

Physiological Psychology (830:313:02)

Syllabus: Fall 2021

HYBRID COURSE

Monday (physical meeting) 11:00 – 12:20 in SEC-111 (Busch Campus) and Asynchronous

This is a hybrid course, in which some time is allocated to in-person meetings in a lecture room. The remainder of the time involves asynchronous delivery of information. Approximately 40% of the course material will be given in our lecture room (SEC-111).

For Fall 2021 mask use inside buildings and classrooms is mandated by the university. Therefore, please make sure to bring your masks to class. The good news is that the number of students in the class is well below 50% of the capacity of the room (200 seats). Therefore, you will have the opportunity to stretch out and sit well apart.

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Course Description

This course addresses the biological basis of behavior. For anyone who plans a career in neuroscience or neuroscience-related research, it is good preparation. But it is *essential* preparation for anyone who plans to get a Ph.D. (i.e. go to graduate school) in behavioral neuroscience. In addition, it is important for those who plan to go to medical school and specialize in neurology and/or psychiatry.

The focus will be on the brain - its structure, chemistry and function – and how it generates behavior. We will not cover how the nervous system controls basic physiological functions such as cardiovascular activity, respiration, gastrointestinal function and other visceral functions. We are interested in behavior. Therefore, additional topics will address how the brain processes sensory information, generates movement and goal-oriented behavior, encodes information for short and long-term retrieval (learning and memory), and regulates emotion. Finally, we will briefly discuss how brain dysfunction accounts for psychiatric and neurodegenerative disease.

Major Learning Goals

After completing this course, students will know about the following:

1. The anatomical distinctions of the nervous system
2. How neurons release neurotransmitters and respond to chemical information
3. How information is stored and retrieved in the brain (the basis of learning and memory)
4. How the brain controls movement
5. How the brain organizes sensory information into perceptual experience
6. What drives motivational behaviors, such as sleep and food intake
7. How emotion is regulated by different regions in the brain
8. What genetic and biochemical factors determine psychiatric and neurological problems
9. The neurobiology of mood disorders and schizophrenia

Textbook

Physiology of Behavior, 12th Edition; Neil R. Carlson and Melissa A. Birkett; Pearson Publishers
ISBN: 9780134080918

E-book access through VitalSource (<https://www.vitalsource.com/>) ISBN: 9780134517858

The textbook is mandatory. This is a fact-intensive course with considerable material to learn. It is a serious introduction to the field of Behavioral Neuroscience, and therefore, **a textbook is essential**. You should also make sure that you get the 12th edition. Moreover, 25% of your assessment will be quizzes based on chapters from the book.

Lectures

Lectures will adhere closely to the general topics in the textbook. Some sections of the textbook will be assigned as private (but examinable) reading, since time will not allow for all material to be covered in class. Conversely, some lecture material will not come from the textbook.

Lecture outlines will be posted online as pdf files labeled 'Slide Set_1', 'Slide Set_2', etc. The number does not refer to the lecture number, since the slide sets may represent 2-3 lectures of material.

When we are in our lecture room, please **SILENCE YOUR CELL PHONES! AND PUT THEM AWAY**. I have no objections to students using laptops, so long as you are not surfing the net when you should be attending to the lecture.

Academic Integrity

Academic dishonesty obviously is discouraged. You should be aware of the link to the Rutgers academic integrity office: <http://academicintegrity.rutgers.edu/academic-integrity-at-rutgers/>. If you have not already done so, you should explore this and the 'Academic Integrity Policy' link, where you can read the levels of violation and sanctions.

Assessment

There will be three exams. These will be based mainly on lectures but assigned reading may be tested in exams. Each exam will be worth 25% of the total grade and will be taken online. The remaining 25% of your total grade will be obtained by completing assignments and taking quizzes online. The assignments and quizzes will be based on chapters and/or select pages from the textbook (that I will tell you to read). The two lowest scoring quizzes will not be included in your final grade.

Grading System

Students will need to achieve predetermined cut-off points for grades of A, B+, and so on. Cut-off points will be as follows:

A 90-100 B+ 86-89.9 B 78-85.9 C+ 74 -77.9 C 65 -73.9 D 55-64.9 F <55

Makeup Exams

I will need to verify all excuses for missing an exam. Questions will be different on makeup exams, but they will address the same material as the regularly scheduled exam. If the exam is missed for a legitimate and verifiable reason, the student must sit for the makeup within three weekdays of the scheduled date for the missed exam. Written and signed documentation will be required.

Legitimate reasons for a makeup: Health issues, Rutgers athletic obligations, religious events, and other similar (predetermined and fixed) events that are going to interfere with taking the scheduled exam. You will need to provide proof regarding the issue. And it is up to you to anticipate the conflict and let me know about these upcoming events so that we can administer the exam earlier. If you don't take the exam, then you will either (i) fail to receive any points, or (ii) have the option to take the makeup within three working days after the scheduled date for the exam.

