

NEUR 200 / PSYC 202

Introduction to Neuroscience

Fall, 2021

SCHEDULE –

Mondays and Wednesdays

12:30pm – 1:45pm

PROFESSOR

Dr. David Yager

ddyager@umd.edu

Office hours:

Monday and Wednesday

2:00pm–3:00 pm

and on [WebEx](#) (best)

TEACHING ASSISTANTS

Vedavalli Govindan

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Kathryn Perlowitz

kperlowi@umd.edu

TAs are available for [WebEx](#) appointments

PREREQUISITES

BSCI 170/171 or an equivalent college-level biology course (includes an AP course with a test score of 4 or 5)

(Not open to students who have completed PSYC 301 or BSCI 353.)

CREDITS

Three

In an evolutionary sense, the job of the nervous system is to produce, control, and coordinate behaviors that help an animal survive and reproduce. Neuroscience is the study of how the nervous system does that. Neuroscientists work at all levels of organization, from genes to nerve cells to ‘simple’ neural circuitry to the complex neural networks that produce memory, problem-solving, and social interactions.

Imagine: the 170 billion cells making up the three pounds of tissue between your ears, create everything that you experience, that you do, that you think, that you feel. Your brain is YOU.

Neuroscience research is moving forward very quickly these days. Almost every week, there are exciting and often surprising new discoveries. Beyond basic nervous system functions, this new knowledge is helping us understand disorders of the nervous system like schizophrenia, addiction, Parkinson’s disease, autism spectrum disorders, Alzheimer’s disease, depression, and bipolar disorder.

A major goal of NEUR 200 is to immerse you in the excitement of neuroscience by giving you the basic tools with which to appreciate our growing understanding of normal and abnormal nervous system function.

Summary of the course’s learning outcomes:

The first third of the course will introduce you to the basics: the structure of the nervous system and how neurons communicate with one another. We will give close attention to the synapse and neurotransmitters, using the abnormalities in schizophrenia and Parkinson’s disease to help us understand normal mechanisms.

In the second portion of the course, we will explore how the nervous system gathers and interprets information from the external world. We will use touch, pain, and visual processing as our examples. We will then see how the brain uses sensory information to control movement.

Your brain’s structure and function are constantly changing - this is plasticity. You will learn how the nervous system develops, changes across the lifespan, and compensates for damage along the way. Memory is a form of plasticity, and we will examine its mechanisms in detail. We will finish the semester studying sleep, in part because it is fascinating and in part because its study pulls together many of the major principles of CNS function.

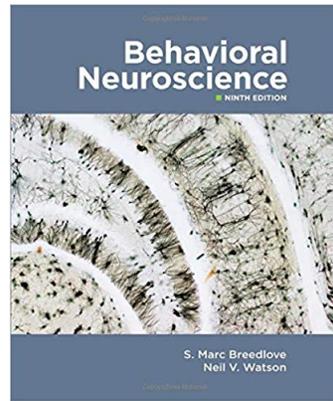
Throughout the course, we will consider the impact of neuroscience on society as well as the effects of societal norms and policies on neuroscience research.

Go to the course’s [CANVAS](#) site for full descriptions of the learning outcomes.

NEUR 200 is a gateway course for further studies in neuroscience at UMD and is required for the Neuroscience Major.

READINGS

Optional, highly recommended



Behavioral Neuroscience (9th ed.)

by Breedlove and Watson

ISBN: 978-1605359076

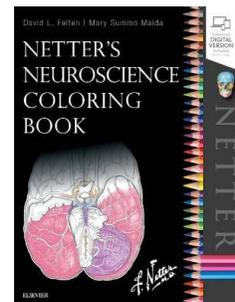
Price: **\$170 to buy**
\$85 to rent
Used ???

(The 9th edition is best, but the 8th would be OK.)

This is a new edition of a highly successful textbook. Excellent graphics, a pleasantly readable text, and a sensible organization make this easily the best of all the books I 'auditioned' for NEUR 200. The associated website has various materials including animations and videos that may or may not be useful as study aids.

I know this isn't the cheapest neuroscience textbook, but renting access on-line or a used hard-copy will be fine for almost everyone. An excellent text like this one provides an important learning asset. It gives you different graphics than I use in class and a different way of presenting the same material. Both will help you understand the most challenging topics, especially in the first two-thirds of the course.

