

SCHEDULE

Tu–Th 12:30 – 1:45
1250 Biology–Psychology

PROFESSOR

Dr. David Yager
2123L Biology–Psychology
ddyager@umd.edu

Office hours:

Mondays 10:00 – 11:00
Wednesdays 1:30 – 3:00
Fridays 10:00 – noon



TEACHING ASSISTANT

Chelsea Haakenson
0140 Biology–Psychology
chaakens@terpmail.umd.edu

Office hours:

Monday 5:00 – 6:00
in review sessions

PREREQUISITES

BSCI 170/171 or equivalent

CREDITS

Three

PSYC 301

Biological Basis of Behavior

Spring 2020

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.

PSYC 301 provides a broad introduction to neuroscience, always keeping the behavioral consequences in view.

Understanding the workings of the human nervous system with its 86 billion neurons (plus an equal number of glial cells) and a thousand times that many connections for communication is a truly daunting task. Imagine: you have about 170 billion cells making up the three pounds of tissue between your ears, tissue that controls everything that you experience, that you do, that you think, that you feel.

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 PSYC 301 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.

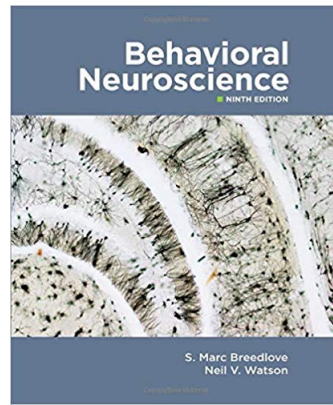
Your brain’s structure and function are constantly changing. We will use this ‘plasticity’ to help us understand the neural mechanisms underlying more complex behaviors. You will learn how the nervous system develops, changes across the lifespan, and compensates for damage along the way. Memory is a 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 major principles from throughout the course.

Go to the course’s CANVAS site for full descriptions of the learning outcomes.

PSYC 301 is equivalent to NEUR 200, which is a gateway course for further studies in neuroscience at UMD and is required for the Neuroscience Major.

READINGS

Required



Behavioral Neuroscience (9th ed.)

by Breedlove and Watson

ISBN: 978-1605359076

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

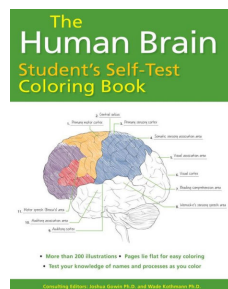
(The 9th edition is best, but the 8th would be OK.)

This is a brand-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 PSYC 301. 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 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.

Semi-optional

The following two books can be of especially great value in learning about CNS structure, one of the most difficult areas for many students. I **highly recommend** that you get a bunch of colored pencils and one of the two coloring books to help you overcome the challenges of learning neuroanatomy. The Netter book has been most often chosen by previous students.

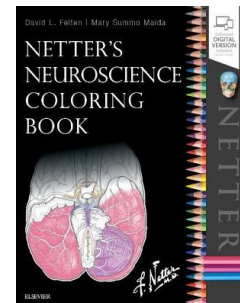


The Human Brain: Student's Self-test Coloring Book

by Wade Kothman,

ISBN: 978-1438008707

Price: **\$24**



Netter's Neuroscience Coloring Book

by Felton and Maida,

ISBN: 978-0323509596

Price: **\$20**

Truly optional

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

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

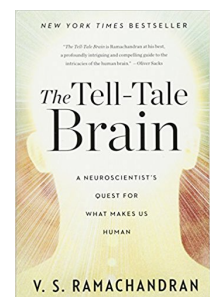
The Tell-Tale Brain would be a good place to start.

The Tell-tale Brain

by V.S. Ramachandran,

ISBN: 978-0393340624

Price: **\$11**

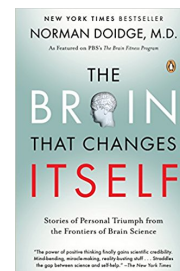
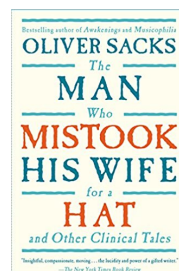


The Man Who Mistook His Wife for a Hat

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 that concern the more personal and societal implications of neuroscience research. Their goal is to challenge your thinking about the brain and behavior while putting the concepts from the lectures into a broader context.

Some exam questions will come from these materials.

As an extension of this syllabus, the PSYC 301 ELMS-CANVAS site describes in great detail all aspects of class activities, policies, and assignments. It is your responsibility to fully understand all of the policies and instructions presented both here and on the CANVAS site.

ASSESSMENTS

Philosophy

Exams are not anyone's favorite part of a course, but they serve important purposes. They are excellent motivators for studying and learning. I use them as a teaching tool by designing questions that bring together ideas or make specific points. They are a mechanism for evaluation of how you're doing during the course, and how well you performed throughout the whole course. Consistent with those purposes, I do my best to make the exams intellectually stimulating. When appropriate, I am reasonably generous about curving exam scores.

