NEU 301: Introduction to Neuroscience I

Section 001 and Section 002
3 credits
Fall 2024

SECTION INFORMATION:

Section	Meeting Day and Time	Location
001	Wednesday 12:40-1:30pm	McDonel Hall C107
002	Wednesday 11:30am-12:20pm	McDonel Hall C107

INSTRUCTOR INFORMATION

Valerie Hedges, Ph.D. (She/her/hers)
208 Giltner Hall
Office hours: weekly and by appointment
hedgesva@msu.edu

COURSE DESCRIPTION:

This is the first semester of a two-semester introductory neuroscience course sequence. The topics presented in NEU301 will cover the basic principles of cellular and systems neuroscience, including discussions focused on neurophysiology, chemical signaling, central nervous system and peripheral nervous system anatomy, visual systems, auditory systems, olfaction, and gustation. Information in this course will be presented as 1) recorded videos and 2) in-class assignments that are completed in synchronous sessions facilitated by teaching and learning assistants.

MY COURSE PHILOSOPHY:

I really enjoy teaching introductory level courses for students, because I get to witness first-hand the excitement as you learn about the breadth of topics in neuroscience. Our nervous system is responsible for amazing things and learning the mechanisms of nervous system function will allow you to better understand the physiology of the body and learn more about yourself! All of you have a reason that you pursued neuroscience as a degree, or as a course, and my hope is that you all develop an appreciation for the many topics that neuroscience encompasses.

I believe that you will learn best by engaging in this course in the following ways:

1) Keeping up with the weekly deadlines
2) Reading our short, assigned readings
3) Watching the content videos each week and taking notes
4) Completing the assignments each week
5) Interacting with the instructors and peers

I recognize that as students you all have many things going on in your lives and I want to express that I want to support your learning in this course through any challenges that you may experience.

COURSE GOALS:

1. Develop an appreciation for the many sub-disciplines that exist in the field of neuroscience.
2. Learn the fundamental principles of the anatomy and physiology of the nervous system.
3. Define, articulate and model the molecular, cellular, and anatomical organization of the central and peripheral nervous systems.
4. Understand the properties of nervous system cells that allow them to use electrical and chemical signals for cellular communication and be able to predict how nervous system cells will function in different scenarios.

5. Understand, describe, and model the structure and function of brain systems (visual, auditory, olfactory, gustatory, balance) and predict how the function of these systems is altered following a stimulus.
6. Interpret primary data from scientific literature and be able to identify and assess the experimental approaches used in neuroscience.

INSTRUCTORS, STUDENT HOURS, LA STUDY GROUP

We are fortunate to have a whole team of instructors to assist you in this course! The table below lists our 2 graduate teaching assistants and three undergraduate learning assistants. Regardless of which section you are in, all students are permitted to attend any of the listed student hours or study groups.

Student hours are times that course instructors will be available to answer any questions that you have about the content or the course (or anything else). These are being held on Zoom for your convenience. The Zoom links and passwords are listed below. You can expect this to be an individual meeting between the student and the instructor.

LA Study Groups are an opportunity for current students to connect with students from last year to study the course content each week. We will have LA study groups that are available on both Zoom and in-person. All students are welcome to attend and can come whenever the feel like they would benefit from the opportunity. You can expect that this will be multiple students working together.

Name	**Instructor Type**	**Email**	**Student Hours / LA Study Group Day and Time**	**Location/ Zoom link and Password**
Valerie Hedges, Ph.D. (she/her)	Course Coordinator (both sections)	hedgesva@msu.edu	Student Hours: Tuesday 1:00pm – 3:00pm	https://msu.zoom.us/j/98631316108 Meeting ID: 986 3131 6108 Passcode: NEU301
Melinda Meiring (she/her)	Teaching Assistant (both sections)	meiringm@msu.edu	Student Hours: Wednesday 9:00am- 11:00am	
Bridgette Weiss (she/her)	Teaching Assistant (both sections)	weissb10@msu.edu	Student Hours: Friday 11:00am – 1:00pm	
Elizabeth Widun (she/her)	ULA (section 1)	widuneli@msu.edu	LA Study Group (Elizabeth and Angelica): Wednesday 2:10pm-3:30pm	In-Person! Room: McDonel 38
Angelica Lorenzon (she/her)	ULA (section 1)	lorenz23@msu.edu		
Kaitlyn Wasilewski (she/her)	ULA (section 2)	wasile18@msu.edu	LA Study Group (Kaitlyn): Monday 12:00pm – 2:00pm	

TABLE SHOWING ALL AVAILABLE OPPORTUNITIES FOR STUDENTS TO CONNECT WITH INSTRUCTORS

There are times to meet with instructors throughout the week.

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 am			**Student Hours: Melinda** Weds 9:00 am – 11:00 am		
9:30 am					
10:00 am					
10:30 am					
11:00 am					**Student Hours: Bridgette** Fri 11:00 am – 1:00 pm
11:30 am					
12:00 pm	**LA Study Group: Kaitlyn** Mon 12 pm – 2 pm				
12:30 pm					
1:00 pm		**Student Hours: Dr. Hedges** Tue 1:00 pm – 3:00 pm			
1:30 pm					
2:00 pm			**LA Study Group: (in person) Angelica and Elizabeth** Weds 2:10 pm- 3:30pm		
2:30 pm					
3:00 pm					
3:30 pm					

COMMUNICATION:

Email: I will communicate with you through your D2L email account. *Please forward your D2L email to your MSU email address to make sure that you receive the emails for our class!*

You are responsible for reading and responding appropriately to the emails sent to your account. In an effort to promote professionalism in communication, please be mindful of using respectful language in your emails and the teaching team will do the same.

- If an instructor reaches out to you requesting a reply, please reply within 24 hours of the email being sent on Monday-Thursday, or 48 hours of the email being sent Friday-Sunday
- Please allow 48 hours for an email *response from the course instructor*
    - If a response is not received, please email again as I can receive many emails in a given day
- Please make sure you are checking D2L daily for announcements and emails.

Private Discussion Forums: If you have questions about the course or content, you may ask them through the Private Discussion Forum on D2L to get a direct response from an instructor. Only the course instructors have access to this discussion forum (not other students).

Announcements: All emails in the class will be archived as "announcements" in D2L so that you always have access to the information sent via email.

PREREQUISITES: (BS 161 or BS 181H or LB 145) and (BS 162 or BS 182H or LB 144)

RECOMMENDED COURSES: PSY 101

CONTENT KNOWLEDGE REQUIREMENTS

Students should have a basic understanding of biology (homeostasis, diffusion, concentration gradients, molecular and cellular biology, including parts of the cell and their functions, basic genetics, and basic literacy in graph reading). These

skills will be necessary to build on as we focus in on nervous systems function. If you feel that you need more review in these areas, then please review your notes from your introductory biology courses or freely available resources, such as Khan Academy.

COURSE PLATFORM/STRUCTURE:

For the fall 2024 semester, NEU 301 has two different sections. Both courses will be taught as hybrid courses with an in-person meeting once weekly on Wednesdays. Content for both sections will be delivered through:

1) Asynchronous online lecture videos on D2L
2) An in-class assignment
3) Practice questions
4) Reading from the course text

Content Videos: Why are they online and asynchronous?

- More inclusive: They allow for you to access them at any time, and don't require that you attend class at a specific time for access to the material (videos can be downloaded, sped up, or slowed down, rewatched). This benefits many students and accommodates students with caregiving needs, work responsibilities, illness, or those that commute during periods of bad weather.
- More accessible: Videos are captioned which allows for students to read along with the video, and there are multiple shorter videos broken up by topic, allowing you more flexibility of when and where you watch the videos. You can also pause and rewatch as needed.

In-class assignments, Practice Questions, and Reflection Activities: What is the purpose?

- Low-stakes opportunities to practice the type of critical thinking and problem solving that you will encounter on exams.
- Opportunity to reflect on your preparation methods and assess the pros and cons of that method with a goal of honing your studying and preparation skills.

Reading: How much? How often?

- Our course text is FREE and online (you will always have access to it- even after our class).
- The chapters are short and pertain directly to what we are learning in class.
- Each week you will typically read 1-3 short chapters (less than 45 min of reading each week).

COURSE MATERIALS

You will need your MSU NetID to login to the course from the D2L homepage to access our course materials (http://d2l.msu.edu). In D2L you will access online videos, course materials, and additional resources. Activities will include readings, quizzes, discussion forums, and email among others.

