

Chemistry 676: **Neurochemistry**

Instructor:	Dr. Kelly Drew
Office/office hrs:	104 Irving I, MWF 10-12:00
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Lecture:	MWF 3:30-4:30, Reichardt Room 165 (coincides with lectures for chem. 474)
Homework:	<p>Assignments posted on course schedule are due at the beginning of the next class unless otherwise indicated. Homework turned in after the deadline will not be accepted unless arrangements are made before the homework is late.</p> <p>See schedule for when homework is due. Permission to hand-in HW via e-mail may be arranged in advance and will not be accepted without prior arrangements.</p> <p>Homework and reading assignments (other than from the text book) will be posted on blackboard</p>
Home-work make-up:	Attend neuroscience seminars. A write-up about a seminar will substitute for one HW assignment (peer-reviews of selected articles). Up to 3 HW assignments can be substituted by a seminar write-up.
Course Description:	<p>This course is designed to teach graduate students critical thinking skills and experimental design in basic and applied aspects of interneuronal signaling. Lectures will be based on chapters from assigned text as well as current literature relevant to these topics. Critical thinking skills and experimental design will be taught through discussion of original research papers that relate to the lecture topic.</p> <p>Prerequisite: BIOL B417, CHEM F470 or equivalent instruction in basic cell and molecular biology and nervous system function.</p>
Course Goals:	Students should learn to identify significant research questions related to inter-neuronal communication and learn to perform at the level of an independent investigator in critical analysis of peer-reviewed literature in neurochemistry and in written and oral communication of the strengths and weaknesses of hypothesis driven research in the area of neurochemistry.
Student Learning Outcomes	<p>Written homework, group project and final project assignments will be used to assess</p> <ul style="list-style-type: none"> • Familiarity with current literature related to functions and diseases associated with neurotransmitter/neuromodulator • Ability to critically evaluate published papers and prepare written comments addressing limitations to experimental design, experimental approach and interpretation of results. • Ability to suggest means to improve a manuscript that are sufficient and appropriate to submit as comments to authors when invited to peer review a manuscript. • Ability to formulate a hypothesis about structure activity relationships between endogenous neurotransmitter, agonists and antagonists. <p>Exams and quizzes will be used to assess understanding of</p> <ul style="list-style-type: none"> • Detailed mechanisms of neurochemical transmission and the ability to design experiments to test hypotheses regarding these mechanisms and the physiological functions related to these processes. <ul style="list-style-type: none"> ➤ Synthesis ➤ Storage ➤ Regulated release ➤ Receptor subtypes and effectors ➤ Termination of effect ➤ Basic neurochemical anatomy of transmitter systems <p>(Homework) Students will be guided by the instructor through critical evaluation of peer-reviewed papers to achieve the following objectives:</p> <ul style="list-style-type: none"> • Apply knowledge of neurochemical transmission to interpretation of peer reviewed papers. • Apply knowledge of neurochemistry and experimental design to critically evaluate original research papers and literature reviews. • Develop critical thinking skills and oral and written communication styles to defend one's own interpretation of the data. • Know how to prepare comments for authors to be submitted in response to an invitation by a journal editor to review a manuscript. <p>(Group project assignment) Students will gain practice with oral presentations of original research</p>

Comment [KD1]: Dear Professor Drew, I serve on the Graduate Academic Advisory Committee and we are reviewing the syllabus for 474/674. We have some requests for a revised syllabus:

- 1) The committee raised concerns over making a bigger distinction between course goals and student learning outcomes.
- 2) Additionally, the committee requested more clarification in the instructional methods section.
- 3) We also thought that "late homework" could be more explicitly defined. For example, is homework late at the end of the class time or the end of the day or week, etc.?
- 4) On a slightly different note, the committee has been looking for extra course readings for stacked courses and an explicit extra work description and grading detail for the 600 level students.
- 5) Finally, the # for disabilities services has changed to 474-5655

The revised syllabus should go to Jayne Harvie. Thanks and please contact me with any questions. Best, Vince

Comment [KD2]: Learning outcomes are significantly different from chem. 474. And more weight is given to critical thinking assignments.