Schedule of Lecture Topics

Please note that this is the intended flow of topics. The timing of introducing a topic may vary. Where it is stated that a quiz will be given (see instructions below), this will typically be on Wednesdays. I will post on Canvas a separate document that provides specific instructions about the quiz and how to handle any technical problems.

Since this is a hybrid course we have Monday mornings (11-12:20) set aside to meet in our lecture room (SEC-111). For this reason, Exams 1 and 2 will be given on Monday during this period. Exam 3 will also be on a Monday, 12/16 (see end of syllabus).

Quizzes (Wed 5pm -Thurs 5 pm)

Please note that unless otherwise stated, quizzes will be available for 24 hours from Wed 5pm until Thurs 5pm. Once you begin a quiz, it will count down as programmed. For some quizzes you may have 40 minutes, whereas for others it may be 80 minutes. Therefore, please pay attention to the instructions with each quiz. Finally, unless specified, quizzes will be based entirely on the required reading. If lectured material is to be quizzed, this will be stated. However, lectured material is always assessed in the exams.

Videos

Most weeks, lecture videos of powerpoint slides will be posted along with detailed notes when it is deemed appropriate. These videos will need to be streamed within canvas. The video lectures will extend any information that was introduced during a Monday meeting and/or the prior week. The Monday meetings can also be used to clarify anything that was not understood in a video lecture posted during the prior week. There will also be other videos posted that are of an instructional nature (e.g., clips from documentaries).

Please note the change in designated days in Week 2: We will meet on Wed 9/8

Week 1 Course Overview

Semester Begins: September 1 (Wed)

- Read Chapter 1
- There is no physical meeting this week. I will upload a video lecture providing an overview of the course and some introductory material.

Week 2 Neurons and Glia

Note that Monday 9/6 is Labor Day. Therefore, as per Rutgers academic calendar 2021-2022 Monday Classes will be on Wed 9/8

- We will cover the cells of the nervous system – focus will be on *neurons* the essential connecting units within the nervous system
- **Required reading:** Chapter 2 (up to page 32)
- **Quiz 1:** Chapter 1 and Chapter 2 (up to and including page 32)

Week 3 Neurophysiology and Communication

Monday 9/13 Class Lecture and Discussion

- Read Chapter 2 (pages 33 – 53)
- This week will cover how neurons generate action potentials. These are electrophysiological events necessary to ensure that chemical information passes between neurons. Without this property there is no chemical signaling and consequently no behavior or other form of nervous system mediated regulation.
- **Quiz 2:** Chapter 2 (pages 33 – 53)

Week 4 Neuroanatomy

Monday 9/20 Class Lecture and Discussion

- Required reading Chapter 3 (*Structure of the Nervous System*: skip pages 64-69 on development)
- The topic of neuroanatomy looks at the organization of the nervous system and how distinct areas of the brain are dedicated to different types of behavior (e.g., motor, cognition, emotion). Our attention is mainly on the brain, but we will also cover the spinal cord and the peripheral nervous system.
- **Quiz 3:** Chapter 3 (the quiz will exclude pp 64-69 on development)

Week 5 Neurotransmitters

Monday 9/27 Class lecture and discussion

- Required reading Chapter 4 (psychopharmacology)
- Neurotransmitters are the chemical signals that are essential for communication between neurons at the synapse. This chemical signaling is the basis of all behavior. Many psychoactive and psychiatric drugs have their effects on mood and other behaviors by modulating neurotransmitter concentration and/or action.
- **Quiz 4:** Chapter 4

Week 6 Monday 10/4 **Exam 1 (online): The exam will be on lecture material that covered chapters 2-4.**

- Required reading: Chapter 6 (vision)
- **Sensation and Perception:** After the exam, we will move on to new topics. This week will introduce sensation and perception. We will focus on the visual system. In doing so, the intent is to demonstrate how large portions of the brain take part in constructing the world around us. Your work this week will involve having to read Chapter 6 in preparation for lectures (live and recorded) in Week 7.

Week 7 Sensation and Perception: Vision

Monday 10/11 Lecture and Discussion

- I have singled out vision since the neurobiology is well understood and vision offers an excellent illustration of how circuits operate in the brain. The emphasis will be on (i) discussing how different cerebral hemispheres process different parts of the visual field (ii) how you know the identity of what you are looking at and how you know where it is located in space, (iii) different types of visual disorders. To understand this, we will have a brief and general overview of the visual system from the eye to the posterior cortex (and beyond).
- **Quiz 5** (written assignment due by Friday 5 pm): This will be based on the vision lectures. You will be asked to write up a report on the visual system. Detailed instructions will be provided.