Textbook

To reduce costs for students, we will be using a **freely available online Open Educational Resource (OER)** that I have prepared for our course. There will not be any materials that you need to purchase for our course. When accessing the OER, be aware that it can be downloaded, viewed in different accessible formats, and can be printed by the MSU library for a nominal fee if you wish to have a hard copy. Note that chapters in this text are much shorter than traditional textbooks and are more focused on the content that we will be covering in our

course. If you are interested in recommendations for other Neuroscience textbooks (for recreational or supplemental reading) please contact me (Dr. Hedges) directly (I love books).

Text Link (be sure to bookmark it!): Introduction to Neuroscience – Simple Book Publishing (msu.edu)

DIVERSITY STATEMENT

Your experience in this class is important to me. I am committed to providing an inclusive learning environment for all members of our community, where students from diverse backgrounds and perspectives are recognized, respected and seen as a source of strength and a source of enrichment for our intellectual community. I strive to be respectful of diversity in gender, sexuality, disability, age, religion, socioeconomic status, ethnicity, race, and culture. Your suggestions for ways in which these areas in the class can be strengthened are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

We have all lived through an unprecedented time in the pandemic and tragedy on our campus, resulting in substantial challenges outside of the classroom. If you are experiencing any type of hardship that may impact your participation and engagement in this class, please reach out. You do not need to share details that you are not comfortable sharing. We can work together to create a plan to move forward.

LAND ACKNOWLEDGEMENT

Michigan State University occupies the ancestral, traditional and contemporary lands of the Anishinaabeg – Three Fires Confederacy of Ojibwe, Odawa and Potawatomi peoples. In particular, the university resides on land ceded in the 1819 Treaty of Saginaw. We recognize Michigan's 12 federally recognized Native Nations, historic Indigenous communities in Michigan, Indigenous individuals and communities who live here now, and those who were forcibly removed from their homelands. In offering this land acknowledgement, we affirm Indigenous sovereignty, history and experiences.

Take Action: Visit the Nokomis Cultural Heritage Center near the Meridian Mall in Okemos to learn more about the indigenous peoples of this area.

LEARNING PACT

The Learning Pact is taken from *Liquid Syllabus* course provided by CVC-OEI/@ONE and authored by Michelle Pacansky-Brock.

INSTRUCTOR EXPECTATIONS

1. I will provide you with a clear, organized course that is designed to ensure you meet our course outcomes in a meaningful manner.
2. I will provide a variety of assignments to ensure your learning needs are met.
3. I will be actively present in your learning.
4. I will provide a supportive and safe environment for you to share and discuss ideas with your peers.
5. I will reach out to you when I sense that you need support.
6. I will treat you with dignity and respect and be flexible to support your individual needs.
7. I won't be perfect. I am human and will make mistakes at times. I will view mistakes as an opportunity to learn and grow.

STUDENT EXPECTATIONS

1. You strive to be an active participant in this course and strive to meet due dates.
2. You will maintain an open line of communication with me so I understand how to support you.
3. You will contact me if you have a concern with meeting a due date.
4. You strive to regularly contribute to collaborative activities to ensure other members of the community have ample opportunity to read/listen, reflect, and respond to your ideas.

5. You will treat your peers with dignity and respect.
6. You will do your best to have patience with technology. There will be hiccups, expect them. We will get through them together.
7. You will give yourself grace. Expect to make mistakes. You are human and you are stressed.

COMPUTER SKILLS AND DIGITAL INFORMATION LITERACY

- Using the learning management system, D2L
- Using email with Attachments
- Copying/pasting and editing text
- Basic word processing skills necessary for completion of assignments
- Basic internet literacy skills to efficiently navigate D2L and email

COURSE SPECIFICS

You will need your MSU NetID to login to the course from the D2L homepage to access our course materials (http://d2l.msu.edu). In D2L you will access online videos, course materials, and additional resources. Activities will include readings, quizzes, discussion forums, email, and other online activities. This is not a self-paced course- that is, there will be assignments that are due at specific times throughout the week. Students that do not meet these deadlines will not earn credit for those assignments.

IN PERSON MEETING- WEDNESDAYS (SEE SCHEDULE)

During the in-person meeting students will have an opportunity to work through an in-class assignment with their peers and instructors. These assignments do not count toward student grades, but rather are low-stakes formative assessments for students to improve their learning of the course content. This time will be used as work time, with lots of one-on-one interaction from instructors. There will also be time during the in-person meeting for students to speak with instructors and ask questions about course content outside of the assignment questions if desired. Attendance will be recorded but will not have an impact on your grade.

All students have the option to attend a synchronous Zoom meeting during our regular in-person class time. You will have the opportunity to work on the in-class assignment with other students on Zoom. A dedicated course instructor will moderate the Zoom room and address any questions. You will also get to hear any discussions that occur with the in-person students.

NEU 301 Synchronous Zoom Meeting (both sections)

Join Zoom Meeting
https://msu.zoom.us/j/93381628358

Meeting ID: 933 8162 8358
Passcode: NEU301

COURSE OUTLINE/SCHEDULE:

The detailed course schedule is available as a separate document on D2L. This schedule lists topics, assigned readings, quizzes, exams, and assignments. Due dates are indicated on the schedule.

Each part of the course is detailed in the following sections, but below are general guidelines regarding your routine in this course.

Our weeks will "start" on Friday, then we will have our in-person meeting the following Wednesday, and the quiz for that unit will be due the following Friday.

Friday Morning at 8:00 AM:

- Content videos for the upcoming week open and will always remain open
- Assignments for the upcoming week open

Wednesdays

- In-person and Synchronous Zoom meeting time
- Dedicated time to speak with instructors and peers and work on in-class assignment

Friday at 11:59 PM:

- Quiz from previous week is due
- In-class assignment from previous week has a suggested due date (must be turned in before next exam)

Exams will open on the first date indicated in the schedule at 10:00 AM and close on the second date indicated in the schedule at 11:59 PM.

LATE WORK POLICY

Please note that there are due dates for our weekly D2L quizzes for the purpose of 1) keeping students on track over the course of the semester and 2) so that students can complete exams during the indicated time on the course schedule. We have seen how students can quickly get behind on their course work if there are no deadlines for any assignments.

I understand that sometimes circumstances might prevent you from completing quizzes by the indicated due date. To help you in these situations, a 48-hour submission grace period will be offered for all Quizzes that will allow you to turn in quizzes up to 48 hours after the indicated due date. *No additional extensions will be available to make sure that everyone stays on track with the course material and our schedule.*

If you have a more serious or long-term problem that prevents you from completing assignments by the indicated due dates, this needs to be communicated with me (Dr. Hedges) as soon as possible so that alternative arrangements can be made.

In-class assignments and practice problem assignments must be turned in to be granted access to the exam.

COURSE CONTENT

Students will be responsible for the content that is covered in content videos, in-class assignments, and the text.

CONTENT VIDEOS

- Content videos will have captions available, can be downloaded, and can be sped up or slowed down.
- Videos may request that you pause your video and complete an activity. These activities are short exercises that are meant to help students think through material.

Please understand that the schedule that is on D2L is only tentative and may be changed by the instructor to accommodate better learning of the material. I recommend that students read the assigned text before watching the lecture videos to help facilitate learning.

COURSE ASSIGNMENTS

I have been making an effort to improve grading equity within this course. For grades to be more equitable, they should only reflect a student's performance rather than their behavior (like participation or attendance). Towards this effort, student grades will no longer incorporate any required participation grades.

Your grade in this course will only reflect the knowledge and understanding that you have demonstrated on content-based assessments in the course.

Your grade in this course will be determined by your grades on D2L WEEKLY QUIZZES and EXAMS.

1) D2L WEEKLY QUIZZES

The purpose of D2L weekly quizzes is to give you a low-stakes opportunity to assess your understanding of the content. Quizzes should be used as a tool to keep up with content presented weekly in the course and to assist in exam preparation.

You get 3 attempts on each quiz, with the idea that you will study your mistakes and then try to understand and correct those mistakes through resubmitting the quiz with the correct answers.

- Quizzes are due Friday at 11:59 PM
- Quizzes will have a 48-hour grace period for submission, allowing you to turn them in by Sunday at 11:59pm if circumstances prevent you from completing the quiz prior to the due date. You do not need to inform me if you intend on using this submission grace period.
- Each Quiz will consist of 10 questions (multiple choice, multiselect) and are not timed
- You will have 3 attempts on each quiz, and only the highest grade will be recorded
- You can review feedback on quizzes ae soon as you earn a "satisfactory" grade, or after 3 attempts (regardless of score)
- A short video is available on D2L under "How to Videos" that shows you how to see your quiz feedback. If you miss a quiz, the quiz answers cannot be reviewed.

