BIPN 194/BGGN284 Advanced Topics in Modern Biology: Glia and Disease
Spring 2021

Professor: Stacey M. Glasgow
Email: sglasgow@ucsd.edu
Class Meeting Time: Tuesdays 10am-11:20am
Location: Virtual-Zoom. The link for each class is on the course Canvas page (canvas.ucsd.edu).
Meeting ID: 963 1432 4449

Virtual Office Hours: By appointment only and required for the presenting group of the week. The group should arrange to meet with me on Thursday or Friday before your Tuesday presentation. Members of the presenting group must coordinate their schedules and then a representative should coordinate with me to find a time we can meet. I highly encourage you to share your contact information (email and phone numbers) with your group to facilitate scheduling. The meeting is intended to provide feedback on presentation materials and answer any questions about the paper to help in presentation preparation. Groups should come prepared having read the materials, have started to prepare a presentation, and know what they need help with. The best way to contact me is by e-mail to schedule your personal meetings. Please include "BIPN194 or BGGN248" in the subject line of emails concerning this class.

Course Website: There will be a Canvas site for the course (canvas.ucsd.edu). Announcements, updates, postings, required reading material and grades will be communicated on the course website using Canvas.

Prerequisites: This upper-division course is intended for junior/senior undergraduate students and Master's students. Prior to enrollment, BIPN 100 (Physiology I) or BIPN 140 (Cellular Neurobiology) must be completed.

Course Format: The first lecture will be instructor led. All other course meetings will be student-led discussions of primary research literature. All meetings will be very interactive, with all students expected to participate in discussions and presentation. **Expect to spend at least 4 hours/week on the assigned reading and summary preparation, and 10+ hours the week you are presenting a paper.**

Syllabus: (subject to change)

class	Date	Lecture Topic	Group #
1	**March 30**	**How to read a research paper and introduction to Glia**	
2	**April 6**	Astrocytes and memory	**1**
3	**April 13**	Myelin and age-related memory	**2**
4	**April 20**	Oligodendrocytes in WMI	**3**
5	**April 27**	Astrocytes in Depression	**4**
6	**May 4**	Astrocytes in Huntington's disease	**5**
7	**May 11**	Glia in tau pathology	**6**
8	**May 18**	Microglia in neurodegeneration	**7**
9	**May 25**	Reprogramming cells as a treatment for disease	**8**
10	**June 1**	**No class work on Final assignment due June 4th**	

Course Materials: No textbook is required. PDFs of the required readings will be posted on the course Canvas website. In addition, other papers will be recommended to give additional background on concepts covered in the required reading. Students may need to seek out other

resources if further background information is needed to help them understand the required readings. These additional readings can be found by searching PubMed (https://www.ncbi.nlm.nih.gov/pubmed/). Be sure to be logged into the UCSD server while searching PubMed in order to have access to most journal subscriptions.

Grading and Evaluations:

Attendance	8%	40pts (4ea)
In class participation (discussion and 8 written evaluations)	12%	60pts (5/2.5)
Primary research article summary (8 total)	30%	150pts (18.75 ea)
Group presentation	30%	150pts
Final assignment: review article	20%	100pts
Total	100%	500pts

Grading Scale: The class grades will not be curved.

%	Grade	%	Grade	%	Grade	%	Grade
>97	A+	87-89	B+	77-79	C+	60-69	D
93-97	A	83-86	B	73-76	C	0-59	F
90-92	A-	80-82	B-	70-72	C-		

Summary of due dates: Please upload your documents to Canvas.

Weekly Article Summary:	Due on **Mondays** by 11:59pm. (first one due April 5, 2021)
Weekly Presentation Evaluation:	Due on **Mondays** following the Tuesday presentation by 11:59pm. (first one due April 12, 2021)
Final writing assignment:	Due **Friday, June 4, 2021** by 11:59pm.
Group presentation:	Please submit one copy per group by 9am the day of your presentation

Attendance and Participation: Attendance is mandatory. Students will be expected to participate in the discussion of assigned papers during class and to ask questions during the presentation. Unexcused absences or arriving late will impact your participation grade. If students are not participating on their own, **the instructor will randomly call on individuals to respond to questions and comments.**

