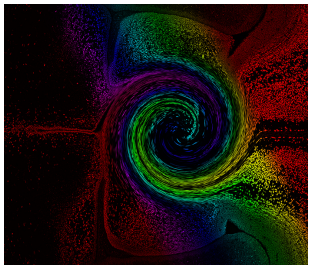
Developmental and Systems Neuroscience
NEUR 335-002 | Fall 2025



This swirling vortex-like image is a representation of the struggle brain cells endure. Cells from each side of the brain must travel a long way across the complex midline environment to make connections.
Image by Laura Morcom; caption by Queensland Brain Institute

Instructor: Dr. Jennifer Brielmaier **E-mail/phone:** jbrielma@gmu.edu / 703-993-1469
Class time: T – Online; R -- 12-1:15 pm **Location:** T – Online; R – Horizon 3010
Office hours: W 2-3 pm & by appt. (Zoom) **Office location:** Fairfax, DK 2045
Meeting scheduler: https://brielmaiersontag.youcanbook.me/
Zoom link for office hours/individual appointments: https://gmu.zoom.us/j/8641621768

Last day to add Sept 2
Last day to drop with 100% tuition refund Sept 8
Last day to drop with 50% tuition refund Sept 16

COURSE DESCRIPTION AND FORMAT

Developmental neuroscience refers to the study of the cellular and molecular events underlying the emergence of the nervous system during embryonic development and beyond. Topics include patterning of the nervous system, cell differentiation, axon guidance, synapse formation, and neural death. Systems neuroscience involves the study of neural circuits, organized into sensory and motor systems, whose activity gives rise to complex functions. For each of these systems, pathways of information flow, information processed at each level, overall function, and consequences of injury/damage will be discussed. Students are also expected to become familiar with the scientific methods used to tackle questions in developmental/systems neuroscience as well as current questions and/or controversies in the field.

This course follows a blended, flipped design. Students will view recorded lectures and additional animations/videos and will take end of chapter quizzes online. Classroom meetings will be dedicated to reviewing information and completing active learning exercises in teams. For each class contact hour, students are expected to spend twice as much time reading, viewing lecture videos, and preparing for and taking quizzes. There are weekly deadlines and exams will be given in class on specific dates. All course tasks are described in detail below. A typical week is organized as follows:

1. View lecture videos and accompanying module content (at home)
2. Complete the end of module quiz (at home)
3. Class meeting (working in groups):
    - Active learning exercise(s)
    - Exit reflection

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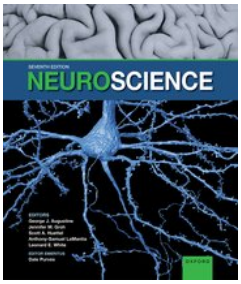
RECOMMENDED TEXTBOOK



- Augustine, G.J. et al. (2023) *Neuroscience, 7th Edition*. Sinauer Associates. ISBN: 0197616259

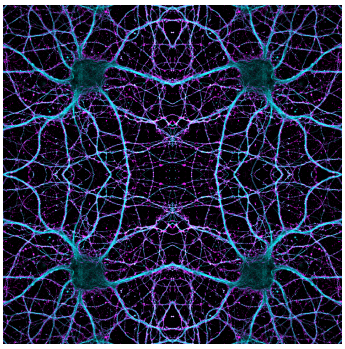
Optional recommended materials:

- Diamond, M.C., Scheibel, A.B., & Elson, LM. The Human Brain Coloring Book. Coloring Concepts, Inc. ISBN: 978-0064603065

COURSE LEARNING GOALS

By the end of the semester, students should be able to:

- Describe molecules and signaling pathways responsible for various neurodevelopmental processes.
- Outline the specific pathways through which sensory information is transmitted from peripheral receptors to brain regions responsible for higher-order processing and integration.
- Outline the specific pathways within the brain and spinal cord responsible for control of simple and complex motor behaviors.
- Apply information learned in lectures to complete active learning exercises in teams (e.g. problem sets, inquiry-base activities, case studies, peer teaching, concept mapping, finding real-life examples).