2) IN-CLASS ASSIGNMENTS

I consider in-class assignments to be incredibly important within our course. They allow for opportunities for you to practice your critical thinking and problem solving for exams. It is in your best interest to actively complete and understand your in-class assignments.

- The in-class assignment will be the focus of our in-person meeting, but can be worked on outside of class as well
- You should bring a laptop or tablet that will allow you to electronically complete a word document.
- You are encouraged to work collaboratively in small groups weekly (up to 5 people per group).
- You are encouraged to review and start working on the in-class assignment *before* attending the in-person meeting.
- In-class assignments are non-graded assignments, but must be turned in to be granted access to the associated exam.

- Those that turn in the assignment by the suggested due date will receive feedback on the assignment.
- Video Key and Key documents for the assignment will be located on D2L and will be available after the assignment is turned in. It is the responsibility of each student to check that their in-class assignment answers are correct against the provided keys.

3) PRACTICE QUESTIONS

Practice Questions are short assignments that will allow students to practice answering a couple of questions related to the topics of the week.

- Practice Questions (and Keys) will be available as files on D2L
- Practice Question are non-graded assignments and are only for those that desire additional ways of engaging with the course content.

4) REFLECTIONS

You will complete guided Reflection assignments at least 2 times, and up to 6 times over the course of the semester: at the beginning of the semester, following our first four exams, and at the end of the semester (see course schedule).

- The 'Start of the Semester Reflection' and 'End of Semester Reflection' are required of all students.
- Completion of 'Exam Reflections' will be required to complete Exam Revisions (if you choose not to complete exam revisions, then the associated exam reflection is not required).
- Each exam will have a separate Exam Reflection
- Reflections will be completed as an assignment on D2L and will be open during the indicated times on the course schedule

5) EXAMS

The bulk of your grade in our course will be determined by summative assessments (exams) that assess learning and understanding of the material. For complete details see 'Exam Information' module on D2L

- There will be five exams in this course that will be graded out of 40 points each. These points are only used to determine what level was achieved on the exam (details in grading section)
- Each exam will cover the material covered since the previous exam (content videos, recitations, course text) and will not be cumulative. This includes the Final Exam which will NOT be cumulative.
- Permitted Resources for Exams: Course notes, Recitations assignments, Course Text (open note/open book)
- You are NOT permitted to use the internet as a resource on your exams. Answers received from internet sources are a violation of academic honesty and will result in issuance of an academic dishonesty report. Use of generative AI is also not permitted on exams.
- Exam dates are noted in the schedule posted on D2L.
- Exams will be administered through D2L and consist of multiple-choice questions and multiselect questions that will be graded automatically by D2L.

All associated in-class assignments must be turned into D2L to gain access to the exam. If you have not completed the in-class assignments, then you will need to submit them incomplete.

Missed Exams:

You are given a window of time to complete the exam to provide flexibility. Exam dates are located in the syllabus and in the course schedule posted to D2L. Reminder emails will also be sent for each exam**. It is the responsibility of the student to complete the exam during the specified time.** If an exam is missed due to a circumstance outside the control of the student, this must be communicated with me (Dr. Hedges) as soon as possible, but must be done within 24 hours of the missed exam.

A scheduled event is not outside your control. These events need to be communicated with me (Dr. Hedges) prior to the exam as soon as possible.

Exam Revisions:

An exam is a learning tool and learning from your mistakes on an exam is a powerful way to improve your learning of the course content. For this reason, each of you will have the opportunity to complete Exam Revisions. Exam Revisions will consist of a second attempt on the exam that will be opened after the first attempt has been graded and posted.

The grades from the first attempt and second attempt on the exam will be averaged together to determine the final grade on the exam. You will have the opportunity to review your incorrect responses and feedback on those incorrect responses prior to your submission of your second attempt. **A document is posted on D2L under the "Exam Information" Module that has the details for how to complete Exam Revisions.**

Reviewing Exam Feedback:

- You will be emailed with details specifying the dates for exam review and exam revisions through your D2L email account
- All students interested in completing Exam Revisions will need to first complete an **Exam Reflection** assignment that will be made available on D2L.
- After submission of the Exam Reflection, a second attempt will be made available on the exam

Completing Revisions on Exam:

- Exam revisions are not required but are available for students that wish to improve their score on each exam.
- When taking the second attempt on the exam, you will only be able to answer the questions that were previously incorrect. A red exclamation mark will denote questions that can be retaken.
- You may attempt to correct as many questions as you would like and have the **chance to earn back 50% of the points missed on the exam.**
- Note that you are only able to potentially move up one grading category by completing exam corrections (moving from an 'unsatisfactory' to a 'satisfactory' or moving from a 'satisfactory' to a 'strong').

Example Grade Determination:

Attempt 1:
Overall *attempt 1* score = 29/40 or 72.5%
On attempt 1 of the exam, this student earned a "Satisfactory" on the Exam. If they were satisfied with this score, then no further action is needed.

Attempt 2:

Let's pretend that this student decided to complete the second attempt and earned the following grade:

Overall *attempt 2* score = 39/40 or 97.5%

The scores on the first attempt and second attempt will be averaged to determine the Final grade on the Exam.

Determination of final score on Exam
Final Exam Score = Average of attempt 1 and attempt 2= (29+39)/2= **34/40, or 85%**

In this example, the student increased their grade to a 34/40 and now has a grade of "Strong" on the Exam.

GRADING

WHY THIS STRUCTURE?

Research has shown that grades promote extrinsic motivation rather than intrinsic motivation. This means, that for many students, the focus of a class is about earning "X" number of points over the joy of learning and thoroughly understanding the material. My hope is that with this scoring system, the focus can be placed on learning and practicing scientific skills and improving on those skills from the start of the semester to the end.

I have observed how the focus on earning points can greatly increase stress in students and diminish the learning environment overall. So, in our class I will instead be grading most assignments using a more general scale where performance is categorized into 2 or 3 grading categories. This will allow students to understand whether they are meeting the expectations for the course, while allowing for students to make some mistakes that do not necessarily lower their grade.

To allow students the opportunity to improve their performance, students will have the chance to review and revise their assignments to promote all students reaching a level of satisfactory performance. My hope is that this will allow students to enjoy learning about the topics in the course and better understand the purpose and benefit of the different assignments. Recognizing that student preparedness can vary widely in our course, the overall goal of this structure is to make grades more equitable, increased inclusiveness by providing opportunities to improve, decrease student stress, promote intrinsic student motivation, and provide all students the opportunity to improve their science skills.

Please refer to the "advice from past students" on D2L to read about past students' experiences in this course and the advice that they have to bestow upon new students in the course.

QUIZ GRADING (Total of 13 quizzes)

Quizzes are 10 questions each (except the first quiz over the syllabus that is 20 questions). Students get **3 attempts on each quiz**, with only the highest score being recorded. Quizzes will be graded as Credit or No Credit.

To earn "Credit" on a quiz:

- The quiz must be completed within the allowed grace period of submission on D2L
- The submission must earn a minimum grade of 70% correct

If any of the above criteria are not met, then a grade of "No Credit" will be given.

EXAM GRADING (Total of 5 Exams)

Exams will be graded out of 40 "points". These points do not count towards your final grade, but instead will be used to determine what grading level was achieved on the exam. Exams will be graded as "Strong", "Satisfactory", or "Unsatisfactory". Each grade has an associated score (2, 1, 0) that will be used to calculate your final grade in the course.

To earn a grade of "Strong" on an exam (and a score of 2):

- The exam must be completed on time within D2L
- The submission must earn a **minimum grade of 32/40 (80%)**

To earn a grade of Satisfactory on an exam (and a score of 1):

- The exam must be completed on time within D2L
- The submission must earn a **minimum grade of 24/40 (60%)**

A grade of Unsatisfactory on an exam (and a score of 0) will be earned if:

- Exams are not completed on time
- The submission earns **less than a 24/40 (60%)**

**Students will have the opportunity to review and submit revisions to earn back points lost on their exam with the goal of achieving either a "Strong" or a "Satisfactory grade". (See Exam Revisions)

Final Grade Calculation:

- The MSU 4.0 grading system is used report final course grades. Grades for assignments will be posted electronically to D2L within one (1) week of the completed assignment/assessment due date.
- Refer to D2L often to determine your progress in the course. Instructors are not able to predict the grade that you will earn in this class prior to the completion of all assignments.
- In order to earn a particular final grade level, you must meet the minimum requirements in every category listed in the table below.
- Exams will be determined to be Strong (2), Satisfactory (1) or Unsatisfactory (0) AFTER Exam Revision scores have been determined. If you elect to not complete Exam Revisions, then your first attempt score will be determined to be Strong, Satisfactory or Unsatisfactory.

