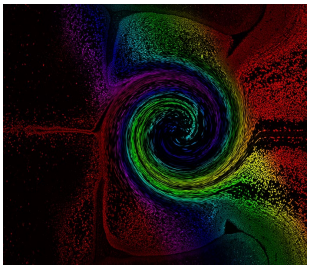
Developmental and Systems Neuroscience
NEUR 335-002 | Fall 2024



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 4014
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

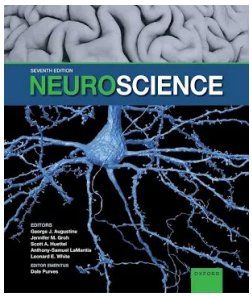
Last day to add Sept 3
Last day to drop with 100% tuition refund Sept 9
Last day to drop with 50% tuition refund Sept 17

Course description:
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.

Course format:
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 chapter quiz (at home)
3. Class meeting (working in teams):

- Chapter quiz review
- Active learning exercise(s)
- Exit reflection



Required textbook:

- Purves, D., et al. (2023) *Neuroscience, 7th Edition*. Sinauer Associates. ISBN: 0197616259

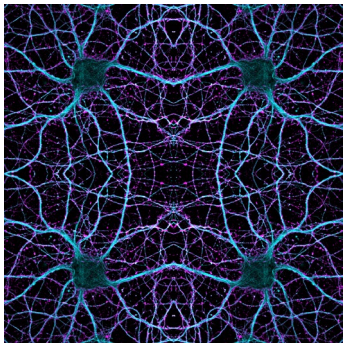
Optional recommended materials:

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

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).
- Communicate the findings of a developmental or sensory neuroscience research study in terms an educated layperson can understand.



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:

- **Chapter Quizzes:** To ensure preparation for the in-class activities, you will take an online quiz (via Blackboard) 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 chapter 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, chapter 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 Blackboard for instructions and rubric) at the end of each class meeting. Each of the 10 regular Thursday meetings are worth 6 participation points (3 pts. for participation in the activities, 3 pts. for the exit reflection) for a total of 60 possible points. I understand that life happens. Thus, the final participation grade will be calculated out of 48 points (i.e., two class meetings 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 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. May have arrived a few minutes late or engaged in some off-task behavior (e.g. side conversations, cell phone use).	Did not attend class or was extremely 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.

- **News & Views Report**: Effective oral and written communication is a "transferable skill" that transcends disciplines. The ability to engage the lay public is critical to garner financial support for research. However, as we delve deeper into our particular research area, it becomes more difficult to convey information in a manner that the general public can grasp and become excited about. Thus, students will hone their written communication skills by writing a 1-2 page "News & Views" style summary of a review or primary research paper. Sample reports and guidelines are posted on Blackboard. These reports may be submitted at any time leading up to the deadline; all reports must be uploaded to Blackboard no later than **Thursday, November 17**. The report is worth 32 points.

Grading:

Points Breakdown:

Chapter Quizzes	120 points
Participation	48 points
Exams	180 points
News & Views Report	32 points
TOTAL	**380 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.

Tentative **Schedule**

NOTE: **You are responsible for all announcements and any syllabus modifications made in class each week whether you are present or not.**

In person meeting dates are **bolded.**

Week	Topic	Purves Chapter	Coloring Book Pages	Work Due (by start of class Thurs)
T Aug 27 **R Aug 29**	Course Introduction		1-1 - 1-5, 2-1, 2-3	Read the syllabus Review Basic Concepts
T Sept 3 **R Sept 5**	Early Brain Development	22	3-2 - 3-7, 3-11, 3-12	Ch. 22 Quiz
T Sept 10 **R Sept 12**	Const. of Neural Circuits	23		Ch. 23 Quiz
T Sept 17 **R Sept 19**	Experience-Dependent Plasticity	24		Ch. 24 Quiz
T Sept 24	**Prepare for Exam 1**			
R Sept 26	**EXAM 1 (Chapters 22, 23, 24)**			
T Oct 1 **R Oct 3**	Central Visual Pathways	12	5-16, 6-7, 6-8	Ch. 12 Quiz
T Oct 8 **R Oct 10**	The Auditory System	13	6-17, 6-18	Ch. 13 Quiz
T Oct 15 **R Oct 17**	The Chemical Senses	15	6-5, 6-11	Ch. 15 Quiz
T Oct 22 **R Oct 24**	Somatosensory System	9	5-34	Ch. 9 Quiz
T Oct 29	**Prepare for Exam 2**			
R Oct 31	**EXAM 2 (Chapters 9, 12, 13 ,15)**			
T Nov 5 **R Nov 7**	Movement: LMNs	16	4-1 – 4-3	Ch. 16 Quiz
T Nov 12 **R Nov 14**	Movement: UMNs	17	4-11 – 4-12	Ch. 17 Quiz
T Nov 19 **R Nov 21**	Movement: Basal Ganglia	18		Ch. 18 Quiz

