

Biology 6690: Special Topics in Neurobiology

Winter Semester, 2021

Instructor: Dr. David Njus

Lab: 0162 Biological Sciences

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Office Hours: Tuesday, Thursday, 4:00–5:00 pm on Zoom

Class times: Monday, Wednesday, 4:00-5:15 pm on Zoom

<https://wayne-edu.zoom.us/j/92897069695?pwd=eGJiclR2d0NFMitsZXJ2aW5xTnR2QT09>

Class announcements, reading and other material will be posted on Canvas.

Prerequisite: Molecular and Cellular Neurobiology (BIO 4690) or consent of instructor

Course description: This course will enable students to apply their knowledge of neurobiology to explore a current research area in depth. The topic for Winter Semester 2021 will be the molecular and cellular basis of pathological conditions affecting the nervous system. During the course of the semester, we will discuss the interplay of various pathological phenomena including proteinopathies, oxidative stress, microglial activation, and autophagy and relate these to neurodegenerative diseases such as Parkinson's and Alzheimer's, genetic disorders such as Huntington's, and other pathologies caused by trauma and drugs. The course will involve reading and discussing articles from the scientific literature.

Course Objectives:

At the end of the course, students should be able to

1. Read and critique papers from the scientific literature
2. Describe experimental methods in current use in neurobiology
3. Present a clear and concise in-depth analysis of a specific topic in neurobiology
4. Write a detailed and accurate critique on the current state of knowledge on a specific topic in neurobiology

Presentations: On Monday of each week, Dr. Njus will introduce a question, provide some background information and present hypotheses proposed to answer the question. A paper from the scientific literature will be assigned as reading. On Wednesday, a group of students (3 or 4 undergraduates or 2 graduate students) will present the paper, critique its results and conclusions, and lead a discussion about how the paper answers the question of the week. Every student should take notes at both Monday and Wednesday sessions, as these will be helpful in completing the written assignments described below.

Written Summaries or Abstracts: Each week, each student will write a concise (250-500 words) summary of the question of the week, the hypotheses and his/her view of the significance of the question and our understanding of the answer. These will be due on Monday of the following week. We will discuss 13 papers over the course of the semester. Each student must submit summaries of ten of these. There is no right or wrong response for these summaries. At the end of the semester, these will be your record of what we discussed, and I hope it will give you an interesting look at how your understanding and perspective on the subject developed over the course of the semester.

Grading: Grades will be based on a 1000-point scale as follows:

| | |
|---|-------------|
| 10 written summaries (50 points each) | 500 |
| <u>2 in-class presentations (250 points each)</u> | <u>500</u> |
| Total | 1000 points |

Grades will be assigned based on the following scale:

| | <u>Undergraduates</u> | <u>Graduate Students</u> |
|----|-----------------------|--------------------------|
| A | 925-1000 points | 925-1000 points |
| A- | 900-924 | 900-924 |
| B+ | 875-899 | 875-899 |
| B | 825-874 | 825-874 |
| B- | 800-824 | 800-824 |
| C+ | 775-799 | 775-799 |
| C | 725-774 | 725-774 |
| C- | 700-724 | 700-724 |
| D+ | 675-699 | |
| D | 625-674 | |
| D- | 600-624 | |
| F | 0-599 | 0-699 |

General Policies:

1) Anyone caught cheating or plagiarizing will automatically receive a failing grade for the assignment or paper, with no opportunity to drop or replace that score. A second episode of cheating will result in a grade of F for the course and may also result in initiation of university disciplinary action. For discussions of cheating and plagiarism, see the "Student Code of Conduct," which can be found at <https://doso.wayne.edu/conduct/pdf/student-code-of-conduct.pdf>.

2) Any special considerations (disabilities, religious holiday conflicts, etc.) must be brought to the attention of the instructor by January 19, 2021 or as soon as possible. If you have a disability that may interfere with your ability to successfully complete the requirements for this course, you are invited to contact Student Disability Services (1600 Undergraduate Library; 313-577-1851) to discuss appropriate accommodations on a confidential basis.

