NEU 492: Special Topics in Neuroscience
Neurophysiology underlying Neurodevelopmental Disorders

Fall Semester 2025
Monday, Wednesday 12:40-2:00 PM
Biochemistry 111

Instructor:
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Course Description:

This course focuses on basic research regarding neurophysiological alterations in different animal models of autism spectrum disorder (ASD). The course will involve initial lecture presentations by the instructor, and weekly paper discussions. Students will be expected to consistently participate in paper discussions and presentations. The final grade will be dependent on classroom participation, student presentations, and short written summaries of primary literature.

This course involves ***active discussion*** among the entire class as well as within small groups. ***Your attendance and participation are critical for the success of this course***. Absence from class affects your participation grade unless there is a valid reason, in which case an additional assignment will be given.

Course Prerequisites: NEU 301 and NEU 302

Goals:
1) Reinforce and increase your knowledge of neuroscience and neurophysiology.
2) Learn to discuss the alterations in neuronal function associated with neurodevelopmental disorders.
3) Improve reading and comprehension skills for primary research articles.
4) Improve critical thinking skills regarding basic scientific research.
5) Improve writing and oral communication skills.

Attendance Expectations:

It is expected that you attend class ready to participate during your scheduled class time. Ready to participate entails reading the required readings and completing the required assignments before class. You will need to be prepared for each class so that you can contribute to the class discussion. This course involves active discussion among the entire class and within small groups on the readings. The ideal student will contribute to discussions in class but will also let others participate. There will also be a group oral presentation/discussion of a student-chosen research papers with the whole class. Your attendance and participation in class discussions are critical for your success in this course. Please contact me via email before any absences. Unexcused absences will result in a zero for all assignments missed.

Academic Integrity and Use of generative AI:
1) Please make all assignments in your own words.
2) The use of generative AI tools is not permitted in this course for the following activities:
   - Writing summaries and interpretation of the figures within the research papers
   - Generation of verbiage associated with the slides for oral presentations.
   - MSU Academic Integrity website: https://ombud.msu.edu/resources-self-help/academic-integrity

Course Activities and Grading:

Final grade will be determined based on the scores from the assignments noted below.

Points Received	% Points Received	Grade
337-375	90-100	4.0
318-336	85-89.99	3.5
300-317	80-84.99	3.0
281-299	75-79.99	2.5
262-280	70-74.99	2.0
243-261	65-69.99	1.5
225-242	60-64.99	1.0
<224	<59.99	0.0

1) Pre-class preparation (~51%): 16 assignments, 12 points each, 192 total points
For each scientific paper assigned for class discussion, please read the assigned paper and complete the **Figure Facts** worksheet *prior* to the start of class. The **Figure Facts** should be submitted via D2L prior to start of class. The **Figure Facts** will be used to facilitate the class discussion about the paper. Each day that an assignment is late will result in a deduction of 10% from the grade. **Students presenting papers do not need to submit Figure Facts regarding their paper.**

2) In class participation (~17%): 21 sessions, 3 points each, 63 total points
You must come prepared for class. All students need to read the assigned articles and understand them so that you can participate in class discussions. Completing the **Figure Facts** worksheet will help you to think about what you have read, prompt you to do some additional relevant searches on your own and integrate current information with prior information/conclusions that we have discussed in prior classes.

Additional questions to think about for class discussion:
1) What was the most significant finding of the study?
2) Do you believe their conclusion is supported by the results?
3) What else would you like to see in the paper?
4) What are two questions you have about the paper?

3) Paper Presentations (~32%): 2 presentations worth, 60 points each, 120 total points
There will be 12 research papers that we discuss which chosen by student pairs that will lead the discussion that day (see Class Calendar below). Group presentations should follow the model we use in the initial research paper presentations (weeks 1-7). Groups will choose a primary research paper that is in the area of neurophysiology of Autism. *This paper should **NOT** be a review article.* Groups should have their suggested research paper sent to me for approval at least 2 weeks in advance of presentation.
The research paper presentation is an oral slide presentation and class discussion based on your research paper. The presentation should follow the examples I have given in the first half of the semester. The presentation should consist of: 1) background leading to the current study, 2) brief discussion of the methods necessary to understand the study, 3) lengthy discussion of the results with emphases on the figures, 4) conclusions of the paper, and 5) strengths and weaknesses of the study and any remaining questions raised by the study.
You will be evaluated on your **preparation** (quality of slide show and knowledge of the content), **oral presentation** (logic, delivery, and timing), **discussion period** (asking and answering questions), and **clarity** of presentation and discussion.

Reading Materials
Most reading materials will consist of peer-reviewed research papers or other supplements (to be posted on D2L). There is no official textbook for this course.
For pertinent background information to facilitate understanding of the research papers, the following textbook is recommended:
Neuroscience: Exploring the Brain by Mark Bear, Barry Connors, and Michael Paradiso.
This text is available as an electronic resource from MSU Library with the following link:

TENTATIVE CLASS CALENDAR
Any changes to the calendar will be announced ahead of time and post to D2L.