Minimum # of Credit Quizzes (total of 13)	Total Score* from all 5 Exams	Completed Start of Semester Reflection	Completed End of Semester Reflection	Grade in Course
11	10	Yes	Yes	**4.0**
11	8-9	Yes	Yes	**3.5**
9	7	Yes	Yes	**3.0**
9	6	Yes	Yes	**2.5**
7	5	Yes	Yes	**2.0**
7	4	Yes	Yes	**1.5**
7	3	Yes	Yes	**1.0**
Less than 7	Less than 3	No	No	**0.0 (not passing)**

** Your "Score" on the exam is a 2, 1, or 0 based on the definitions in the syllabus*

Example Final Grade Calculation:

A student has the following grades:

- 2 “Strong” exams, and 3 “Satisfactory” exams
- 12 “Credit” Quizzes

In this example the student has completed more than the minimum number of “Credit” quizzes to get any grade in the course, which means that the grade will ultimately be determined by exam performance. The total exam score for this student is 7 (2 ‘strong’ exams each with a score of 2, and 3 ‘satisfactory’ exams each with a score of 1). According to the table, this will result in a final grade of a 3.0 in the course.

CLASS POLICIES

CONTESTING GRADES

You are expected to review your feedback for exams and quizzes, posted keys and posted videos on D2L before bringing your concerns to the instructors. Honestly self-assess whether you perhaps misunderstood or overlooked something, and if that mistake led to your grade. You are encouraged to contact your instructor to help clarify misunderstandings of the material. If a genuine grading error has been made, it would be appropriate to email or attend office hours to discuss your concern. However, I will not re-grade individual elements of an assignment/exam.

If you believe that the grade you received did not reflect the overall quality of the assignment/exam, you may formally request a re-grade of the entire assignment by Dr. Hedges within 7 days that the grade was posted to D2L. Please email Dr. Hedges stating as such, and that you understand the new grade will stand. It may be lower, higher, or the same as your initial grade.

STATEMENT OF OWNERSHIP

As members of a learning community, you are expected to respect the intellectual property of course instructors, like me. All course materials presented to you are my copyrighted property and are subject to the following conditions of use:

- You **may not** post recordings or other course materials online through sites such as Course Hero, Chegg, etc. or distribute them to anyone not enrolled in the class without the advance written permission of the course instructor and, if applicable, any students whose voice or image is included in the recordings.

- You **may not** commercialize lecture notes and university-provided course content. This includes posting any course materials to online sites.

GENERATIVE AI USE

The use of generative AI on exams in this course is not permitted. I have purposefully tried to make our course a less stressful environment, but I understand how ubiquitous this technology is. Please use only the notes generated from the content videos and the online course text as resources on our exams. Among other issues such as biased responses, generative AI does not always provide accurate responses, is prone to providing incomplete information about a topic, and foremost is not a representative indication of your understanding of our course content.

My goal is for you to enhance your problem solving and critical thinking skills in our course, and you will have many opportunities to hone these skills.

Please see the following link for MSU guidance about the use of generative AI: Guidelines and Policies on Generative AI Use at MSU

Any students found violating the conditions described in "statement of ownership" or "generative AI use" will face academic disciplinary sanctions, including receiving a penalty grade in the course, and issuance of an academic dishonesty report.

REQUESTING A RECOMMENDATION LETTER:

I receive many requests for letters of recommendation, and usually end up writing 50-60 letters every year. I will only agree to write letters of recommendation after the semester is complete, and I have observed your performance in the course. Letters of recommendation are important as you pursue various programs. It is in your best interest to only ask individuals that know you personally to be letter writers and have verbal assurance from the individual that they can write you a strong and positive letter.

I require that students earn a 4.0 in the course and have a 3.5 GPA overall and that they have demonstrated course engagement by participating in bonus work and interacting with the instructional team. You will need to submit your CV or resume, a personal statement, a copy of your transcripts, and a completed questionnaire (that I will send to you after I agree to write the letter). I will be unable to complete letters if the student fails to submit these materials within 2 weeks of the due date of the letter.

HOW TO BE AN LA FOR NEU 301/302:

If you are interested in being an LA for 301/302, then you should contact me (Dr. Hedges) via email during the spring semester. You will be asked to fill out a questionnaire and return it to be placed in the pool of other interested students. I will choose LAs based on their responses to that questionnaire, demonstrated ability to interact well with their peers during in-person meetings, and demonstrated mastery of the subject matter through performance on assessments. I will make these decisions after the successful completion of both NEU 301 and NEU 302 (typically by the end of May).

HONORS OPTION

Please see Honors Option module on D2L for details.

TECHNOLOGY RESOURCES AND REQUIREMENTS:

TECHNOLOGY REQUIREMENTS AND RESOURCES

- Internet connection (preferably high speed)
- Access to D2L homepage: D2L Home Page
- Access to Google Classroom page: Google Classroom Home page
- See the Student Handbook under Policies and Procedures for Computer Technology and Laptop requirements
- The MSU Tech Store offers special computer hardware and software pricing for students.
- Microsoft Office 365 if available (for free) to all students by logging in through this website: Microsoft 365 MSU with your MSU username and password

TECHNICAL ASSISTANCE

- If experiencing a problem, you are required to contact the help desk first.

- If you require technical assistance, or need to report a problem:
    - Visit the IT support site: MSU IT Support
    - Visit the D2L Help site: D2L Help Site
    - Call IT Help Line at 517-432-6200 or toll free (844) 678-6200
- If you have any technology difficulties accessing D2L, contact the IT Help Line, explain the situation, and ask for assistance.
- Faculty is not responsible for assisting in resolving technology difficulties
- You are required to notify me via email regarding any technical difficulties, **after** speaking with IT Help Desk

RESOURCES FOR MSU STUDENTS:

The Resource Center for Persons with Disabilities – RCPD offers resources, support, and accommodations to students with disabilities. This can include, but is not limited to, autism spectrum disorders, blindness and visual impairment, brain injury, chronic health disabilities, deaf / hard of hearing, learning disabilities and attention deficit, mobility disabilities psychiatric disabilities, and temporary conditions. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at www.rcpd.msu.edu.

Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation ("VISA") form. **Please present this form to Dr. Hedges as soon as possible.**

Counseling and Psychiatric Services - CAPS is the place on campus for students seeking help for a wide range of concerns, including depression, anxiety, stress management, homesickness, adjustment or acculturation, relationships, gender identity and sexual orientation (LBGTQ) concerns, substance abuse, trauma, eating or body image concerns, and other personal mental health concerns.

Student Advocates for Essential Needs Security (SAENS) is a registered student organization within MSU that is open to currently enrolled undergraduate and graduate students. SAENS works with MSU's on and off-campus resources to raise awareness and support the needs of students related to housing, food, and basic care items. SAENS advocates on behalf of students for the equitable distribution of essential need items to students including affordable housing, access to healthy food options, and access to hygiene resources to promote student success.

The Student Parent Resource Center offers a supportive environment to obtain information and resources for all student parents and their families on and off campus. Within Resource Center is the Student Parents on a Mission (SPOM), a registered student organization for MSU students with children. This support system connects student parents through parent meetings, family fun events, scholarship awards, and a holiday adoption program.

Office of the University Ombudsperson - Whether you are a student, faculty member, or staff, the Office of the University Ombudsperson offers a confidential place to discuss both academic and nonacademic concerns including, administrative issues, workplace issues, or any concern that may relate to Michigan State University students.

The Online Engagement Center, part of the Neighborhood Student Success Collaborative – We promote academic proficiency, institutional navigation and socio-emotional engagement, which support student success. We do this through: Academic advising and academic success coaching, Engagement Center resources, our student success programs (Spartan Success Scholars, DOW STEM Scholars Program, and Detroit M.A.D.E. Scholars Program) and Collaborative Learning Center (where we train peer educators across the university, provide success skill workshops, and are experts on non-cognitive indicators of academic success)

The Spartan Strong Foundation has been created to provide support for the evolving needs of individuals impacted by tragic events. The Spartan Strong Fund exists to harness Spartans' collective will to take action and support one another.