Week 8 Motor System/Neurological Disorders

Monday 10/18 Lecture and Discussion

- Select pages in chapters 8 and 15 will be required reading.
- The motor system is the basis of our ability to move. We are less concerned with muscles in this section, and more concerned with how the brain orchestrates meaningful, organized, and coordinated movements. Grace, precision, and timing of movements are properties requiring neural control. The motor system is very likely the fundamental reason for why we have a nervous system. Organisms need to approach, escape, explore and cultivate their environments. Motor skills – learned and refined – are the basis of a person’s expertise. Think of musicians, singers, orators, carpenters, hair stylists, cyclists and swimmers, just to name a few areas of specific motor function. The brain has considerable “real estate” devoted to motor performance. But when this goes wrong, it can be devastating. Neurological disorders like Parkinson’s and Huntington’s disease exemplify this dramatically.
- **Quiz 6:** select pages from chapters 8 and 15 will be provided

Week 9 Emotion

Monday 10/25 Lecture and Discussion

- Required reading: Chapter 11
- Emotion is a specific state that drives behavior. For example, different behaviors are orchestrated when in a state of happiness, fear, anger, disgust, and sadness. The face often conveys the motor expression of emotion, along with whatever other motor actions are initiated (e.g., running or freezing when frightened). We will attend to how the brain produces emotion, and, will focus mainly on fear.
- **Quiz 7:** chapter 11

Week 10 Ingestive Behavior

Monday 11/1 Lecture and Discussion

- Required reading: select pages in Chapter 12

- The basic drives are thirst, food, sleep and sex. These are common to most species as they are fundamental to survival. Our focus in this section will be on eating. This is a fundamental behavior that all organisms perform. It is the act of *energy* intake. The cultural embellishments made to eating behavior and how food is prepared and presented are secondary to the fundamental necessity of food as a fuel. How we initiate and stop a meal, and what areas of the brain are controlling the timing and duration of eating will be discussed. We will also consider the notion of pleasure, since food intake is very much dependent on liking what we eat.
- **Quiz 8:** select pages from chapter 12 (ingestive behavior)

Week 11 Monday 11/8: Exam 2 (taken online): All material covered after Exam 1

Learning and Memory

- Required reading: Chapter 13
- The topic of learning and memory is part of what we call cognition. Our skills and abilities are based on acquisition of information and the ability to keep that information intact as a memory to be used. More generally, our sense of ourselves and who we are in relation to our environmental, social, and familial context relies heavily on memory. The major brain structure associated with memory is the *hippocampus*. However, since there are many “bits” of information to learn, remember and retrieve, the laying down of memories is embedded in circuits between different parts of the brain. The hippocampus just happens to be central to how memory is laid down.

Week 12 Learning and Memory (cont.)/Drugs and Addiction

Monday 11/15 Lecture and Discussion

- Required reading: select pages in Chapter 18.
- In this week we will finish up learning and memory
- We will also commence the topic of psychoactive drugs and addiction. We will emphasize how addiction involves a strong learning component. And this learned component to addiction can account for craving and relapse to drug-seeking behavior. We will briefly cover the major psychoactive drugs and focus on their mechanisms of action.
- **Quiz 9 (Written assignment due Friday 5PM):** This assignment will be based on questions provided in Week 11.

Week 13 Drugs and Addiction (cont.)

Monday 11/22 Lecture and Discussion (Note this is Thanksgiving Week: No work to be assigned 11/24-11/28)

- We will finish up our treatment of drugs and addiction

Week 14 Stress and Anxiety

Monday 11/29: No in-person class this week (Wed classes are on Monday as per the Academic Calendar)

- Required Reading: select pages in Chapter 17

- We all understand stress and anxiety as experiences of psychological pressure and worry. And it is easy to consider such experiences as inappropriate. However, they are normal and involve the activation of key areas of the brain and the endocrine system (i.e. the hormonal system). This helps us cope with challenges in life. It is often thought of as pathological when we cannot stop “stressing” or experience excessive levels of anxiety. Investigations into why this happens are the basis of pharmacological psychiatric interventions.

Quiz 10: Chapter 17

Week 15 Mood Disorders and Schizophrenia

Monday 12/6 Lecture and Discussion

Required Reading: Chapter 16

The major type of mood disorder in psychiatry is depression, although bipolar disorder is also a mood disorder, in which fluctuations between depressive and manic states take place to the detriment of normal functioning. The older term for mood disorders is ‘affective disorders,’ and from a neurobiological standpoint this topic logically follows from that of anxiety and stress. Many of the same notions are applied in trying to understand mood disorders from what could be thought of as a “brain-in-disarray” perspective. The same can also be applied to schizophrenia, which is the extreme version of the “brain-in-disarray” perspective, in which circuits are not operating normally and result in what is referred to as psychotic behavior.

Quiz 11: Chapter 16

Week 16

Monday 12/13: final day of classes – There will be no physical meeting

Students should review material and should take this opportunity to ask last minute questions to clarify material in previous weeks. A zoom session will be open during the normal designated time of 11-12:20.

Final Exam (online): 12/16, 8AM-11AM – based on all material covered after Exam 2