The second book can be of especially great value in learning about CNS structure, one of the most difficult topics for many students. Get a bunch of colored pencils and the coloring book to help you overcome the challenges of learning neuroanatomy.



Netter's Neuroscience Coloring Book

by Felton and Maida,

ISBN: 978-0323509596

Price: **\$20**

Optional, for broader perspective on neuroscience

These classic books have been very popular with students in the past. They use medical case studies to illustrate concepts, which makes them especially readable.

The Sacks book was among the first of the genre and still one of the best.

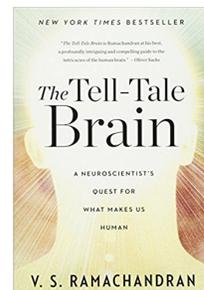
The Tell-Tale Brain would be a good place to start.

The Tell-tale Brain

by V.S. Ramachandran,

ISBN: 978-0393340624

Price: **\$11**

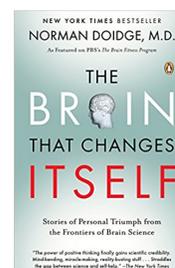
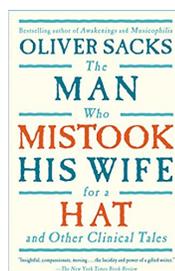


The Man Who Mistook His Wife for a Hat

by Oliver Sacks.

ISBN: 978-0684853949

Price: **\$11**



The Brain that Changes Itself

by Norman Doidge,

ISBN: 978-0143113102

Price: **\$11**

Additional readings

There will be additional required readings and/or videos for section of the course. Their goal is the highlight more personal and societal implications of neuroscience research. Exams will contain questions from these assignments.

The NEUR200 /PSYC202 ELMS-CANVAS site is an extension of this syllabus. It describes in great detail all aspects of class activities, policies, and assessments.

You really, really, **really** need to understand all of the policies and instructions presented both here and on the CANVAS site.

ASSESSMENTS

Assessments like exams, quizzes, and writing assignments have the dual roles of helping you learn and demonstrating your skills and mastery of the material. Assessments are opportunities for feedback on how you are doing and ways in which you can improve. They are also an important motivational force. NEUR 200/PSYC202 this semester has three assessment types:

Exams
(in class)

There will be **three midterm examinations** during the course. The exams will be 75-minutes long and primarily non-cumulative. The exams will include multiple choice questions along with short-answer questions of diverse types, often involving diagrams. Exam dates: **October 4th, November 3rd, and December 13th.**

Each midterm will be worth **250 points (500 points for the course; lowest score dropped)**

The 120-minute **final exam at 8:00am December 20th** will be cumulative and worth **350 points.**

Essays

Three times during the semester, you will hand in an **800-word essay** on a topic of your choice, most often related to the assigned readings. See the CANVAS site for the specific requirements and extensive guidance. Due dates: **September 20th, October 20th, and November 29th.**

Each essay will be worth **250 points (750 points for the course).**

Optional quizzes
(on Canvas)

On Monday evenings each week, I will post a **quiz** on CANVAS covering the previous week's lectures. **The first quiz is an exception. It will cover course details, policies, and procedures described in the syllabus and the CANVAS pages.** The quiz will normally be 10-20 multiple-choice questions.

You may take a quiz three times. If you eventually score 100% on a quiz, you will get 3 bonus points added to your next midterm score. The maximum for each exam is 10 bonus points. Bonus points for the dropped exam will go to the other midterms.

Optional credit

You can earn additional points toward your course score in two ways: **1)** regular attendance at weekly review sessions and WebEx appointments; and **2)** extended essays. You can find details in the relevant CANVAS pages.

For course score calculation, these additional points are not included in the total points possible (otherwise they wouldn't be true bonus points)..

Course grades

Your final course score will simply be the total number of points earned including bonus points as a percentage of the total points possible (**1600**).

Letter grades will be assigned from the percentage course score using an equal divisions scale, e.g. 80.00 to 83.29 = B-, 83.30 to 86.69 = B, 86.70 to 89.99 = B+

LEARNING RESOURCES

Lectures

The two 75-minute lectures each week are essential components of the course. Exam questions come exclusively from lecture material. Attendance is not required, but savvy students attend regularly.