As neurons grow in culture they develop extensive networks and make connections with one another. The neuron shown here has been incubated with a protein, shown in pink, that binds to these synaptic regions. *Image by Callista Harper*; *caption by Queensland Brain Institute*

GRADED WORK

- **Module Quizzes:** To ensure preparation for the in-class activities, you will take an online quiz (via Canvas) after completing each online module. Each quiz has 12 questions worth 1 point each. All quiz questions are multiple-choice and cover topics that will appear on exams. Quizzes are open book/note but there is a time limit. You may only take each quiz once. **Quizzes must be completed by the start of class on the Thursday on which they are due.** There will be a total of 11 module quizzes, and your lowest quiz grade will be dropped. Thus 10 quizzes will account for a total of 120 points.

- **Participation:** The online portion of the class is asynchronous, meaning students can work through the modules (lecture videos, additional videos/animations, quizzes) at their own pace as long as they are completed prior to each Thursday meeting. Humans learn best when they are actively engaged in tasks and with each other. Thus, active participation is required in the Thursday class meetings. Though most of the work will be

done in groups, each student will be graded on his or her individual participation during class (see rubric below). Each student must also complete an exit reflection (see Canvas for instructions and rubric) at the end of each class meeting. Each of the 10 regular Thursday meetings are worth 5 participation points (3 pts. for participation in the activities, 2 pts. for the exit reflection) for a total of 50 possible points. I understand that life happens. Thus, the final participation grade will be calculated out of 45 points (i.e., one class meeting can be missed without penalty). Please note that the final point total may be subject to change if the schedule changes. No one can earn more than 100% for participation. In other words, extra credit will not be given for attending every class meeting.

Excellent (3)	**Average (2)**	**Poor (0-1)**
Arrives on time (within 10 min) and preparation before class is very evident. Participation is active and effective (e.g. contributing to small group and whole class discussion, asking and answering questions, taking a leadership role).	Preparation is somewhat evident. There is some participation but also a fair amount of passive listening within the group and whole class discussions. This score may be given for arriving 10-20 min late or for engaging in some off-task behavior (e.g. side conversations, cell phone use) even if participation was otherwise good.	Did not attend class or was extremely (> 20 min) late; or was present but showed no evidence of participation; or was disruptive/disrespectful, and/or engaged in repeated off-task behavior.

- **Exams:** There will be a total of three non-cumulative exams consisting of multiple choice, fill in the blank, and/or short answer questions. **Exams will be taken in class** on the Thursday dates noted in the schedule (see below). Each exam will be worth 60 points. There will also be an OPTIONAL final exam (cumulative, all multiple-choice, and also worth 60 points) that can be used to replace a low score on Exam 1, 2 or 3.

Grading:

Points Breakdown:

Chapter Quizzes	120 points
Participation	45 points
Exams	180 points
TOTAL	**345 points**

Grades will be assigned according to the following scale: *A+ 97% or above; A- 90-92%; A 93-96%; B+ 87-89%; B 83-86%; B- 80-82%; C+ 77-79%; C 73-76%; C- 70-72%; D 60-69%; F 59% & below*

Incomplete (IN) grades will be assigned only in cases of compelling and documented need, in accordance with policies set forth in the University Catalog.