Weekly written summary: Written summaries in Word or PDF format are due by **11:59pm the Monday before class**. *Late assignments will not be accepted*. Students are required to read the assigned paper and write a one-page summary (maximum) on the assigned article, **except** on the day you are presenting. Please use 1" margin, single space, Arial/Times and font size 11 for the writing assignment. Your summary should address the following points:

- What is the overall question being asked?
- Why is this question important?
- What were the specific hypotheses and how did the authors test them?
- What conclusions did the authors arrive at from their experiments? (be sure to state the experiments)
- Did their results address their question?
- What is the next research question that follows from the author's findings in the paper (in your opinion)?
- What are the implications of the paper in glia biology field?

- What are three questions you have about the paper? These can be about a technique being used, why a certain experiment was done, confusion on interpreting data etc. Provide these in bullet points at the end of the document.

Presentation:
Groups will be determined on the first day of class. Each group will have 40 minutes for the presentation and 15-20 minutes for questions and discussion. Each group member will have equal presentation time and should be prepared to answer questions and engage the class in discussions. Presentations will be graded using a rubric. Please see the end of the syllabus for a summary of the rubric.

Group meetings to prepare for presentations: Each group of presenters needs to exchange contact information (phone numbers and email information) and arrange meetings to discuss the overall presentation and how the presentation will be divided among group members. These meetings are essential. I will also meet with the entire group Thursday or Friday to discuss the presentation and help with questions. This is a mandatory meeting that will help with your presentation. Each group member should be prepared for this meeting and have read the paper and prepared ~4-5 slides. After our meeting, the group may wish to meet again to tweak the presentation. Note that while the presentation should be cohesive, each group member will receive an individual grade that is reflective of their part in the project. Each group member should be very familiar with the paper and should be able to answer questions and lead the discussion if needed.

Presentation details: The group's entire presentation should be in one presentation document. Please use PowerPoint or Keynote file formats. Please make sure that all group members and I have a copy of the presentation in case there are technical issues. Your presentation should be uploaded to Canvas by 8am the day of the presentation. The presenting group should log on to Zoom promptly to ensure that the presentation and screen sharing is working properly.

Presentation Components:

Background/Introduction: In this part of the presentation you need to describe the biological question that the authors were addressing. You will need to provide the necessary background for the paper so that your audience can understand the importance of the authors' question.

Results: Here you need to logically present the experimental results. How did the authors address their question? Explain the tools and methodology that the authors use to address the question. What are the specific conclusions from their results? I recommend that the figures in the paper are split up between group members. Most figures in papers have multiple panels. Many papers have supplementary figures that support the main figure and these are required reading for the paper. You will need to decide which of the panels in a figure to present and if any supplemental figures should be presented. For each figure you should explain what is being tested and why. Most figures have one or two main conclusions, be sure you are clear about these and can explain these to the class. Experiments require proper controls, also make sure you understand why the given controls were used. Discuss reservations, if any, about the data.

Conclusions and implications: Overall what are the findings of this paper? Does the data support the conclusions? What are the next steps that follow from these experiments? How do the data impact the field?

Non-presenters: You are expected to read every paper before coming to class and be prepared to discuss and ask questions. During class you are expected to participate in discussion and ask questions. If students are not participating on their own, the instructor will randomly call on individuals to respond to questions and comments. Please have your camera on so that the presenters can interact with you and vice versa. If this is not possible, please email me to explain. **At the end of each class you will write a short (1-2 paragraphs),** constructive evaluation of the presentation, except on the day you are presenting. These evaluations need to address how the presentation helped clarify the paper and your questions, what aspects of the presentation were particularly good, and how the presentation could have been improved. These evaluations need to be constructive and are an important part of your participation grade. Your comments may be shared with the presenters. **Evaluations are due on the Monday by 11:59pm** the week following the presentation and are to be uploaded on Canvas in a Word Doc file.