Exams

There will be **three in-class examinations** during the semester, each worth **200 points**. Only the two highest scores from these three exams will be used in computing the course score.

All students must take the **comprehensive final examination**, which is worth **300 points**.

Essays

Twice during the semester, you will hand in an **800-word essay** on a topic of your choice from the assigned readings. See the CANVAS site for the specific requirements and extensive guidance.

Each essay will be worth **200 points (400 points for the semester)**.

Course grades

The final course score will simply be the total number of points earned on the tests and essays as a percentage of the total points possible (**1100**). (miniExams can provide bonus points.)

Letter grades will be assigned from the 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+

There will be no extra-credit assignments. There will be no retakes of examinations.

LEARNING RESOURCES

Images and videos

After each lecture, I will post the images used up on CANVAS in the Modules section. These will be in PowerPoint and in PDF formats. It is not always possible to post every video I show in class because the files can be very large. Most lectures will have a Panopto recording.

Practice quizzes

Monday night each week (except mini-exam weeks) starting February 3rd, Chelsea will post a practice quiz covering the previous week's lectures on CANVAS. The quiz will normally be 8-10 multiple-choice questions similar, but not identical to in-class exam questions.

You can take the quiz up to 3 times; only the highest score will be recorded. Each quiz you complete with a score of 100% will add one (1) percentage point to your grade on the test covering the material in the quiz.

An important point: Each quiz will be available for one week, i.e., until the following Monday at 11:59 pm, and then be replaced by a new quiz. As part of my anti-cramming initiative, **old quizzes will NOT be available, so be sure to take the practice quizzes regularly.**

miniExams

There will be **three optional online mini-exams**, each one worth **20 bonus points**. These will be longer and more challenging than the practice quizzes. The mini-exams will be time-limited to 20 minutes and will be available 4:00pm-10:00pm on the test day. Only the two highest scores will contribute to your course score. See more details on CANVAS.

Review sessions

Every Monday from 5:00 - 6:00 starting February 3rd, Chelsea will be available in Room 0140 BPS for a review/discussion of the previous week's lecture material. These will be in 'question-and-answer' format, and she will not present any new information. **Highly recommended!**

One or two days before each exam, I will host a 'question-and-answer' review session covering all the material for that exam. The specific places, dates, and times are TBA.

Office hours

I have scheduled extensive office hours. **Use them!**

I and other faculty routinely see that students who come to office hours do better on their exams. That is especially true for neuroscience courses, which can require study strategies unlike those in many other courses. When you stop by, we can talk about the material covered in lecture, study strategies tailored to your learning style, exciting neuroscience research - whatever will be useful and interesting for you.

Emails

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

COURSE POLICIES

PSYC 301 will adhere to the University-wide [Policies for Undergraduate Courses](#). What follows are policies specific to this course and brief descriptions of the University policies for your convenience.

Electronics in the classroom

No computers, phones, or tablet devices are permitted during our classes.

More than a decade of substantial research shows that the downsides to computers in the classroom thoroughly outweigh any possible benefits. I think many, if not most, students have come to realize this.

(Students with documented ADS accommodations can be excepted.)

Turn off your phone or put it in airplane mode before class starts.

Missed assessments

Following University guidelines, a makeup exam or assessment due date adjustment can be given in cases where an unexpected, major problem (severe illness/injury, hospitalization, kidnapping, etc.) prevents a student from attending an exam. Recreational travel, family social events, and hangovers are examples of non-valid justifications for a make-up exam. 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 official, written documentation validating the reason for missing the exam. A note from a parent/friend or a fake document from the Web won't work. If the student does not inform me promptly or does not present me with timely, complete documentation, there will be no makeup and the student's score for the exam will be zero (0%). **To be fair to everyone, I strictly follow this policy.**

Incompletes

An "incomplete" will be assigned as a grade only in cases of compelling and documented need. Incompletes are normally reserved for students experiencing a catastrophic event near the end of the semester. To qualify for an incomplete, the student must have finished a substantial portion of the course, i.e. at least two of the exams, and be performing at a "C" level or better. The student will be asked to sign an "incomplete contract" stipulating the requirements and date for the completion of the course and assignment of a final grade.

Online

We have an ELMS-Canvas site for the course and will be using it extensively. Be sure to familiarize yourself with the site.

Be sure your notification setting for Announcements is 'ASAP' so that you don't miss time-critical information. Examples: deadline changes, canceled classes, grading information.

To access CANVAS, go to [ELMS](#) which is both a portal and a source of help and information about the system. There are, for instance, online tutorials on using ELMS-Canvas

If you have trouble logging on, try the [DIT Help Desk](#).

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

Resilience and academic success

Please make your personal well-being a priority throughout this semester.

Sleeping long and well, moving your body, 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](#).

Academic integrity

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 [Student Honor Council](#).