Videos of the lectures will generally, but not necessarily always, be posted on Panopto.

Lecture slides

I will post the images used in each lecture up on CANVAS in the **Modules** section. These will be in PowerPoint and in PDF formats. It is not possible to post every video I show in lectures because some of the files are very large.

Review sessions

There will be two review sessions with some scheduling flexibility related to exams, holidays, etc. The sessions will be on ZOOM accessed through our Canvas site. These will be Q&A only - no presentations or new material. Days and times to be determined.

WebEx appointments

Veda, Katie, and I will each be available during several hours every week for individual appointments scheduled through WebEx on our CANVAS site. Please be sure to sign up for appointments at least 24 hours in advance.

An exhortation!

Successful students know it. TAs know it. Faculty know it. It's simply a fact:

Students who attend office hours (appointments) and review sessions learn more and improve their performance in their courses.

We are making about 23 staff hours available to you each week. Use them!

Emails

Katie, Veda, and I are happy to respond to emails for class business, confirming appointments, and **brief** questions about course content. We are almost always able to respond within 24 hours, and usually much sooner.

COURSE POLICIES

NEUR 200 will adhere to the University-wide [Policies for Undergraduate Courses](#). What follows are policies specific to this course and brief descriptions of some of the University policies for your convenience.

Classroom community

It's simple: you will treat all your classmates with respect and consideration. All the time. No exceptions. Healthy intellectual discourse often involves disagreement, and everyone should feel free to express their opinions with the assurance that theirs will be heard and fairly evaluated. Neither I nor the TAs nor the students in the class will tolerate comments or actions that are, explicitly or by implication, disparaging, demeaning, discriminatory, or disrespectful in any way.

For more detailed information, visit the [Psychology Department Diversity and Inclusiveness site](#).

NEUR 200 online

To reiterate this very important point: We have an ELMS-CANVAS site that is the heart of the course. Consider the information in the CANVAS site an essential part of the syllabus.

Be sure to read **everything** related to each activity and assessment. It is truly sad how often students lose points simply because they didn't read the relevant material on CANVAS.

To access CANVAS, go to [ELMS](#). If you need assistance, there are online tutorials and the folks at the [DIT Help Desk](#) can also help

Do this!



Go to your CANVAS Account and be sure your notification setting for Announcements is 'Right Away' so that you don't miss time-critical information like deadline changes or technical issues.

Electronics in the classroom

You may not use electronic devices of any kind during lectures. No computers, no phones, no tablets, no iPads - no electronics at all.

I am especially intolerant regarding phones. **Your phone should always be off or in airplane mode during lecture.**

Many of you already know and understand the reasons most instructors are adopting a 'No electronics' policy. In short, it is to benefit your learning while insuring that you do not interfere with anyone else's learning. I'll be happy to point you to the extensive research literature supporting this policy.

(Students with ADS accommodations should contact me during the first week of classes to discuss their particular needs.)

Extensions and missed assessments

Following University guidelines, a due date extension or makeup assessment can be given in cases where an unexpected, major problem prevents a student from completing an assignment or assessment on time. Examples of things that **do not** qualify for extensions/make-ups: planned family events, vacation travel, changes in employment schedule. The student or a representative must email me or call me **as soon as the problem arises** to inform me of the situation. At the earliest possible time, the student must present me with documentation establishing the reason for their request. If the student does not follow these procedures, there will be no extension or makeup and the score for the assessment will be zero (0%).

To be fair to everyone, I strictly follow this policy.

Academic integrity

I'm including below the official policy statement on academic integrity, but first, my personal opinion based on long experience with students, plus many years on the PSYC Undergraduate Committee and as Associate Chair for Undergraduate Education:

Cheating is just plain dumb. For so many reasons.

There are many ways to cheat in any course. I won't make it easy to do and anyone I catch will face severe consequences. However, my baseline stance is that you are all honorable and are all smart enough to understand that the short-term benefits of cheating are overwhelmingly negated by the long-term consequences.