Week	Date	Assigned Readings	Activities	Assignment Due
1	Mon. 8/25	Syllabus	Discuss Course Structure & Expectations	
	Wed. 8/27	Gadad et. al. (2013) *Neuropathology and Animal Models of Autism: Genetic and Environmental Factors*	Discuss Paper	
2	Mon. 9/1	**No Class**		
	Wed. 9/3	*Optional Reading* Chapt. 2: The Prototypical Neuron Classifying Neurons	Lecture: Neuroanatomy Primer	
3	Mon. 9/8	FXS: anatomical changes Irwin et.al. (2002) *Dendritic Spine and Dendritic field Characteristics of layer V Pyramidal Neurons in the Visual Cortex of Fragile-X Knockout Mice*	Discuss paper	Figure Facts
	Wed. 9/10	*Optional Reading* Chapt. 3: The Ionic Basis of the Resting Membrane Potential Chapt. 4: Action Potentials, Axons, and Dendrites	Lecture: Intrinsic Properties of Neurons Primer	
4	Mon. 9/15	FXS: intrinsic property alterations Luque et.al. (2017) *Excitability is Increased in Hippocampal CA1 Pyramidal Cells of Fmr1 Knockout Mice*	Discuss paper	Figure Facts
	Wed. 9/17	*Optional Reading* Chapt. 5: Synaptic Transmission	Lecture: Synaptic Transmission Primer	
5	Mon. 9/22	FXS: Synaptic transmission Gibson et.al. (2008) *Imbalance of Neocortical Excitation and Inhibition and Altered UP States Reflect*	Discuss paper	Figure Facts

		Network Hyperexcitability in the Mouse Model of Fragile X Syndrome		
	Wed. 9/24	*Optional Reading* Chapt. 25: Memory Acquisition	Lecture: Synaptic Plasticity Primer	
6	**Mon. 9/29**	FXS: mGluR plasticity Huber et.al. (2002) *Altered synaptic plasticity in a mouse model of fragile X mental retardation*	Discuss paper	Figure Facts
	Wed. 10/1	Wilson et.al. (2007) *Absence of metabotropic glutamate receptor-mediated plasticity in the neocortex of fragile X mice*	Discuss paper	Figure Facts
7	**Mon. 10/6**	*Optional Reading* TBD	Lecture: Behavioral Measures in Autism	
	Wed. 10/8	FXS: Behavioral alterations TBD	Discuss paper	Figure Facts
8	**Mon. 10/13**	**No Class**		
	Wed. 10/15	Research Paper TBD	Group 1 Presentation	Figure Facts
9	**Mon. 10/20**	**No Class**		
	Wed. 10/22	Research Paper TBD	Group 2 Presentation	Figure Facts
10	**Mon. 10/27**	Research Paper TBD	Group 3 Presentation	Figure Facts
	Wed. 10/29	Research Paper TBD	Group 4 Presentation	Figure Facts
11	**Mon. 11/3**	Research Paper TBD	Group 5 Presentation	Figure Facts
	Wed. 11/5	Research Paper TBD	Group 6 Presentation	Figure Facts
12	**Mon. 11/10**	Fragile X Syndrome wrap-up/	Class Discussion	

		Introduction to New Model		
	Wed. 11/12	Research Paper TBD	Group 1 Presentation	Figure Facts
13	**Mon. 11/17**	Research Paper TBD	Group 2 Presentation	Figure Facts
	Wed. 11/19	Research Paper TBD	Group 3 Presentation	Figure Facts
14	**Mon. 11/24**	Research Paper TBD	Group 4 Presentation	Figure Facts
	Wed. 11/26	Research Paper TBD	Group 5 Presentation	Figure Facts
15	**Mon. 12/1**	Research Paper TBD	Group 6 Presentation	Figure Facts
	Wed. 12/3	-Pulling it all together-	Class Discussion	

Accommodations for Students with Disabilities:

Michigan State University is committed to providing equal opportunity for participation in all programs, services, and activities. 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 rcpd.msu.edu. Once your eligibility for accommodations has been determined, you will be issued a verified individual services accommodation form ("Accommodation Letter"). *Please present this form to me at the start of the term.* Requests received after this date will be honored whenever possible.

Steps for using the Figure Facts Worksheet (FFW):

1. What is the experimental question being asked or tested (*a single sentence*).

2. Short paragraph summarizing the study. Be concise and limit to 4-6 sentences.

3. Adjust the FFW as necessary. Specifically, add rows to match the number of figures in the paper. If a figure has multiple panels (ex. 1A, 1B, 1C), add the appropriate labels (ex. A, B, and C) to the "panel" column of the FFW.

4. Examine Figure 1. Get as much information as you can out of the figure and legend. Then, read the corresponding text for Figure 1. Complete the FFW for Figure 1. Use phrases and abbreviations. Use your own words. You may prefer bulleted points. Do NOT copy or paraphrase from the text or legend.

5. Repeat the process for all of the figures. Always look at the figure first and then the text. Always put the descriptions in your own words.

6. Develop **3 questions** related to the research article that can be asked during class to stimulate discussion. These can be questions related to things not understood when reading the paper.

Figure Facts Worksheet Example

Author & year:			
Experimental question being asked/addressed: - *Single sentence on what is being tested in study*			

Brief Summary of Study:
 	
  - *Single paragraph*
  - *4-6 sentences*			

	Panel	**Technique Used:**	**These data show:**
Figure 1			
Figure X			
3 questions pertaining to the paper	1. 2. 3.		