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COURSE SCHEDULE
In person meeting dates are **bolded.**

Week	Topic/Module Number	Augustine et al. Chapter	Coloring Book Pages	Work Due on Thursday (Quizzes by 12 noon; Exit Reflections by 11:59 pm)
T Aug 26 **R Aug 28**	1. Course Introduction		1-1 - 1-5, 2-1, 2-3	Read the syllabus Review Basic Concepts
T Sept 2 **R Sept 4**	2. Early Brain Development	22	3-2 - 3-7, 3-11, 3-12	Module 2 Quiz and Exit Reflection
T Sept 9 **R Sept 11**	3. Construction of Neural Circuits	23		Module 3 Quiz and Exit Reflection
T Sept 16 **R Sept 18**	4. Experience-Dependent Plasticity	24		Module 4 Quiz and Exit Reflection
T Sept 23	**Prepare for Exam 1**			
R Sept 25	**EXAM 1 (Modules 2, 3, 4)**			
T Sept 30 **R Oct 2**	5. Central Visual Pathways	9	5-16, 6-7, 6-8	Module 5 Quiz and Exit Reflection
T Oct 7 **R Oct 9**	6. The Auditory System	10	6-17, 6-18	Module 6 Quiz and Exit Reflection
T Oct 14 **R Oct 16**	7. The Chemical Senses	14/15	6-5, 6-11	Module 7 Quiz and Exit Reflection
T Oct 21 **R Oct 23**	8. Somatosensory System	12	5-34	Module 8 Quiz and Exit Reflection
T Oct 28	**Prepare for Exam 2**			
R Oct 30	**EXAM 2 (Modules 5, 6, 7, 8)**			
T Nov 4 **R Nov 6**	9. Movement: Lower Motor Neurons	16	4-1 – 4-3	Module 9 Quiz and Exit Reflection
T Nov 11 **R Nov 13**	10. Movement: Upper Motor Neurons	17	4-11 – 4-12	Module 10 Quiz and Exit Reflection
T Nov 18 **R Nov 20**	11. Movement: Basal Ganglia	18		Module 11 Quiz and Exit Reflection
T Nov 25 R Nov 27	12. Movement: Cerebellum *NO CLASS -- THANKSGIVING*	19		See below
T Dec 2	**Module 12 (Cerebellum) Quiz Due** **Prepare for Exam 3**			
R Dec 4	**EXAM 3 (Modules 9, 10, 11, 12)**			
R Dec 11	**OPTIONAL Final Exam Time and Location TBD**			

COURSE POLICIES

Commitment to an inclusive learning environment: Your experience in this class is important to me. It is my intent that students from all diverse backgrounds, perspectives and circumstances be well served by this course and that students' learning needs are addressed. If there are aspects of the design, instruction, and/or experiences within this course that result in barriers to your inclusion or accurate assessment of your achievement, please notify me as soon as possible and/or contact the Office of Disability Services. If you are seeking accommodations for this class, please first visit ods.gmu.edu for detailed information about the Disability Services registration process. Then please discuss your approved accommodations with me. Disability Services is located in Student Union Building I (SUB I), Suite 2500.
Email: ods@gmu.edu | Phone: (703) 993-2474.

Class Schedule Change/Cancellation Policy: Because this is an online asynchronous course, it is unlikely that the schedule will be changed. However, please check Canvas and your email regularly. This is how I will communicate any schedule changes that could occur. If a class meeting needs to be cancelled due to illness or personal/family emergency, the Thursday class meeting *may* be held online via Zoom. If that is not possible, asynchronous work may be assigned. Any announcements pertaining to class cancellation/format change will be posted on Canvas and emailed to students.

Makeup policies:

- Module Quizzes: Any module quiz not taken by the deadline will receive a grade of zero. Because the lowest quiz grade will be dropped, module quizzes cannot be made up under any circumstances.
- Exams: The optional final can be used to replace a missing or low score on Exam 1, 2, or 3. There will be no exam makeups scheduled outside of the optional final exam.
- Class Participation: Points earned for participation in the class activities *cannot be made up outside of the classroom.* Alternative work will only be given to students with the relevant academic accommodation from the Office of Disability Services.
- Exit Reflections: The reflections are due by 11:59 pm the day of each Thursday class meeting. A max of half credit (1 pt.) will be given for late reflections. No credit will be given for a reflection submitted more than 1 week late. An exit reflection can only be completed if you attended class that day.