OK, here's the official blurb:

Essential to the fundamental purpose of the University is commitment to the principles of truth and academic honesty. Accordingly, the Code of Academic Integrity is designed to ensure that the principle of academic honesty is upheld. Although all members of the University share this responsibility, the Code of Academic Integrity is designed so that special responsibility for upholding the principle of academic honesty lies with the students.

It is the responsibility of each student to understand what actions constitute a violation of the Code and understand the consequences of Code violation.

The University of Maryland Honor System is fully described at [Office of Student Conduct](#).

In past semesters, the issue of plagiarism has come up regarding the essays you will be writing. I will provide specific guidance on this topic before the first essay.

I highly recommend the [MIT Handbook for Academic Integrity](#) for excellent and thorough explanations of all academic integrity topics, but especially plagiarism.

Accessibility

If your effective learning requires accommodation of any type, you can find information and assistance at [Accessibility and Disability Services](#). Each semester students with documented needs should apply to ADS for accommodation. **There is a new system that makes ADS logistics especially easy.**

Good communication is crucial so we can work together to optimize your learning experience. Be sure to keep me posted on how the course is going for you.

Arrangements for specific assessments should be made at least a week ahead of time.

COVID-19

The sad reality is that the pandemic is still with us. We can't ignore that.

You have an essential responsibility to yourself and to the people around you to adhere to the [University rules and guidelines regarding COVID-19](#).

For our class, two of the precautions are especially relevant:

- 1) Everyone will wear a mask whenever they are in the classroom. I will as well, except when I am actually lecturing. Even then, I will stay back away from the first rows of students.
- 2) If you are experiencing any symptoms that even remotely resemble those of COVID-19, do not come to class. There will normally be Panopto recordings of lectures, and you can contact me directly to be sure you don't miss anything important.

Resilience and academic success

Please make your personal well-being your top priority.

Sleeping long and well, exercising regularly, being thoughtful about what you put into your body, and enjoying meaningful connections with others will make you resilient and help you engage more fully in your academic experiences.

Beyond being a student, you are a unique person carrying your own history, thoughts, emotions, and identities with you. It is important to acknowledge any stressors you may be facing, be they social, emotional, physical, cultural, or financial. There are ways to reduce the impacts of such stressors on your academic and personal well-being. Don't be hesitant about asking for help in pursuing the ways that best fit your own situation. The [UMD Basic Needs Security pages](#) list a broad range of helping resources. A good place to find non-judgemental listeners is the [Counseling Center](#), and [there are many other options as well](#).

Religious observances

The University System of Maryland policy provides that students should not be disadvantaged because of observances of their religious beliefs. When assignments or assessments overlap with religious obligations, we will work out a way to accommodate both.

Good communication is crucial. Let me know your plans as far ahead of time as possible.

By University policy, it is the responsibility of the student to inform the instructor in advance of any intended absences for religious observances. This normally means at the beginning of the semester or course.

Course evaluations

CourseEvalUM will be open from approximately November 30th through December 13th for you to complete your evaluations for Fall, 2021 courses. Your feedback is confidential. You can go to the website directly ([CourseEvalUM](#)) or access it through CANVAS.

NEUR 200/PSYC202 is a relatively new course, so your comments and opinions are vital to guide its continuing improvement. **If you have a suggestion, don't wait for the formal course evaluation - let me know right away!** We can talk about it and see if it might be possible to implement an improvement immediately.

Copyright

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All course materials, including instructions, presentations, assessments, content outlines, and similar materials are the intellectual property of the course instructor and protected by legal copyright. You may take notes and make copies of course materials for your own personal use. You may not, nor may you allow others to distribute lecture notes and course materials publicly, whether or not a fee is charged, without the express written consent of the instructor. For example, it is a violation of this copyright and therefore illegal to upload to or provide for posting on the internet any assessment questions or answers to such questions.



