

Behavioral Neuroimmunology

Carleton College, Spring 2018

Instructor Information

Instructor	Email	Office Location & Hours
Gisel Flores-Montoya, PhD.	mflores@carleton.edu	T.B.A.

Textbook: No textbook will be used. During each class we will discuss scientific papers (either review or research papers) that will be given ahead of time (see text-box below).

Important: Most of the material to be covered in class will be provided as papers in pdf format that will be posted in Moodle. You are expected to READ THEM before class, so make sure to check Moodle regularly for updates. The pdf files are copyrighted; therefore they are intended for personal use only.

General Information

Description (What will you learn?)

Until recently the fields of behavior and neuroimmunology have been studied separately, however, in the past few years the scientific community has provided convincing evidence that the peripheral immune, neuroimmune, and central nervous systems interact more strongly than previously thought and thus influence behavior. Importantly, these interactions can be beneficial or detrimental for the brain. In other words, the interaction between these systems can promote brain health and/or exacerbate behavioral and brain disruptions. In this course, you will learn to critically analyze and synthesize complex behavioral neuroimmunology scientific findings and learn about state-of-the-art techniques in neuroimmunology. More importantly, you will identify gaps in the literature and apply the knowledge learned in the class in order to develop hypotheses and propose experiments to answer your research questions.

Pre-requisite: Behavioral Neuroscience (216) or permission by the instructor.

Course Goals (What do I want you to be able to do by the time you get out of this course?)

At the beginning of the semester all students are expected to already have a basic knowledge of the language and fundamental concepts of neuroscience and biology. As you may already know neuroscience and neuroimmunology are intimately related fields thus having a basic knowledge of neuroscience will aid in your learning of how behavioral neuroimmunology relates to brain and behavior during health and disease. *Students are expected to become able to critically analyze published material in behavioral*

neuroimmunology and to develop the intellectual abilities required to apply the tools of behavioral neuroimmunology if they were to decide to pursue a career in research.

Topics Covered

The course will cover the core essential topics in behavioral neuroimmunology that any student in higher education should know in depth. These topics range from molecular biology (e.g. cytokine expression and function) to behavior (e.g. memory, anxiety, social behavior, and motor function.) Specifically, the topics to be covered in this course are listed below:

1. The innate and adaptive immune systems
2. Cytokines, inflammation, and behavior
3. Microglia, astrocytes, and behavior
4. G-protein coupled receptors (GPCRS) and immune cell migration: implications for behavior
5. The peripheral and brain lymphatic systems: implications for behavior
6. Interactions between the peripheral immune system and the central nervous system: the role of the vagus nerve
7. Brain health, development, and function: the role of neuroimmune cells
8. Brain disruptions: the role of neuroinflammation
9. Gut microbiota, the gut-brain-axis, and behavior
10. Interactions between the neuroendocrine system and neuroimmune system: implications for behavior

Course Approach

I will conduct this course in a combination of self-teaching, interactive review sessions, and class discussions.

Self-teaching: As a higher-level course, a significant portion of the “teaching load” will fall on you. Your commitment and discipline will greatly determine how much you will learn. You will be expected to read in detail both, the review papers and the research papers provided for each class (to be posted on Moodle.) For review papers, you are expected to understand the material presented on the review. This implies that you may need to consult other resources, such as basic textbooks in behavioral neuroscience, neuroimmunology, genetics, molecular biology, and other review papers to familiarize yourself with the

concepts and language required to understand the review. For research papers, you are expected to understand the goal of the paper, the methodology used throughout the study, and the actual data presented in each figure. This **does mean** that you will be expected to read and understand the Materials and Methods section and consult other sources whenever questions arise that keep you from fully understanding experimental matters related to the paper. If you are totally unable to understand a given topic, or cannot find the relevant information required, even after seriously attempting it on your own, you will be expected to approach the instructor (not the other way around!).