The Lesbian, Bisexual, Gay, and Transgender Resource Center – We lead and collaborate on university-wide initiatives that prepare students to thrive in our diverse world, and enhance the campus climate and support services for students marginalized by their sexuality or gender identity.

The MSU Food Bank- MSU Student Food Bank was founded to help students who are dealing with food insecurity (having limited food availability with a reduction in the quality or variety of food intake that often results in disrupted eating patterns). A lack of food security can be a considerable obstacle to academic success. The MSU Student Food Bank is a non-profit and serves over 6,000 students, many with families, and distributes over 110,000 pounds of food. See their site about eligibility and use of this service. The Greater Lansing Food Bank also offers mobile distribution and food pantries.

The Campus Meditation Map was created by Beal Scholar Anhad Viswananth as part of the Garden's Wellness program. Go to the link for a map and a list of meditation sites.

MSU POLICIES

ATTENDANCE:

Students are expected to participate in all course activities. See the Ombudsperson's web site for a discussion of student observance of major religious holidays, student-athlete participation in athletic competition, student participation in university-approved field trips, medical excuses and dean's drop for students who fail to attend class sessions at the beginning of the semester.

THE SPARTAN CODE OF HONOR ACADEMIC PLEDGE:

"As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing to endeavor to build personal integrity in all that I do."

ACADEMIC INTEGRITY

The "Academic Freedom for Students at Michigan State University" document (found at http://splife.studentlife.msu.edu) is a legal document that you, as a member of the MSU community, should be familiar with. The welcome letter at the beginning reads, in part:

"As an academic community, it is necessary to set standards that will promote an environment conducive to learning The first part of the Spartan Life presents the policies, regulations and guidelines developed to provide an atmosphere that furthers opportunities for intellectual and personal development while protecting individual freedoms. As a student you are encouraged to exercise your rights and you are expected to meet your responsibility to adhere to the standards set. The second part of this guide serves to inform you of the rules, regulations, rights and responsibilities that have been established in the interest of all member of the University community."

Academic misconduct, including but not limited to plagiarizing, cheating, and submitting falsified data will not be tolerated in this course. Individual student assignments that contain portions that are deemed by Dr. Hedges to be highly similar to an assignment submitted by another student in current or previous semesters or to an internet or published source may be considered a violation of academic integrity. See "Section 1.00 PROTECTION OF SCHOLARSHIP

AND GRADES and Student Academic Integrity FAQs" for detailed information about definitions of academic integrity, examples of misconduct, and advice about how to avoid it.

In this class, you are NOT permitted to share answers or materials with other students (past, present or future) nor are you permitted to collaborate on any quizzes or exams in this course with any other students (past, present, or future). You are not allowed to obtain assignments from another student enrolled in the current or a previous semester. When required to use information from published papers or other sources, it must be re-stated in your own words and cited as specified in class.

Suspected violations of the MSU policies will result in a meeting with Dr. Hedges. Depending on the severity of the violation, penalties for academic dishonesty may range from 0 points for an item on the assignment, to 0 points for the entire assignment, to a failing grade for the class. If a penalty grade is administered, Dr. Hedges is required to submit an academic dishonesty report to the university, which will be added to the student's record. The student will be required to complete a course on academic integrity, and the Dean may choose to impose other sanctions. Providing your completed assignments and answers to quizzes and assignments, to other students currently enrolled in NEU301 or those who may take NEU301 in the future is considered a violation of academic integrity and may subject you to sanctions by the university even if you are no longer enrolled in the class.

TITLE IX: OUR COMMITMENT:

"Michigan State University is committed to fostering a culture of caring and respect that is free of relationship violence and sexual misconduct, and to ensuring that all affected individuals have access to services. For information on reporting options, confidential advocacy and support resources, university policies and procedures, or how to make a difference on campus, visit the Title IX website."

LIMITED CONFIDENTIALITY:

"Essays, journals, and other materials submitted for this class are generally considered confidential pursuant to the University's student record policies. However, students should be aware that University employees, including instructors, may not be able to maintain confidentiality when it conflicts with their responsibility to report certain issues to protect the health and safety of MSU community members and others. As the instructor, I must report the following information to other University offices (including the Department of Police and Public Safety) if you share it with me (in writing or in person), if I overhear it from others, or if I am informed by others:

--Suspected child abuse/neglect, even if this maltreatment happened when you were a child

--Allegations of sexual assault or sexual harassment when they involve MSU students, faculty, or staff

--Credible threats of harm to oneself or to others

These reports may trigger contact from a campus official who will want to talk with you about the incident that you have shared. In almost all cases, it will be your decision whether you wish to speak with that individual. If you would like to talk about these events in a more confidential setting you are encouraged to make an appointment with the MSU Counseling Center." http://oie.msu.edu/mandatory-reporting.html

RELIGIOUS OBSERVATION POLICY

We will honor the Religious Observance Calendar for the University. Students who are absent from classes on these days will not be disadvantaged in any way. I have made an effort to avoid scheduling major assignments during the major holidays of religions on campus when possible.

- Exams that do fall on a religious holiday can be reasonable rescheduled without any penalty.
- You do not need to use a late pass for an assignment that falls on an observed religious holiday.
- **You must inform me (Dr. Hedges) at least 2 weeks prior to the due date of the assignment or exam that it falls on an observed religious holiday to make arrangements in advance for that assignment/exam**

GRIEF ABSENCE POLICY

The faculty and staff should be sensitive to and accommodate the bereavement process of a student who has lost a family member or who is experiencing emotional distress from a similar tragedy so that the student is not academically disadvantaged in their classes or other academic work (e.g. research). For undergraduate students it is the responsibility of the student to: a) notify the Associate Dean or designee of their college by completing the grief absence request form https://reg.msu.edu/StuForms/Stuinfo/GriefAbsenceForm.aspx in a timely manner, but no later than one week from the student's initial knowledge of the situation, b) provide appropriate verification of the grief absence as specified by the Associate Dean, and c) complete all missed work as determined in consultation with the instructor. It is the responsibility of the Associate Dean or designee to: a) determine with the student the expected period of absence – it is expected that some bereavement processes may be more extensive than others depending on individual circumstances, b) notify the faculty that the student will be absent, and c) receive verification of the authenticity of a grief absence request upon the student's return. It is the responsibility of the instructor to work with the student to make reasonable accommodations and to include appropriate language describing such accommodations in their course syllabus, so that the student is not penalized due to a verified grief absence. Students who believe their rights under this policy have been violated should contact the MSU Office of the University Ombudsperson for information on the academic grievance procedures.

COURSE DROPS AND ADDS

Can be found on the academic calendar at: https://reg.msu.edu/ROInfo/Calendar/academic.aspx

Unit Learning Objectives NEU 301

Week 2- Neurons and Glia LOs:

- Contrast the structure and function of neurons vs. glia and describe criteria that can be used to classify different types of neurons.
- Describe the structural and functional differences between axons and dendrites that allow for communication with other cells/tissues.
- List the three main types of glia and their main functions.
- Determine when use of Nissl or Golgi stain is appropriate for histological analysis.
- Differentiate between anterograde and retrograde transport and the functions of each type of transport.
- Contrast the structure and function of neurons vs. glia
- Construct a model of a neuron, indicating the important structural elements and their functions.
- Describe the structural and functional differences between axons and dendrites.
- Recommend the appropriate histological techniques to analyze cytoarchitecture and neuronal structure
- Apply understanding of retrograde and anterograde transport to predict how different tracers would affect the brain.
- Identify the role of microglia in the nervous system and how microglia accumulation within the brain is altered following ischemic stroke.

Week 3- Resting membrane potential LOs:

- Explain how ion movement across the cell membrane is influenced by diffusion and electrical forces and predict ion movement across the membrane due to both chemical and electrical gradients.
- Differentiate between ‘membrane potential’ and 'equilibrium potential', indicating the unit of measure and how it is measured.
- Compare and contrast equilibrium potential and resting membrane potential.
- Apply the Nernst and Goldman-Hodgkin-Katz equations appropriately to determine equilibrium potential and resting membrane potential, identifying the necessary information required for each calculation.
- Identify the relative (high vs low) ionic concentrations inside and outside the cell for the following ions: K+, Na+, Cl-, and Ca2+
- Differentiate between the membrane proteins that are responsible for allowing ions to move across the cell membrane from those that maintain the resting membrane potential.
- Model the ionic basis of the resting membrane potential and predict how alterations in extracellular K+ will affect resting membrane potential.
- Predict ion movement across the membrane due to both chemical and electrical gradients.
- Model the ionic basis of the resting membrane potential and predict how alterations in extracellular K+ will affect resting membrane potential.
- Compare and contrast equilibrium potential and resting membrane potential.
- Apply the Nernst and Goldman-Hodgkin-Katz equations appropriately to determine equilibrium potential and resting membrane potential, identifying the necessary information required for each calculation.
- Compare and contrast equilibrium potential and resting membrane potential, including what they each measure.
- Apply the Nernst and Goldman-Hodgkin-Katz equations appropriately to determine equilibrium potential and resting membrane potential, identifying the necessary information required for each calculation.
- Identify the relative (high vs low) ionic concentrations inside and outside the neuron for the following ions: K+, Na+, Cl-, and Ca2+

- Differentiate between the membrane proteins that are responsible for allowing ions to move across the cell membrane from those that maintain the resting membrane potential.