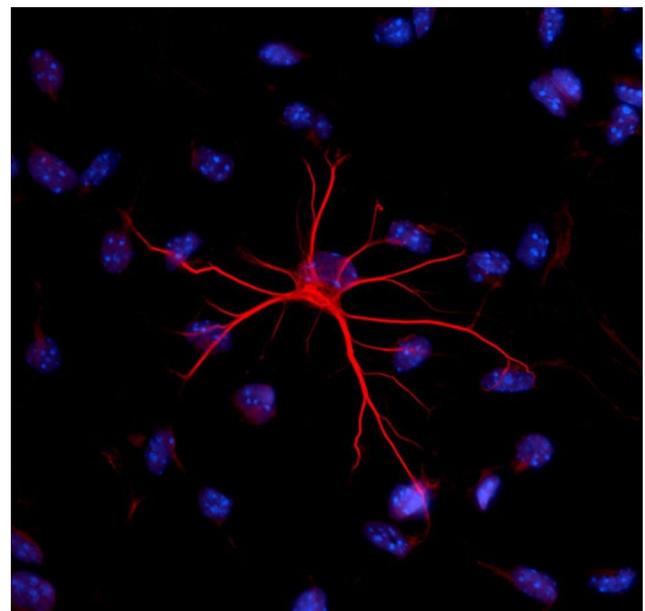
Rock Stars of Neuroscience

These are zebra fish embryos, a mainstay of studies of neural development and genetics.

The 'eyes' are actually the developing nostrils.

The real star of the show

They may not look like much, but the star-shaped astrocyte, not the neuron, is the most abundant cell type in the brain. Without astrocytes you couldn't think, you'd get brain infections, many brain cells would starve and those that survived couldn't communicate, you'd run out of some neurotransmitters, and you'd have a high probability of dying at a young age from Alzheimer's disease.





The Basics

September 20th –
Essay #1 due

October 4th

Interacting with the external world

October 20th –
Essay #2 due

November 3rd

Lecture Schedule

Well, actually more a schedule of topics. The lectures each week will cover the topics listed. I may go slower or faster depending on feedback you give me. There are also often exciting developments in neuroscience research that are well worth some time as practical demonstrations of concepts we're discussing. Bottom line: I like to keep some flexibility regarding the specific lecture schedule and content.

We will begin with an overview of the anatomy of the nervous system and its cells, information you will use throughout the course. These lectures will also introduce several fundamental concepts like homeostasis and neural networks. This may sound like basic, boring stuff of mostly historical interest, but don't be fooled. Some of the most stunning recent advances in neuroscience are right here in the fundamentals. Topics will include:

Cellular structure of the nervous system: neurons, glia, stem cells

CNS functional anatomy for basic life functions and unconscious behavioral control

CNS functional anatomy for sensory perception, cognitive behaviors, and emotions

The most fundamental function of neurons is communication, which requires both electrical and chemical signals. The signals do so much more than simple information transfer, however. To understand complex capabilities like memory, you need to appreciate the functions and flexibility of neural signals. Topics will include:

Powering the system - the membrane battery

Short-range signals for neural integration - postsynaptic potentials; neural codes

Long-range signals for information transfer - action potentials

Chemical signals between neurons - neurotransmitters and synaptic function

Synaptic physiology is central to understanding even the most complex CNS functions. To drive this home, we will talk about:

Synaptic system disorders - schizophrenia, Parkinson's disease, and other disorders as time permits

Examination #1

The nervous system acquires information from the external world (about a baseball, for instance - where it is, how fast it's traveling), processes it (for instance, predicts the baseball's trajectory), and issues the commands necessary to perform an appropriate behavior (running to the place the baseball will be so you can catch it). This scheme of **Input** → **Processing** → **Output** governs everything we do. The continual interplay between input and output is called **sensorimotor integration**. Our next topics will include:

Acquiring information about the world: how sensory systems work

Touch and pain as examples of sensory processing

Our primary sensory modality - vision

Sensorimotor integration - planning movements

Sensorimotor integration - executing and controlling movements; proprioception

Examination #2

Plasticity

The three pounds of predominantly fat and water situated between your ears somehow is YOU - your personality, your thoughts, your emotions, your dreams, your consciousness.

You now know the basic structures and physiology of the brain, so it's time to delve into the mysterious realm of complex behaviors. We can't yet answer the biggest questions such as: How are memories stored? Why do we sleep? What is consciousness? However, neuroscience offers some tantalizing possibilities.

The overarching theme of the last portion of the course is **CNS plasticity**.