	<p>towards the following objectives:</p> <ul style="list-style-type: none"> • Become familiar with original literature related to a topic of interest in neurochemistry • Develop effective techniques for oral presentation of original research • Develop effective techniques for optimizing positive group dynamics and productivity as a team player and as a group leader.
Instructional Methods	Instructional methods will consist of about 40% traditional lecture on material from the text book and 60% discussion and interpretation of peer-reviewed literature.
Text:	Basic Neurochemistry: Molecular, Cellular and Medical Aspects by George J. Siegel (Editor), 8th edition.
Other Required Reading:	Original research and review articles as assigned
Exams and Grading:	Exams and quizzes will typically consist of a subset of review questions provided in class. There will be no make-up exams or quizzes except under extreme circumstances. If such circumstances arise notify Dr. Drew (474-7190) before the scheduled time of the exam. If a make-up exam is approved it must be completed within 1 week of the original exam. Any student suspected by the instructor of cheating on a quiz or exam may be assigned a course grade of F; course drop forms will not be signed in these cases. The letter grades assigned will be based on the overall performance of the class but will usually be in the range 90-100=A, 80-90=B, 70-79=C, 60-69=D, and below 60 is failing.
Drop a quiz option	Students may attend up to 3 online seminars at http://neuroseries.info.nih.gov/ and write a critical review of each presentation addressing areas for improvement in slide formatting/graphics, development of background and significance appropriate for the audience, communication of a hypothesis and overall rigor of experimental design, clarity of results, soundness of interpretation and discussion of caveats that limit interpretation or application of research findings. These 3 critical reviews may substitute for one quiz grade.
Final Project	A final project will consist of one of the following: Prepare a 5 page research proposal for hypothesis driven research that may be related to but does not duplicate the student's thesis research project; or Write a manuscript based on results and methods provided by the instructor. Final projects will be evaluated on accurate development of background knowledge and statement of a testable hypothesis, compelling discussion of significance appropriate for a particular funding agency or audience, overall rigor of experimental design or discussion of caveats that limit interpretation or application of research findings. Discussion of alternative approaches that could diminish limitations.
Disabilities	Students with a physical or learning disability are required to identify themselves to Mary Matthews (474-5655) in the Disability Services office, located in the Center for Health and Counseling. The student must provide documentation of the disability. Disability Services will then notify Prof. Drew of special arrangements for taking tests, working homework assignments, and doing lab work.

Assignments for Chemistry 675

2 Exams (50 pts ea.)	100 pts
3 Quizzes or 2 quizzes + optional (25 pts ea.)	75 pts
Presentations of original research papers	100 pts
Comprehensive final exam	100 pts
Homework (10 pts ea.) + 10peer review	~300 pts
Final Project (100 pts)	<u>100 pts</u>