Week 4– Action Potential potential LOs:

- Understand how graded potentials are related to action potentials, where they are found within the cell, and how the opening of ion channels can lead to depolarization and hyperpolarization of the membrane potential.
- From memory graph:
    - an action potential and label each stage of the action potential. Within each stage, identify the ions responsible for the corresponding change in voltage, the direction of ion movement, the state of the involved ion channels (open, closed, inactivated, etc.).
    - an example of depolarization, hyperpolarization, and repolarization of the membrane potential, indicating whether each one is an increase or a decrease in membrane potential.
- Predict action potential changes when provided with ion concentrations and permeabilities or alterations in channel mechanics.
- Describe the characteristics of voltage-gated Na+ and K+ channels (what causes them to open, when they are open, when they close, etc.).
- Compare and contrast absolute refractory periods and relative refractory periods, including status of ion channels.
- Explain the proteins critical for optogenetic studies and the experimental control that optogenetics provides to researchers.
- Define the 'neural code' and how stimulus intensity relates to the neural code.
- Describe the factors that affect the speed of an action potential and compare and contrast how action potentials differ in conductance between myelinated and unmyelinated neuron axons. Include a discussion of saltatory conduction, where the voltage-gated ion channels are located, and the speed of transmission.
- Predict how opening different types of ion channels will result in either depolarization or hyperpolarization.
- Identify where the different ion channels are located within a neuron and what causes them to open.
- Model the voltage clamp method and understand how it was used to determine the flow of ions during an action potential.
- Draw and explain the predicted inward and outward current graphs when the membrane is at -120 mV, 0 mV, and +52 mV.
- Draw the predicted inward and outward current graphs when the cell is exposed to either TTX or TEA.
- Predict ion flow results of voltage-clamp experiments given a clamped membrane potential value, or vice versa
- Understand what is meant by an increase or a decrease in membrane potential and how this related to depolarization, hyperpolarization, excitatory postsynaptic potentials, and inhibitory postsynaptic potentials
- Compare and contract graded potentials and action potentials, the ions and receptors responsible for these membrane potential changes, and where each type of change in membrane potential is found within a neuron.
- Identify where the different ion channels are located within a neuron and what causes them to open.
- Differentiate between different types of refractory periods
- Describe the different phases of the action potential and the movement of ions that causes each phase, taking into account changes in permeability of ions throughout the action potential.

Week 5 – Synaptic signaling LOs:

- Illustrate a chemical and electrical synapse, identifying the relevant proteins and their functions.
- Explain the steps necessary for chemical neurotransmission, including:
    - Neurotransmitter synthesis and storage in the presynaptic terminals
    - Neurotransmitter release: including proteins necessary for exocytosis

    - Neurotransmitter action at postsynaptic receptors: including the differences between ionotropic and metabotropic receptors and the types of postsynaptic potentials
    - Neurotransmitter clearance/degradation
- Contrast neurotransmitter synthesis, packaging, and release of amino acid and amine neurotransmitters vs. peptide neurotransmitters
- Model summation of excitatory and inhibitory synapses spatially and temporally.
- Relate how postsynaptic potentials influence action potentials
- Explain the effects of an action potential on presynaptic axon terminal, identifying the ions and ion channels that are involved, and any other critical proteins.
- Predict how changes in Ca2+ concentration will alter synaptic signaling.
- Explain how neurotransmitters can affect membrane potential and ion current flow in the postsynaptic cell.
- Predict changes in membrane potential from the integration of excitatory and inhibitory inputs.
- Compare and contrast the cAMP pathway with the PIP2 pathway.
- Define the steps of the chemical synapse, including:
    - the relevant structures and proteins
    - Neurotransmitter synthesis and storage in the presynaptic terminal
    - Neurotransmitter release: including proteins necessary for exocytosis
- Contrast neurotransmitter synthesis, packaging, and release of small molecule vs. peptide neurotransmitters
- Define EPSP and IPSP, identifying the flow of ions that would cause an EPSP or IPSP, and if this would cause an increase or decrease in membrane potential.
- Describe the cellular location for measuring postsynaptic potentials vs. action potentials.
- Define spatial and temporal summation
- Compare and contrast the cAMP pathway with the PIP2 pathway.

Week 7 – Neurotransmitter LOs:

- Explain the setup and results of the experiment by Loewi
- Define drug agonists and antagonists and predict changes in synaptic activity following administration of the agonists and antagonists given as examples in the ppt.
- For the following neurotransmitters describe how they are synthesized, packaged, cleared/degraded, and their postsynaptic actions: acetylcholine, dopamine, norepinephrine, serotonin, glutamate, GABA
- Define drug agonists and antagonists and predict changes in synaptic activity following administration of the agonists and antagonists given as examples in the ppt.
- Describe the signaling actions of endocannabinoids
- Describe the acetylcholine neurotransmitters system and apply how this system is affected in myasthenia gravis.
- Explain how targets for different neurotransmitter systems should be altered in activity in order to increase or decrease neurotransmitter signaling.
- Identify whether a target within a neurotransmitter system is specific to one neurotransmitter system or if it is shared amongst multiple neurotransmitter systems.
- Define the 2 dopaminergic systems within the brain, including anatomy and function.
- Use the conceptual model to describe how neurotransmitters alter gene transcription through 2nd messenger systems.
- Predict how glutamate and GABA will alter membrane potential after binding to ionotropic receptors.
- Apply the function of the cranial nerves to diagnose patients displaying specific symptoms.

Week 7 – Anatomy LOs:

- Describe the general organization of the central and peripheral nervous systems and explain and recognize the 3 planes of anatomical section for our nervous system and successfully apply anatomical directional terms to describe the relative location of structures in the nervous system, understanding how directional terms in the brain of humans differ from those of the body.
- Describe the anatomical location and functional importance of: each of the meninges, the ventricular system, the blood brain barrier, the cerebral cortex, and the anatomical lobes of the brain, the precentral gyrus and postcentral gyrus.
- Identify how cerebrospinal fluid is produced, how it flows throughout the nervous system, and its functional importance.
- Understand the importance of blood supply to the brain and differentiate between what occurs during an ischemic stroke and a hemorrhagic stroke.
- Define each of the following terms within the nervous system: 'nucleus', 'ganglion', 'tract', and 'nerve', 'gray matter', and 'white matter'. Indicate specific examples of where each is located within the nervous system.
- Distinguish between the different types of white matter connections within the nervous system.

Week 8 – Anatomy and Development LOs:

- Describe the process of neurulation within the ectoderm identifying the ultimate fate of the neural tube, the somites and the neural crest, and detailing the conditions that result from failure of the neural tube to close.
- Describe the differentiation of the rostral portion of the neural tube, contrasting the differentiation of the forebrain, midbrain, hindbrain, and spinal cord.
- Define the location and functional importance of each of the covered brain structures that arise at each level of the brain.
- Describe ways that the living brain can be imaged and indicate which of the imaging techniques can be used to look at brain function and which can be used to look at brain structure.
- Describe the importance of cell proliferation in development.
- Describe how synapse formation occurs within the developing nervous system.
- Identify and understand the importance of the different regressive events that occur in development.
- Identify the regressive events that lead to a decrease in 1) cell number and 2) synapse number
- Explain the specific examples of how trophic factors, apoptosis, synaptic pruning, and synaptic capacitance are utilized as regressive events in neurodevelopment, and what causes each to occur.
- Describe experience-dependent plasticity in the capacity that was covered in class, and explain how it is used to refine synaptic connections.
- Identify the normal functions of Broca's area and Wernicke's area in the human brain and detail what occurs following damage to each brain area.
- Understand the given example of the effectiveness of speech rehabilitation. Differentiate between the effectiveness of therapy, as measured by an increase in brain activity, between an early time point following stroke (T2) and a later time point following stroke (T3).
- Accurately define the plane of section and the type of brain scan given from an example brain image.
- Identify structural changes between 2 given brain images and predict the resulting functional change that would be expected.
- Describe the process of neurulation
- Describe the differentiation of the rostral portion of the neural tube, contrasting the differentiation of the forebrain, midbrain, hindbrain, and spinal cord.
- Define the location and functional importance of each of the covered brain structures that arise at each level of the brain.
- Understand the experiments and data presented in this recitation.