3) Conflicts regarding the grading of any assignment must be brought to the attention of Dr. Njus in a concise and typed appeal within one week of the date the grade is posted. Appeals may be sent as an email.

4) Monday, January 25, 2021 is the last day you can drop the class and get your tuition refunded. Sunday, March 28, 2021 is the deadline for withdrawing from the course. Please note that “**incomplete**” grades will not be issued to students in poor standing who are seeking an alternative to a late drop.

5) Professional behavior is expected in lecture, which includes respecting your classmates by arriving on time, and turning off your audio when you are not speaking. All students must show respect in language and attitude towards the instructors and their fellow students. You are encouraged to discuss differences of opinion with each other, respectfully. Disrespectful students will be asked to leave the class session and will lose their opportunity to turn in any missed assignments.

6) University closures will be publicized through:

- WSU Homepage (www.wayne.edu),
- the University Newsline (313-577-5345),
- WDET-FM (Public Radio 101.9) and
- other local radio and television stations.

Tentative Schedule:

| Week | Date | Paper | Topic |
|---------------------|---|-------|---|
| 1 | 11-Jan | | Overview of neurodegenerative diseases |
| | 13-Jan | 0 | Proteinopathy and Oxidative Stress |
| | 18-Jan | | MLK Holiday |
| 2 & 3 | <i>Do neurodegenerative diseases have a genetic basis?</i> | | |
| | 20-Jan | 1 | Alzheimer's Disease |
| | 25-Jan | | Amyotrophic Lateral Sclerosis |
| | 27-Jan | 2 | Huntington's Disease |
| 4 | <i>Why do proteinopathies involve different proteins in different diseases?</i> | | |
| | 1-Feb | | Alzheimer's Disease (β -amyloid and tau) |
| | 3-Feb | 3 | Traumatic Brain Injury |
| 5 | <i>Why are protein aggregates toxic?</i> | | |
| | 8-Feb | | β -Amyloid |
| | 10-Feb | 4 | α -Synuclein |
| 6 | <i>Is oxidative stress caused by dysfunctional mitochondria?</i> | | |
| | 15-Feb | | Reactive oxygen species and oxidation markers |
| | 17-Feb | 5 | Mitophagy |
| 7 | <i>How are oxidative stress and proteinopathy connected?</i> | | |
| | 22-Feb | | Proteins aggregates affect mitochondria |
| | 24-Feb | 6 | Oxidation affects protein aggregation |
| 8 | <i>What is the role of autophagy?</i> | | |
| | 1-Mar | | Clearance of protein aggregates |
| | 3-Mar | 7 | Regulation of autophagic flux |
| 9 | <i>How do neurons die?</i> | | |
| | 8-Mar | | Mitochondria and Apoptosis |
| | 10-Mar | 8 | Programmed Cell Death |
| Spring Break | | | |
| 10 | <i>How do microglia contribute to neuronal degeneration?</i> | | |
| | 22-Mar | | Microglia and inflammation |
| | 24-Mar | 9 | Microglial activation |
| 11 | <i>Why do neurodegenerative diseases target distinct neuronal populations?</i> | | |
| | 29-Mar | | Dopamine, Parkinson's, manganism and vitiligo |
| | 31-Mar | 10 | Huntington's disease |
| 12 | <i>Pieces of the puzzle</i> | | |
| | 5-Apr | | Apolipoprotein E and Alzheimer's Disease |
| | 7-Apr | 11 | Glucocerebrosidase, Parkinson's and Gaucher's Disease |
| 13 | <i>How do intracellular signaling pathways contribute to pathology?</i> | | |
| | 12-Apr | | Nrf2 |
| | 14-Apr | 12 | AKT/ERK |
| 14 | <i>More pieces of the puzzle</i> | | |
| | 19-Apr | | PARP |
| | 21-Apr | 13 | Vitiligo & Manganism |
| | 26-Apr | | Conclusion |