Interactive review sessions: The goal of these interactive review sessions is to introduce each major topic and provide the basic background required to understand the research papers covered. These will be used as substitution for lectures. Each interactive review session will start with a brief introduction given by the instructor, followed by an interactive discussion of an up to date review paper (or papers) in the topic to be covered. The review paper(s) to be discussed will be provided by the instructor with sufficient anticipation to the review session. The discussions will take the form of guided exchanges of questions and answers that will deal in depth with each specific process. This strategy will force students to be active participants of the review process, therefore stimulating active learning. Notice that for this to be an effective mechanism, each student must read with superb care each review paper. Also notice that you are highly encouraged to ASK QUESTIONS during the interactive review sessions. This is the only way I have to know that something needs further clarification. And remember, in this class THERE ARE NO “STUPID” QUESTIONS. If further clarification is required in any given topic, feel free to approach the instructor during the indicated office hours.

In-class discussions: These will be student-driven discussions related to the specific research papers assigned for each class. They may take several different forms, depending upon the participation of the students and my personal choice, including (but not limited to) individual presentations and whole-class discussions. During in-class discussions we will identify the main question or hypothesis presented in the research paper and execute a critical assessment of the experimental data, the approaches utilized, the type of controls used to validate the data, and the interpretation of the results presented. In some occasions, as deemed appropriate, we will discuss potential alternative approaches to test the hypothesis presented. The active participation of all students is expected. Please make sure to pay attention to your classmates; they may make important points that you may otherwise miss. Your participation in class will be taken into consideration for the final grade (see below).

Grading Policy

Your grade will be determined on the basis of a comprehensive assessment of your skills and their development. To this end, we will use the following elements:

1. Take-home exams: A total of two take-home exams will be administered throughout the semester, each worth 200 points. These will test your understanding, critical skills, and your ability to APPLY all material covered in class. Each of the take-home exams should be done INDIVIDUALLY. Brevity and clarity in writing are two valuable skills to develop. You should exercise these two skills as much as possible. Take-home exams will be evaluated by their content, brevity, clarity, scientific consistency and rigidity, and creativity. Remember, over 95% of all high-impact journals are written in ENGLISH, and success in our careers is to a good extent dictated by our writing abilities, therefore your writing skills will matter. Keep in mind that there are several on-line tools available to check for plagiarism. Plagiarism is severely punished by the university and may provide grounds for dismissal. So, don't even attempt to copy paragraphs or sentences from published material. Material not directly covered in class but related to the topics discussed in class may be included in the exams. In total, take-home exams will contribute 40% of the final grade (i.e., 400 points).

2. In-class quizzes: In-class quizzes provide the most effective way to assess your preparation for class and measure your progress in understanding and interpreting the data presented in scientific papers. These quizzes will most likely take the form of essay questions administered at the beginning of class (10 min). In-class quizzes will contribute 40% of the final grade (i.e., 400 points).

3. Extra points in class: During our in-class discussions I will occasionally offer extra points to the student who provides the best explanation, answer, or experimental approach to a matter under discussion. These points will simply be added to your final grade at the end of the semester. You are encouraged to keep track of your own points.

4. Contribution to the class: At the end of the semester, each student will be asked to evaluate his/her own contribution to the class. To this end, the student should take into consideration how much he/she has contributed to our in-class discussions and to the class in general. Although this is a self-given grade, I reserve the right to increase or decrease this grade depending on the tangible proof of contribution and my own perception. That is, students who did not gain any extra point in class, did not take any in-class activity, and never participated in class, will obviously have tangible and perceptual evidence that are not deserving of a good grade in this item. Therefore, they should not be surprised if their self-scored 100 points are decreased to 5 points or less. This item will contribute 10% of the final grade (i.e., 100 points).