Week 9– Autonomic NS LOs:

- Describe the anatomy and functional divisions of the spinal cord.
    - Understand how afferent information enters the spinal cord and how efferent information leaves the spinal cord

    - Identify dorsal root ganglia, sympathetic ganglia, dorsal and ventral roots, and spinal nerves and where afferent, efferent and mixed nerves are located.
- Differentiate between the somatic and visceral nervous system in terms of their effector cells, pathways, neurotransmitter used, synaptic type, and target responses.
- Differentiate between the sympathetic and parasympathetic nervous systems in terms of their function, target tissues, anatomy, neurotransmitters used, and neurotransmitter receptors used.
- Identify and describe the role of brain structures that have control over the autonomic nervous system.
- Differentiate between the somatic and visceral nervous system in terms of their effector cells, pathways, neurotransmitter used, synaptic type, and target responses.
- Differentiate between the sympathetic and parasympathetic nervous systems in terms of their function, target tissues, anatomy, neurotransmitters used, and neurotransmitter receptors used.
- Define and give examples of afferent and efferent nerves.
- Identify and describe the role of brain structures that have control over the autonomic nervous system.
- Describe the role of baroreceptors and their interplay with the autonomic nervous system in the normal maintenance of blood pressure.
- Understand the role of testosterone in pelvic ganglia receptor expression and function in erectile dysfunction. Describe the goals, methods, and results of the Huang et al. experiment that modeled erectile dysfunction in rodents.

Week 10– Vision, The Eye LOs:

- Identify structures of the eye and describe the functions of each structure, noting which structures are visible from the outside of the eye, an ophthalmoscope, and a cross sectional view.
- Describe the laminar organization of the retina and the order of light information processing through the chain of retinal cells.
- Differentiate between the 2 types of photoreceptors, including in what lighting conditions they are used, their structure, their connectivity, their distribution in the retina, and their relative amount of photopigments.
- Understand where in the visual field humans have the most visual acuity and where they see best in dim lighting.
- Describe phototransduction in rods and cones in both light and dark lighting conditions.
- Describe the center-surround receptive fields of retinal cells.
- Identify the neurotransmitter used by the photoreceptors and the types of receptors that bind the neurotransmitter, as well as differences in response of the receptors.
- Predict membrane potential changes in retinal cells given a specific set of criteria (location of light, type of cell).
- Identify and describe the receptive fields of “ON- and OFF-center” bipolar and retinal ganglion cells in the visual system and how they contribute to an increase or decrease in action potential firing rate within the optic nerve.
- Predict membrane potential changes in retinal cells given a specific set of criteria (location of light, type of cell)
- Identify and describe the receptive fields of “ON- and OFF-center” bipolar and retinal ganglion cells in the visual system and how they contribute to an increase or decrease in action potential firing rate within the optic nerve.
- Explain the mechanism of lateral inhibition in facilitating signal enhancement.
- Identify structures of the eye through the viewpoint of an ophthalmoscope.
- Understand where in the visual field humans have the most visual acuity and where they see best in dim lighting.
- Apply your knowledge of the contribution of rods and cones to central and peripheral vision to the disorders of macular degeneration and retinitis pigmentosa.
- Describe, in detail, phototransduction in rods and cones in both light and dark lighting conditions.
- Identify the neurotransmitter used by the photoreceptors and the types of receptors that bind the neurotransmitter, as well as differences in response of the receptors.

Week 11– Central Visual System LOs:

- Trace the retinofugal and retinotectal projections from the retina to the occipital cortex (including any crossing) and define the function of each projection in vision.

- Explain how visual fields differ between prey and predator species, and how the visual hemifields contribute to our binocular vision.
- Describe the structure and anatomical location of the LGN. Explain how information from the left and right eyes and left and right visual hemifields is processed within the LGN.
- Create a model of the visual field projections into the retina, that allow for visualization of the left and right visual hemifields, including the left and right eye/retina, which portion of the retina is nasal or temporal, central and peripheral visual fields, the left and right LGN, the optic chiasm, the optic nerves, and the optic tracts.
    - Use the model to predict what happens following damage to the visual projection pathways.
    - Use the model to determine which areas of the left and right retina are responsible for vision of the left and right monocular visual fields and binocular visual field.
- Explain the retinotopy that connects the retina, the LGN, and the striate cortex.
- Describe the laminar and columnar organization of the visual cortex, including:
- The experiments by Hubel and Wiesel that determined orientation selectivity of cortical columns.
- Development of the ocular dominance columns and "critical periods" in visual development.
- Plastic changes in ocular dominance columns following monocular deprivation during development.
- Identify the anatomical locations and functions of the dorsal visual stream and ventral visual stream and the specific locations and functions of Area MT, Area V4, Area IT/Fusiform Face Area
- Define visual perception and how the location of the receptive field and the optimal visual stimulus changes at different levels of the visual system.
- Determine the effects of lesions on visual field perception at different levels of the retinofugal projection.
- Identify which brain areas answer these 3 basic questions about a visual stimulus: What is it? Where is it? What is its value?
- Explain why the brain is capable of responding to threatening stimuli before one is consciously aware of the stimulus.
- Describe the results of MRI studies and the function of using MRI as a research technique.
- Describe the role of the amygdala in visual processing.

Week 13– Auditory System LOs:

- Define the properties of sound waves that are related to pitch and loudness.
- Describe the anatomy and function of the outer, middle and inner ears. Understand how sounds are conducted through them and translated into a neural signal by the auditory nerve.
- Identify the membranes and fluid-filled chambers of the cochlea, differentiating between their ionic concentrations.
- Describe and understand the structure and tonotopy of the basilar membrane.
- Describe the structure and function of the organ of Corti and the sensory auditory receptors.
- Describe how the movement of stereocilia can result in either depolarization of hyperpolarization of hair cells.
- Describe the output of the inner ear, differentiating between the output of the inner hair cells and the outer hair cells.
- Explain how the cochlear amplifier contributes to auditory sensitivity.
- Differentiate between the causes of conductive deafness and nerve deafness, identifying appropriate treatments for each disorder.
- Use your knowledge of the anatomy and function of the outer, middle and inner ears to diagnose a patient, such as the example in the recitation.
- Understand how sounds are conducted through each structure and then translated into a neural signal by the auditory nerve.
- Model the structure and tonotopy of the basilar membrane.
- Model the structure and function of the sensory auditory receptors.
- Describe how the movement of stereocilia can result in either depolarization or hyperpolarization of hair cells.
- Explain how mechanically-gated ion channels operate in auditory hair cells.
- Describe how the middle ear serves to both amplify and attenuate sounds.

- Explain how outer hair cells serve as the cochlear amplifier, specifying the function of the cochlear amplifier and the important proteins.

Week 14 (Thanksgiving week)– Vestibular System LOs:

- Identify the various structures within the vestibular system and what each structure detects, describing how each structure contributes to our sense of balance.
- Describe the structure and function of the otolith organs.
- Explain how head tilt leads to the activation/inhibition of the hair cells within the otolith organs.
- Describe the structure and function of the semicircular canals.
- Explain how head rotation leads to activation/inhibition of the hair cells within the semicircular canals.
- Describe the importance of having semicircular canals on each side of the head in detection of head rotation.
- Describe the central pathways conveying vestibular information to the central nervous system
- Know the details of the case study of Cheryl Shiltz and Paul Bach y Rita, identifying possible mechanisms of how vestibular function was restored through Hebbian processing.

