-6 pages in length and contain a minimum of 10 primary source citations (not including reviews). In order to assure that you are on the right track, it is required that you schedule a meeting with the instructor to discuss your topic choice a minimum of 4 weeks before the due date. On the final day of class each student will provide a 5 minute presentation summarizing their paper. The paper and presentation will count towards 25% of the final grade.

Additional Class Policies

Conduct: Please silence your cell phones and refrain from using them, except in cases of emergency. If you wish to use a laptop, please use it only for class purposes and not for browsing the internet.

Academic Integrity: Please read and adhere to the policies regarding academic integrity found in Columbia's Guide to Academic Integrity (<http://www.college.columbia.edu/academics/integrity>). Remember that you are responsible for presenting your own work in assignments and exams and for attributing others' ideas where appropriate. If you have any questions about these policies and how to correctly adhere to them, please make an appointment to see me.

Students with Disabilities: If you have special needs and may require specific accommodations with regard to the classroom or assignments, please 1) Make an appointment to see me during the first week of class

and 2) Contact the Office of Disability Services in Lerner Hall before the start of the course to register for these accommodations.

Textbooks

Required:

- (1) **Rabid: a cultural history of the world's most diabolical virus.** Bill Wasik and Monica Murphy. Viking, 2012.
- (2) **How the Immune System Works.** Sompayrac, L. Sixth Ed. Blackwell Publishing

Recommended:

- (1) Any introductory immunology text, *e.g.* **Janeway's Immunobiology.**
- (2) Any comprehensive neuroscience text, *e.g.* **Neuroscience.** Purves et al., Sinauer

Schedule

The following example schedule gives topics to be covered.

C o	Topic	Reading
1	Course introduction and overview	Sompayrac, Chapter 1
2	Innate Immunity	Sompayrac, Chapter 2
3	Adaptive Immunity	Sompayrac, Chapters 3 and 4
4	Neuroimmune communication pathways	Reardon et al., 2018. Neuroimmune communication I
5	Social factors in immune system function	<p>Stepanikova, 2017 Systemic inflammation in midlife: Race, socioeconomic status, and perceived discrimination. Am J Prev Med</p> <p>Milaniak, 2019 Childhood socioeconomic status and inflammation: A systematic review and meta-analysis. Brain Behav Immun</p>
6	Depression and the immune system	<p>D'Mello, 2017 Immune to brain communication pathways in inflammation-associated sickness and depression. Curr Top Behav Neurosci</p> <p>Miller, 2009 Inflammation and its discontents: the role of cytokines in the pathophysiology of major depression. Biol Psychiatry</p>
7	Immune Factors in Development & Neuroplasticity	<p>Morimoto & Nakajima, 2019 Role of the immune system in the development of the central nervous system. Frontiers in Neuroscience</p> <p>Marc, 2013, Brain development and the immune system: an introduction to inflammatory and infectious diseases of the child's brain. Handbook of Clinical Neurology, Chapter 110</p>
8	Sex Differences in neuroimmune function	<p>Klein & Flanagan, 2016. Sex differences in immune , Nature Reviews. Immunology</p> <p>Rainville et al., 2018. Deciphering sex differences in the immune system and depression, Frontiers in Neuroendocrinology</p>
9	Stress and the immune system	<p>Hantsoo et al., 2019. Inflammation: A proposed intermediary between maternal stress and offspring neuropsychiatric risk. Biological Psychiatry.</p> <p>Michopoulos, 2017. Inflammation in fear- and anxiety-based disorders: PTSD, GAD, and Beyond. Neuropsychopharmacology</p>
10	Neuroinflammation and neurodegeneration/aging	Sompayrac, Chapters 8, 9 and 14
11	Rabid: a cultural history of the world's most diabolical virus (and its psychological implications)	Wasik and Murphy 2012
12	Final Paper and Presentation	