T Nov 26 R Nov 28	Movement: Cerebellum *NO CLASS -- THANKSGIVING*	19		See below
T Dec 3	**Cerebellum Quiz Due** **News and Views Report Due** **Prepare for Exam 3**			
R Dec 5	**EXAM 3 (Chapters 16, 17, 18, 19)**			
R Dec 12	**OPTIONAL Final Exam 10:30-12:00 pm**			

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 Cancellation Policy:
In the event that 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 Blackboard and emailed to students.

Makeup policies:
- Chapter Quizzes: Any chapter quiz not taken by the deadline will receive a grade of zero. Because the lowest two grades will be dropped, chapter 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.

Permission to postpone work will only be given for very acute and important reasons, with documentation and at my discretion. A 10% per day late penalty may be applied.

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.

Generative AI Policy: Generative AI tools such as ChatGPT can both enhance and interfere with learning. All use of generative AI must comply with the university's Academic Standards. Two very important things to keep in mind are that 1) Generative AI does not always produce accurate information or accurate citations; 2) it does not "know" what was covered in our course and often produces responses with information that is not relevant to the course. Unless you

have been specifically asked by me to use generative AI, I expect that you will not use it to ome up with answers for the in-class activities. Using generative AI without explicit permission may result in zero participation points for the entire group for that day.

UNIVERSITY POLICIES

Academic Standards: Students are expected to follow the university's Academic Standards at all times in this course. The standards are upheld in the principles listed below. For more information, please see the Academic Standards website and the Academic Standards Code.

- **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.

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.

Official Communications via GMU E-mail: Mason uses electronic mail to provide official information to students. Examples include communications from course instructors, notices from the library, and notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. You are responsible for the content of university communication sent to their Mason e-mail account and are required to activate that account and check it regularly.

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 the Instructor at least 2 weeks in advance of the conflict date in order to make alternative arrangements.

Resources for Students:

University Writing Center	http://masononline.gmu.edu/student-resources/writingcenter
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/

Schedule Change Policy: Because this is an online asynchronous course, it is unlikely that the schedule will be changed. However, please check Blackboard and your email regularly. This is how I will communicate any schedule changes that could occur.

Notice of a mandatory reporting of sexual assault, interpersonal violence, and stalking: As a faculty member, I am designated as a "Responsible Employee", and must report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per University Policy 1412. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 or Counseling & Psychology Services (CAPS) at 703-993-2380. You may also seek assistance from Mason's Title IX Coordinator by calling 703-993-8730 or emailing cde@gmu.edu.

FERPA: This course will be compliant with the Family Educational Rights and Privacy Act of 1974 (FERPA) as detailed here.

TECHNOLOGY REQUIREMENTS

The following technology is required for access to and success in this course:

1. **A hard-wired, high-speed Internet connection**: Non-stable or slow Internet connections will not excuse failures to complete any assignments or exams on time.
2. **A functioning gmu.edu e-mail account**: You will only be contacted via your GMU e-mail address. I will only respond to emails from GMU addresses.
3. **Downloading capability:** You must have regular access to a computer onto which you can download documents.
4. **Blackboard familiarity:** This course is delivered and conducted entirely online via Blackboard. If you are unfamiliar with Blackboard or need assistance, you can (a) access the Student Tutorial or (b) contact the Help Desk or (c) refer to the Tech Support tab in the upper-right-hand corner of the course site.

Hardware: You will need access to a Windows or Macintosh computer with at least 2 GB of RAM and access to a fast and reliable broadband internet connection (e.g., cable, DSL). A larger screen is recommended for better visibility of course material. You will need speakers or headphones to hear recorded content.

If you are considering the purchase of a new computer, please go to Technology Buying Guide to see recommendations.

Software:. You will need a browser and operating system that are listed compatible or certified with the Blackboard version available on the myMason Portal. See supported browsers and operating systems. Log in to myMason to access your registered courses. Online courses typically use Acrobat Reader, Flash, Java, and Windows Media Player, and/or Real Media Player. Your computer should be capable of running current versions of those applications. Also, make sure your computer is protected from viruses by downloading the latest version of Symantec Endpoint Protection/Anti-Virus software for free here.

Note: If you are using an employer-provided computer or corporate office for class attendance, please verify with your systems administrators that you will be able to install the necessary applications and that system or corporate firewalls do not block access to any sites or media types.

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*