Week 15– System LOs:

- Identify which types of chemicals are responsible for our 5 basic tastes.
- Identify the organs important in taste and their roles in taste.
- Identify the structures of the tongue and differentiate between a papilla, taste bud, and taste cell.
- Explain what is meant by the 'critical threshold' of a taste cell, and how taste cells react in response to exposure of different chemical substances.
- Describe in detail the transduction of salty, sour, sweet, umami, and bitter tastes, including the ion channels affected and the neurotransmitters used.
- Identify the dimers responsible for bitter, sweet and umami tastes.
- Identify the cranial nerves responsible for the delivery of taste information into the CNS.
- Describe the central taste pathway.
- Identify the function of the olfactory system and how it is similar and different to the other sensory systems that have been discussed in class.
- Describe the anatomy of the nose, the olfactory organs, the olfactory receptors, the glomeruli, the olfactory bulbs, and their role in olfaction.
- Describe in detail how odorants cause signal transduction within olfactory receptor neurons.
- Identify the relationship between olfactory receptor cells and odorant receptor proteins.
- Describe how odorant receptors are mapped on the olfactory epithelium and how they signal to the olfactory bulbs.
- Describe population coding in the olfactory system.
- Trace the output of the olfactory bulbs in the central signaling of olfaction.
- Explain labeled-line and population coding.
- Defend with evidence the conclusion that umami taste and sweet taste are labeled line systems.
- Use methods and data in the recitation and explain what information they provide
    - Describe methods used in the recitation and explain what information they provide.
    - Analyze results and state conclusions based on the data presented in the graphs.
    - Predict results and generated conclusions when given data or experimental manipulations similar to those provided in the recitation.

COURSE SCHEDULE: NEU 301 Fall 2024 (Section 001 and Section 002)

Refer to the course calendar (below) for a schedule of topic dates and due dates. Assignment details will be explained in detail within each week's corresponding learning module (week) of the course. If you have any questions, please contact your instructor.

Readings are from our course Open Educational Resource that is freely available to students: Introduction to Neuroscience – Simple Book Publishing (msu.edu).

In-class assignments: Must be turned in to gain access to the associated exam. You will only gain access to the key once you turn the assignment in.

***Practice Questions:** Do NOT need to be turned in prior to the exam. You will only gain access to the key once you turn the assignment in.

Reflections: The Start of semester Reflection and End of semester reflection are required. Exam reflections are only required for those that wish to complete exam revisions.

Exams: All online through D2L. Note opening and closing dates/times on schedule.

Week	***Dates***	***Topic***	***Reading: Introduction to Neuroscience***	***Weds class meeting (in-person or synchronous Zoom option)***	***Assignments***	***Exams***
1	Mon 8/26-Fri 8/30	Class Introduction	Chapter 1	Date: 8/28/24	**Due: 8/30 at 11:59pm** Start of Semester Reflection Start of Semester Survey Grade Agreement Quiz Required to gain access to course content	
2	Friday 8/30-Friday 9/6 **Labor Day 9/2**	Unit 1: Neurons and Glia	Chapter 2, 3, 4	Date: 9/4/24	**Due: 9/6 at 11:59pm** Week 2 In-class assignment Week 2 Quiz *Week 2 Practice Questions	
3	Friday 9/6-Friday 9/13	Unit 2: Resting Membrane Potential	Chapters 5, 6, 7	Date: 9/11/24	**Due: 9/13 at 11:59pm** Week 3 In-class assignment Week 3 Quiz *Week 3 Practice Questions	**EXAM 1 (Unit 1 and Unit 2)** - Opens Sun. 9/15 @8am -Closes Mon. 9/16 @ 11:59 pm

Week	*Dates*	*Topic*	*Reading: Introduction to Neuroscience*	*Weds class meeting (in-person or synchronous Zoom option)*	*Assignments*	*Exams*
4	Monday 9/16-Friday 9/20	Unit 3: Action Potential	Chapters 8, 9, 10	Date: 9/18/24	**Due: 9/20 at 11:59pm** Week 4 In-class assignment Week 4 Quiz *Week 4 Practice Questions Exam 1 Reflection (for those completing revisions)	
5	Friday 9/20-Friday 9/27	Unit 4: Synaptic Transmission Unit 5: Neurotransmitters	Chapters 11, 12, 13	Date: 9/25/24	**Due: 9/27 at 11:59pm** Week 5 In-class assignment Week 5 Quiz *Week 5 Practice Questions	**EXAM 2 (Unit 3, Unit 4, some of Unit 5)** -Opens Sun. 9/29 @8am -Closes Mon. 9/30 @ 11:59 pm
6	Monday 9/30-Friday 10/4	**Synthesis Week** **No In-class assignment or quizzes due** **No new content**		Date: 10/2/24 Class meeting to ask questions/review	**Due: 10/2 at 11:59pm** Exam 2 Reflection **Due: 10/4 at 11:59pm** Exam 1 Revisions Exam 2 Revisions	**Review Exam Feedback on Exam 1 and Exam 2** - Opens Tues. 10/1 @11:00 am - Closes Thurs. 10/3 @8:00 am **Complete Exam Revisions on Exam 1 and Exam 2** - Opens Thurs. 10/3 @8:00 am - Closes Fri. 10/4 @11:59 pm
7	Friday 10/4-Friday 10/11	Unit 5: Neurotransmitters cont. Unit 6: CNS Anatomy	Chapters 14, 15, 16, 17, 18, 19, 20	Date: 10/9/24	**Due: 10/11 at 11:59pm** Week 7 In-class assignment Week 7 Quiz *Week 7 Practice Questions	
8	Friday 10/11-Friday 10/18	Unit 6: CNS Anatomy	Chapters 21, 22, 23, 24, 25	Date: 10/16/24	**Due: 10/18 at 11:59pm** Week 8 In-class assignment Week 8 Quiz *Week 8 Practice Questions	

Week	*Dates*	*Topic*	*Reading: Introduction to Neuroscience*	*Weds class meeting (in-person or synchronous Zoom option)*	*Assignments*	*Exams*
9	Friday 10/18-Friday 10/25 **Fall Break 10/21-10/22**	Unit 7: Peripheral Nervous System	Chapters 26, 27	Date: 10/23/24	**Due: 10/25 at 11:59pm** Week 9 In-class assignment Week 9 Quiz *Week 9 Practice Questions	**EXAM 3 (Rest of Unit 5, Unit 6, Unit 7)** -Opens Sun. 10/27 @8am -Closes Mon. 10/28 @11:59 pm
10	Monday 10/28-Friday 11/1	Unit 8: Visual System: The Eye	Chapter 28, 29	Date: 10/30	**Due: 11/1 at 11:59pm** Week 10 In-class assignment Week 10 Quiz *Week 10 Practice Questions Exam 3 Reflection (for those completing revisions)	
11	Friday 11/1-Friday 11/8	Unit 8: Visual System: Central Visual Systems	Chapter 30	Date: 11/6/24	**Due: 11/8 at 11:59pm** Week 11 In-class assignment Week 11 Quiz *Week 11 Practice Questions	**EXAM 4 (Unit 8)** - Opens Sun. 11/10 @8am - Closes Mon. 11/11 @ 11:59 pm
12	Monday 11/11-Friday 11/15	**Synthesis Week** **No In-class assignment or quizzes due** **No new content**		Date: 11/13/24 Class meeting to ask questions/review	**Due: 11/13 at 11:59pm** Exam 4 Reflection **Due: 11/15 at 11:59pm** Exam 3 Revisions Exam 4 Revisions	**Review Exam Feedback on Exam 3 and Exam 4** - Opens Tues. 11/12 @11:00 am - Closes Thurs. 11/14 @8:00 am **Complete Exam Revisions on Exam 3 and Exam 4** - Opens Thurs. 11/14 @8:00 am - Closes Fri. 11/15 @11:59 pm
13	Friday 11/15-Friday 11/22	Unit 9: Auditory System	Chapter 31, 32	Date: 11/20/24	**Due: 11/22 at 11:59pm** Week 13 In-class assignment Week 13 Quiz *Week 13 Practice Questions	

Week	*Dates*	*Topic*	*Reading: Introduction to Neuroscience*	*Weds class meeting (in-person or synchronous Zoom option)*	*Assignments*	*Exams*
14	Friday 11/22-Friday 11/29 **Thanksgiving Week**	Unit 10: Vestibular System	Chapter 33	Date: 11/27/24 **NO CLASS MEETING** 😊	**No in-class assignment, practice questions, or quiz this week! Have a great break!**	
15	Monday 12/2-Friday 12/6	Unit 11: Olfactory System Unit 11: Gustatory System	Chapter 34, 35	Date: 12/4/24	**Due: 12/6 at 11:59pm** Week 15 In-class assignment Week 15 Quiz *Week 15 Practice Questions End of Semester Reflection	
16	Monday 12/9-Friday 12/13	**FINALS WEEK**			**EXAM 5 (Unit 9, 10, 11)** - Opens Monday 12/9 @8am - Closes Friday 12/13 @ 1pm	