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 request forms that you can provide to your professors as proof of your eligibility for accommodations. **This form should be provided at the beginning of the semester.**

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

Religious observances

The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances.

It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance. Notice should be provided as soon as possible, but no later than the end of the schedule adjustment period. Prior notification is especially important in connection with final exams, since failure to reschedule a final exam promptly can have very serious academic consequences.

Course evaluations

Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning. CourseEvalUM will be open for you to complete your evaluations for fall semester courses between April 28th and May 12th. You can go to the website directly ([CourseEvalUM](#)) or go through CANVAS to complete your evaluations. By completing all of your course evaluations each semester, you will have the privilege of accessing the summary reports for thousands of courses online at Testudo.



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.

Copyright

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Class meetings and 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.



Class Schedule

The first four lectures provide an overview of the anatomy of the nervous system and its cells. We will make a link between structure and function (where it is + what it does) and introduce some of the other 'Big Ideas' of nervous system structure (bilateral symmetry, contralaterality, neurogenesis, and others). The diverse and crucial roles of glia deserve special attention. We will also discuss current ideas about brain networks, homeostasis, and various brain imaging technologies.

January 28th

Introduction to the course; cellular structure of the nervous system

January 30th

Cellular structure of the nervous system – glia; stem cells and neurogenesis

February 4th

CNS functional anatomy for basic life functions and unconscious behavioral control

February 6th

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

One of the most basic jobs of neurons is to communicate – conveying information from the outside world, 'talking' with one another, and sending commands to muscles. The next six lectures will examine the signals that move information from one place to another (action potentials) and other signals (postsynaptic potentials) that allow each neuron to make 'decisions' based thousands of signals from other neurons. We will look especially closely at chemical communication between neurons including neurotransmitter and receptor function.

February 11th

Powering the system – the membrane battery; **Mini-exam #1**

February 13th

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

February 18th

Long-range signals for information transfer – action potentials

February 20th

Chemical signals between neurons – neurotransmitters and synaptic function

February 25th

In-class examination #1

February 27th

Maintaining and varying synaptic communication - receptor types and mechanisms

March 3rd

Neurotransmitter system disorders – schizophrenia, Parkinson's disease

The next group of lectures will introduce you to more of the 'Big Ideas' about how the nervous system works (parallel and hierarchical processing, receptive fields, CNS maps, among others). We will see how the nervous system detects and interprets touch to the skin and light patterns striking the eye. Sensory information is not truly relevant unless it can be used to create and modify behaviors like conscious movement. The constant intimate interplay of sensory and motor systems is sensorimotor integration.

March 5th

Introducing sensorimotor integration: sensory systems - touch and pain

March 10th

Sensory systems: visual system basics; **Essay #1 due by 11:59pm**

March 12th

Sensory systems: visual pathways; **Mini-exam #2**

March 17th

Spring break

March 19th

Spring break

March 24th

Sensory systems - visual perception

March 26th	Sensorimotor integration - planning movements
March 31st	Sensorimotor integration - executing and controlling movement; proprioception
April 2nd	<p>In-class examination #2</p> <p>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. No one knows the answers to the biggest questions, e.g., How are memories stored? Why do we sleep? but neuroscientists have enough information and ideas to make a start.</p> <p>First, plasticity is the ability of the nervous system to change, one of its most fundamental characteristics. We examine CNS plasticity from several perspectives starting with the effects of experience on the structure and growth of the CNS.</p>
April 7th	Neural development - early CNS development; forming connections
April 9th	Role of experience in CNS development - sensitive periods; compensatory plasticity
April 14th	<p>Developmental plasticity and adult behavior - hormones and sex; Essay #2 due 11:59pm</p> <p>Second, how does the nervous system store information and, in the process, create a sense of time?</p>
April 16th	Introduction to the neurobiology of memory and amnesia
April 21st	Anatomy and physiology of memory
April 23rd	<p>Remembering, revising, and forgetting; Alzheimer's disease; Mini-exam #3</p> <p>Finally, biological rhythms profoundly affect our daily behaviors and our overall health and happiness. We will finish the course by studying sleep, the most prominent circadian rhythm, both because of inherent 'coolness' and because it provides an excellent opportunity to pull together many of the conceptual strands that stretch throughout the semester.</p>
April 28th	Biological rhythms - circadian system; sleep propensity curve; social jet lag
April 30th	An introduction to sleep - rhythmic architecture; alterations of consciousness
May 5th	Control of sleep - behavior, neurobiology and neuropharmacology
May 7th	Exploring the function(s) of sleep - memory; emotional regulation; creativity
May 12th	In-class examination #3
May 20th	Final examination - 10:30 am - 12:30 pm

Note: Whenever possible, lectures will be recorded via Panopto and posted on CANVAS. However, keep in mind that this system is not completely dependable, and I can't guarantee that every lecture will be recorded.

Textbook reading guidelines by topic

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

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	Chapter 2 (25-30; 32-36); Chapter 17 (589-590)
CNS anatomy	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.