Final writing assignment: Your final writing assignment will be due by **11:59pm** on Friday, **June 4th**.
Find a paper that you would recommend for the class next year, which will have the same emphasis. Write a two-page, single spaced paper (references should be on a separate page) on why you chose this paper. Begin by stating the question that the authors are addressing. Include background on what was known regarding this question prior to this paper. Describe the experiments that were done in order that they occur in the paper. Include the method used for each experiment and the conclusion from that particular experiment. Elaborate on the overall conclusion(s) of the paper and how it influenced, or will influence, future studies. Finally, as a separate section, write a paragraph on the paper you most enjoyed this quarter and why. Please upload the Word docs on Canvas. In addition to your paper, upload the PDF (and supplemental material) of the paper you are evaluating.

BGGN284 students: The course requirements are the same for you with the exception that your final report is three pages, with more details on significance and future directions. The background section should be longer and the section on potential implications/significance should be expanded. This should include a discussion of follow up experiments.

Technology Etiquette: Please refrain from engaging in personal internet or other communications during class and ensure that your cell phones and tablets are turned off. This is a participation-based course so please have your camera on whenever possible.

Academic Integrity: Integrity of scholarship and learning is fundamental to creating our classroom community and the academic community at large. The University expects that both students and faculty will honor this principle and in so doing protect the validity of University intellectual work. Therefore, Academic dishonesty will not be tolerated. This means that all academic work you submit for this course should be **your own new original work.** To hold everyone accountable for their actions, any serious suspected instances of a breach of academic integrity will be reported to the Academic Integrity Office for review. For more information on academic integrity, please visit https://students.ucsd.edu/academics/academic-integrity/index.html.

Discussion Paper Summary

Week 1	How to read a paper, course overview, and introduction to glia
Week 2	**Discussion paper**: Astrocytes and memory Kol et al. Astrocytes contribute to remote memory formation by modulating hippocampal–cortical communication during learning (2020) Nature Neuroscience. Vol 23. P 1229-1239 **Background reading**: 1. Nagai et al. Behaviorally consequential astrocytic regulation of neural circuits. Neuron 109 (4) p 576-596. 2. Adamsky et al. Astrocytes in Memory Function: Pioneering Findings and Future Directions (2018) Neuroscience Vol 370 p 14-26 3. Goshen et. The optogenetic revolution in memory research (2014) Trends in Neuroscience Vol 37 (9) p 511-522 4. Zhu and Roth. DREADD: A chemogenetic GPCR Signaling Platform (2014) Inter. J. of Neuropsychopharmacology Doi:10.1093/ijnp/pyu007 pp.1-6. (also background for week 9)
Week 3	**Discussion paper**: Myelin and age-related memory Wang et al. Myelin degeneration and diminished myelin renewal contribute to age-related deficits in memory. (2020) Nature Neuroscience. Vol23. P481-486. **Background reading**: 1. Pan et al. Preservation of a remote fear memory requires new myelin formation. (2020) Nature Neuroscience. Vol23. P487-499. 2. Bacmeister et al. Motor learning promotes remyelination via new and conserved oligodendrocytes. (2020) Nature Neuroscience. Vol23. P819-831. 3. Franklin and ffrench-Constant. Regenerating CNS myelin-from mechanisms to experimental medicines. (2017) Nature Reviews Neuroscience. Vol 18. P753-769.
Week 4	**Discussion Paper:** Oligodendrocytes in white matter injury Chavali et al. Wnt-Dependent Oligodendroglial-Endothelial Interactions Regulate White Matter Vascularization and Attenuate Injury. (2020) Neuron. 108(6) 1130-1145. **Background reading**: 1. Paredes et al. Neurovascular communication during CNS development (2018) Developmental Cell. (45) p10-32. 2. Tilborg et al. Origin and dynamics of oligodendrocytes in developing brain: Implications for perinatal white matter injury. (2017) Glia; 66:221-238. 3. Silbereis et al. Towards improved animal models of neonatal white matter injury associated with cerebral palsy. (2010). Disease Models and Mechanisms, 3, 678-688.
Week 5	**Discussion Paper**: Astrocytes in Depression Cai et al. Astroglial Kir4.1 in the lateral habenula drives neuronal bursts in depression. (2018) Nature. Vol 554p 323-342 **Background reading**:

	1. Planchez et al. Animal models of major depression: drawbacks and challenges. (2019) Journal of Neural Transmission (2019) 126:1383-1408. 2. Gururajan et al. The future of rodent models in depression research. Nature Reviews Neuroscience (2019) Vol 20. p686-701. 3. Sild et al. Major depressive disorder and anxiety disorders from the glial perspective: etiological mechanisms, intervention and monitoring. Neuroscience and Biobehavioral Reviews. 83(2017) 474-488. 4. Wang et al. As astroglial basis of major depressive disorder? An overview. Glia (2017); 65:1227-1250.
Week 6	**Discussion paper:** Astrocytes in Huntington's disease Yu et al. Context-specific striatal astrocyte molecular responses are phenotypically exploitable. (2020). Neuron 108, 1146-1162. **Background reading**: 1. Khakh et al. Unravelling and exploiting astrocyte dysfunction in Huntington's Disease. (2017) Trends in Neurosciences. Vol 40 (7) p 422-437. 2. Wilson et al. The contribution of glial cells to Huntington's disease pathogenesis (2020) Neurobiology of Disease. 143. 104963 3. Diaz-Castro et al. Astrocyte molecular signatures in Huntington's disease (2019). Sci. Transl. Med. Vol 11.
Week 7	**Discussion paper**: Glia in tau pathology Bussian et al., Clearance of senescent glial cells prevents tau-dependent pathology and cognitive decline. (2018). Nature 562:578-582. **Background reading:** 1. Sofroniew and Vinters, Astrocytes: biology and pathology. (2010) Acta Neuropathol. 119:7-35. 2. Cohen and Torres, Astrocyte senescence: Evidence and significance. (2019) Aging Cell. e12937.7 3. Pajvani et al, Fat apoptosis through targeted activation of caspase 8: a new mouse model of inducible and reversible lipoatrophy. (2005) Nature Med 11:797-803.
Week 8	**Discussion paper**: Microglia in neurodegenerative diseases Joshi et al. Fragmented mitochondria released from microglia trigger A1 astrocytic response and propagate inflammatory neurodegeneration (2019) Nature Neuroscience. Vol 22. P1635-1648. **Background reading**: 1. Hemonnot et al. Microglia in Alzheimer Disease: Well-Known Targets and New Opportunities. (2019) Front Aging Neurosci. 11:233. 2. Kam et al. Microglia and astrocyte dysfunction in parkinson's disease (2020) Neurobiol Dis. Oct; 144:105028 3. Leng et al. Neuroinflammation and microglial activation in Alzheimer disease: where do we go from here? (2021) Nat Rev Neurol. Dec 14 4. Greenhalgh et al. Immune cell regulation of glia during CNS injury and disease. (2020) Nature Review Neuroscience. Vol 21. P139-152.
Week 9	**Discussion paper:** Reprogramming cells as a treatment for disease Qian et al. Reversing a model of Parkinson's Disease with in situ converted nigral neurons (2020) Nature. Vol 582. P 550-556.

	Background reading: 1. Barker, Götz, Parmar. New approaches for brain repair-from rescue to reprogramming (2018) Nature 557: 329-334. 2. Zhu and Roth. DREADD: A chemogenetic GPCR Signaling Platform (2014) Inter. J. of Neuropsychopharmacology Doi:10.1093/ijnp/pyu007 pp.1-6. 3. Zhou et al. Glia-to Neuron Conversion by CRISPR-CasRX Alleviates Symptoms of Neurological Disease in Mice (2020) Cell 181, 590-603.
Week 10	No class work on Final writing assignment-due June 4th

Rubric Summary

Talks will be scored on the following sections: Introduction, Data, and Conclusion.

Introduction	**Criteria**
Broad Introduction	All information presented is required for listener's understanding of the research
Main research question	Clearly explained
Background	Clearly explains what others have done to set the stage for their research
Significance	Makes clear what motivates them to explore this question and potential

Data	**Criteria**
Logical Flow	Logically follows the data and each interpretation is clearly justified
Methods	Clearly explains methods and how experiments allow an answer to questions
Results	Presents necessary data
Clarity	Clearly explains all results and figures

Conclusion/ Future	**Criteria**
Inferences	Explains what the work infers/means, competing explanations well addressed
Impact of work for field	Clearly explained. Includes discussion of strength and weakness of the paper.
Future research directions	Suggests what should be done next or points out new questions raised by work