Students are responsible for checking the GMU Academic Calendar and making sure they are available to complete coursework throughout the entire semester. For a blended course with an online component this means ensuring you have reliable Internet access from beginning to end. Exams and other work may not be postponed due to travel occurring during the semester, whether planned or not; nor can the final exam be taken earlier than the scheduled timeframe.

Course Artificial Intelligence (AI) Policy: While AI can be a useful tool in certain settings and courses, there is not an appropriate way to use it in this course without compromising your learning and your academic integrity. **Unless you have been specifically instructed by me to use an AI tool, the use of any form of AI, generative or otherwise (including but not limited to ChatGPT, DALL-E, Bard, etc.), is prohibited in this course.** Using AI tools during in-class activities without explicit permission may result in zero participation points for the entire group for that day. You may not use AI tools to study or generate answers to quizzes or study

questions. The AI tools do not know what was covered in this course. Relying on AI tools for answers often leads to producing irrelevant and/or inaccurate information on quizzes/exams.

If it is suspected that you have used any form of AI on any assignment in this course, I will require that you meet with me before I can grade your work. Any work or assignment on which AI was used will receive a zero. Clear violations of the Academic Standards (e.g. providing made up citations) will be referred to the Academic Standards office and possibly subject to sanctions as laid out in the Academic Code.

UNIVERSITY POLICIES

Please visit this link to read through GMU's Common Course Policies, including the University's Academic Standards, Accommodations for Students with Disabilities, FERPA and Use of GMU Email Addresses for Course Communication, and Title IX Resources and Required Reporting. Students are expected to visit this link and read through all policies carefully. See below for additional information on college/university level policies and resources.

Copyright Statement: George Mason University holds the copyright on all materials prepared by me for this course (e.g. lecture slides/videos, assignment questions, quiz and exam questions, chapter study questions). Reproducing or sharing these materials outside of our course (e.g. on study websites such as Chegg, Course Hero, Quizlet, or Study Blue) is a copyright violation and will be reported to the Copyright Office. Students who violate the University Copyright Policy may place themselves individually at risk for liability in the event of a claim of copyright infringement.

Enrollment: Students are responsible for verifying their enrollment in this class. Schedule adjustments should be made by the deadlines published in the Schedule of Classes. After the last day to drop a class, withdrawing from this class requires the approval of the dean and is only allowed for nonacademic reasons. Undergraduate students may choose to exercise a selective withdrawal. See the Schedule of Classes for selective withdrawal procedures.

Religious Holidays: A list of religious holidays is available on the University Life Calendar page. See the Religious Holiday Calendar. Any student whose religious observance conflicts with a scheduled course activity must contact me at least 2 weeks in advance of the conflict date in order to make alternative arrangements.

Resources for Students:

University Libraries	http://library.gmu.edu/
Center for Community Mental Health	http://ccmh.gmu.edu/
University Career Services	http://careers.gmu.edu/
Student Health Services	http://shs.gmu.edu/
Student Support and Advocacy	https://ssac.gmu.edu/

TECHNOLOGY REQUIREMENTS

This course uses Canvas as the learning management system (LMS). You will need the following technology for this course:

- **A computer** running MacOS, Windows, or ChromeOS.

- **Computer speakers or headphones to listen to recorded content.**
- **A stable and strong Internet connection**. GMU IT recommends using an internet speed test website like Ookla (or similar) to ensure your internet connection meets or exceeds the minimum speed required for hybrid/online courses, 1.5 Mbps (download) and 750 Kbps (upload).
- **Microsoft Office** (purchase here) **so you can download and view PowerPoint slides and Word documents.**
- You also need to **download and install Zoom** as this is how you will meet with me for office hours and appointments. It is available to students for free using your GMU credentials.

Our brains are amazing machines - and have quite an amount of variation between people. Here are scans of 15 brains from university students showing the similarities and differences in shape and folds. Image by Veronika Halasz, former student in the Cunnington lab, which studies how the brain processes attention and predicting actions. *Caption by the Queensland Brain Institute*