5. Final Exam: A cumulative final exam worth 20% of the final grade (i.e., 200 points) will be administered during finals week. This final exam will consist of several essay questions that will assess your ability to analyze and discuss data presented in excerpts from two

different papers not previously covered in class, which will be provided with your exam. You will need to read and understand the information presented in the papers and therefore you are likely to need a substantial portion of the time assigned for this final. Therefore, the grading system is as follows:

Exams	400 points (2 exams/200 points each)
In-class quizzes	400 points
Extra points in class	(Extra!)
Contribution to the class	100 points
Final Exam	<u>200 points</u>
1100 Points Total (not including extra points!!!)	

The **final grade equivalency** will be as follows:

A	93-100%	C+	77-79.9%
A-	90-92.9%	C	73-76.9%
B+	87-89.9%	C-	70-72.9%
B	83-86.9%	D	60-69.9%
B-	80-82.9%	F	0-59.9%

Please note that NO CURVES WILL BE APPLIED without exception

General Policies

Students with Special Needs

Carleton College is committed to providing reasonable accommodations to students with disabilities. Students seeking accommodations should contact the Coordinator of Disability Services, Andy Christensen, at 507-222-4464 or anchrist@carleton.edu, who will then inform faculty about student accommodations.

Academic Honesty

Academic honesty is expected of all students at Carleton College. Please visit the following website <http://apps.carleton.edu/campus/doc/honesty/> for access to the full policy on Academic Integrity at Carleton and the Academic Integrity Booklet from Carleton. To clarify, using someone's work without giving that person proper credit (i.e. properly citing their work) or passing other people's works off as your own is considered plagiarism regardless of whether you got the material from a book, the Web or your best friend.

Written Work Policy

Papers cannot be evaluated if they cannot be read. In other words, all assignments must be typed and appropriately bound or stapled. You are expected to use correct spelling, punctuation, and grammar in all of your written work. You must provide complete citations for each source that you use in your written work.

Assignments are always due in class on the day designated. Emailed papers are not an acceptable mechanism for submitting papers and will not be accepted. Late papers will lose a letter grade for each day that they are late. Any exceptions must be properly documented and discussed in advance for an extension to be arranged.

Writing Assistance

The writing center, located on the 4th Libe, has peer writing consultants who can work with you during any stage of the writing process (brainstorming and final proofreading). Hours and more information can be found on the writing center website on <https://apps.carleton.edu/writingcenter/>.

Class Presentation Assistance/Public Speaking Assistance

Speech coaching is a student-staffed resource designed to assist you with class presentations, comps talks, and other speech-related events. Your coach can help you depending on your needs. For example, your coach can help you learn how to tailor the content of your talk for a specific audience, how to present the information in a clear and organized manner, and how to effectively use body language and eye contact. Please visit <https://apps.carleton.edu/campus/asc/speakeasy/> for more information.

BEHAVIORAL NEUROIMMUNOLOGY SCHEDULE: This syllabus is subject to change

Week	Class Type	Topics	Other
1	Introduction Review Paper/s Experimental Paper/s	The innate and adaptive immune systems	
2	Review Paper/s Experimental Paper/s	Cytokines and behavior	
3	Review Paper/s Experimental Paper/s	Microglia, astrocytes, and behavior	
4	Review Paper/s Experimental Paper/s	G-protein coupled receptors (GPCRS) and immune cell migration: implications for behavior	
5	Review Paper/s Experimental Paper/s	The peripheral and brain lymphatic systems: implications for behavior	Exam 1 given to students
6	Review Paper/s Experimental Paper/s	Interactions between the peripheral immune system and the central nervous system: the role of the vagus nerve	Exam 1 due back
7	Review Paper/s Experimental Paper/s	Brain health, development, and function: the role of neuroimmune cells	
8	Review Paper/s Experimental Paper/s	Brain disruptions: the role of neuroinflammation	
9	Review Paper/s Experimental Paper/s	Gut microbiota, the gut-brain-axis, and behavior	
10	Review Paper/s Experimental Paper/s	Interactions between the neuroendocrine system and neuroimmune system: implications for behavior	Exam 2 given to students
11	Final Exam		Exam 2 due back