We will first explore developmental plasticity. In part, that is simply how the nervous system takes shape. Our primary focus, however, will be on how early experience affects CNS development and ultimately, adult behavior. Topics will include:

Neural development - early CNS development; forming connections

Role of experience in CNS development - sensitive periods; compensatory plasticity

Developmental plasticity and adult behavior - hormones and sex

Your brain changes continuously throughout your life. It has the ability to adapt to minimize the effects of bad things that happen. The most common form of plasticity, however, is memory. Storing information entails physical changes in the brain, and that happens every day. We will continue our examination of memory when discussing sleep. Topics will include:

Compensatory plasticity - dealing with damage

The behavior and physiology of memory

Distortions and disorders of memory - false memories, amnesia, Alzheimer's disease

A prominent neuroscientist commented that 'Sleep is the price we pay for plasticity.'

We will devote considerable time to sleep and biological rhythms because: 1) it's very cool stuff with major Real World implications; 2) the topic pulls together many of the themes and concepts from the rest of the course; and 3) sleep is inextricably entwined with CNS plasticity, largely through its roles in memory. Topics will include:

Biological rhythms - circadian system; sleep propensity curve; social jet lag

An introduction to sleep - rhythmic architecture; alterations of consciousness

The neuroscience of sleep - neural mechanisms, pharmacology

Sleep and CNS plasticity - memory; emotional regulation; creativity

November 29th -
Essay #3 due

December 13th

Examination #3

December 20th

Final exam - 8:00am - 10:00am

Breedlove and Watson reading guidelines by topic

(from 9th edition)

Note that these are **not** formal reading assignments. They simply point to sections of the book relevant to particular topics. In almost every case, there is additional information in other parts of the book.

To avoid expending time and energy on material not important for this course: **1)** before the lecture, skim (but don't read) the relevant book section; **2)** listen to the lecture; **3)** read carefully about the topics specifically discussed in the lecture.

Introduction (optional)	Chapter 1 for background; the Appendix will be useful throughout course Chapter 6 on evolution - important throughout the course; evolution basics: (167-180) Chapter 18 (616-628 selectively)
CNS cells CNS anatomy	Chapter 2 (25-30; 32-36); Chapter 17 (589-590) Chapter 2 (36-53)
Membrane battery	Chapter 3 (63-68)
PSPs	Chapter 3 (77-81)
APs	Chapter 3 (68-77)
Synapses	Chapter 2 (30-32); Chapter 3 (81-88)
Neurotransmitters and receptors	Chapter 4 (98-101; 101-105 skim); (106-116 selectively)
Neurotransmitter disorders	Chapter 4 (116-118); Chapter 16 (521-536); Chapter 11 (373-375)
Sensory – touch	Chapter 12 (340-352)
pain	Chapter 8 (234-243; 246-250)
vision	Chapter 8 (252-262)
Motor systems	Chapter 10 (309-331; 337-340)
CNS development	Chapter 2 (44-46); Chapter 11 (348-352; 353-361; 361-366; 369-372)
Role of experience	Chapter 7 (199-209); Chapter 7 (215-229)
Hormones/sex	Chapter 5 (137-143; 158-163); Chapter 12 (383-392; 397-314 selectively)
Memory behavior	Chapter 17 (557-576; 590-592)
Memory mechanisms	Chapter 17 (576-588)
Rhythms and sleep	Chapter 14 (all)

Netter Coloring Book Suggestions

Below are some of the sections from the coloring book that would be helpful for our different topic areas. Use the lecture content as a guide for what is most important.

I'm not trying to be comprehensive - just making some suggestions. There are undoubtedly additional sections of the book that are relevant to each topic.

CNS cells and anatomy (topics roughly in the order we'll discuss them)

Sections 1.1; 1.3-1.8; 1.10
Sections 2.1; 4.1-4.3
Sections 3.4-3.6; 5.1-5.3; 6.1
Sections 3.1-3.3
Sections 2.2-2.9; 8.1-8.5

Neurophysiology

Sections 1.2; 1.11-1.17

Sensory systems

Sections 5.8; 5.11-5.12; relevant parts of Chapter 9 (explore!)

Motor systems

Sections 5.6; 5.9; relevant parts of Chapter 10

The rest

Chapter 11 has more complex systems. Simply chose drawings relevant to what we discuss in class.