Course Schedule

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Date		Lecture #		Topic and Reading Assignments (Reading assignments will usually be discussed in the next class)	Hand-outs and Homework (HW is due at the beginning of the next class period after it is assigned and listed below)
Jan	20	F	1	<p>Introduction to chemistry and the brain http://www.youtube.com/watch?v=bqkUbiUkR5k&feature=relmfu Read http://www.nature.com/nature/journal/v467/n7319/full/nature09510.html Review Chapter "Synaptic transmission and cellular signaling"</p>	<p>HW: Write a review of http://www.nature.com/nature/journal/v467/n7319/full/nature09510.html 1. Briefly summarize the findings 2. Note what aspect of the report makes you trust the results or conclusions. 3. Note what aspect of the report makes you doubt the results or conclusions.</p>
	23	M	2	<p>Techniques Optogenetics http://www.youtube.com/watch?v=I64X7vHSHOE Immunohistochemistry http://en.wikipedia.org/wiki/Immunohistochemistry</p>	<p>HW: 1. Explore professional access to topics in neuroscience and neurochemistry (Handout) 2. Short essay: Is science truth? Recommended: Lies, Damned Lies, and Medical Science http://m.theatlantic.com/magazine/archive/2010/11/lies-damned-lies-and-medical-science/8269/</p>
	25	W	3	<p>Serotonin Article 1: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3071248/?tool=pubmed</p>	<p>HW: Description of Article 1 (take home message from each figure and 3 questions to address when reading the text)</p>
	27	F	4	<p>Discussion of Article 1 How to write a critical review of an original research paper</p>	<p>Form for Peer-Review of Manuscript HW: Critical review of Article 1</p>
Jan	30	M	5	<p>Serotonin continued Article 2: http://www.sciencemag.org/content/333/6042/637.full FYI: http://www.sciencemag.org/content/suppl/2011/07/27/333.6042.637.DC1/Ray.SOM.pdf</p>	<p>HW: Description of Article 2 (take home message from each figure and 3 questions to address when reading the text)</p>
Feb	1	W	6	<p>Discussion of Article 2 Serotonin continued Read: http://en.wikipedia.org/wiki/Receptor_theory</p>	<p>HW: Critical review of Article 2</p>
	3	F	7	<p>Basic Pharmacology Review: http://pdsp.med.unc.edu/kidb.php</p>	<p>HW: Hand-in 3 original research papers to consider for group presentation. Indicate impact factor of journal for each paper.</p>
	6	M	8	<p>Basic Pharmacology continued Read: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2784146/pdf/nihms146111.pdf http://onlinelibrary.wiley.com/doi/10.1111/j.1749-6632.1990.tb16915.x/pdf</p>	

	8	W		<p>Quiz 1 (take home) and meet with groups to select a paper for projects and prepare a timeline for preparing for presentation on 2/17</p> <p>Read: http://www.nature.com/nature/journal/v447/n7143/full/447368a.html</p>	<p>Group meeting/select paper. Title, time line and copy of paper due by end of class.</p> <p>Take home quiz due Friday</p>
	10	F	9	Catecholamines	
	13	M	10	Read chapter on catecholamines	
				No class	
	15	W	11	No class	
	17	F	12	Group Presentations (1)	
	20	M	13	<p>Using PET to image neurochemistry of the brain http://www.dnalc.org/view/1152-Positron-Emission-Tomography-PET-.html</p> <p>Catecholamines continued</p> <p>Article 3: http://jpet.aspetjournals.org/content/early/2012/01/03/jpet.111.189076.long or Salimpoor et al., 2011 http://www.nature.com/neuro/journal/v14/n2/full/nn.2726.html</p>	<p>HW: Description of Article 3 (take home message from each figure and 3 questions to address when reading the text)</p>
	22	W	14	Discussion of Article 3	HW: Critical review of Article 3
	24	F	15	CA continued or Small group discussion of review questions to review for Exam I ; Group meeting and select paper	HW: Hand-in 3 original research papers to consider for group presentation. Indicate impact factor of journal for each paper.
	27	M		Exam I (lectures 1-15)	
	29	W	16	<p>Histamine</p> <p>Read chapter on Histamine</p> <p>Article 4: Espana and Scammel, 2011 http://www.ncbi.nlm.nih.gov/pubmed/21731134</p>	HW: Description of Article 4 (take home message from each figure and 3 questions to address when reading the text)
Mar	2	F	17	Discuss Article 4	HW: Critical Review of Article 4
	5	M	18	<p>Glutamate</p> <p>Read chapter on Glutamate</p>	
	7	W	19	<p>Glutamate continued</p> <p>Article 5: Dash et al., 2009 http://www.jneurosci.org/content/29/3/620.full or http://www.pnas.org/content/99/22/14488.full.pdf+html?with-dis=yes or State-dependent changes in astrocyte regulation of extrasynaptic NMDA receptor signalling in neurosecretory neurons <i>J Physiol</i> August 15, 2011 589 (16) 3929-3941 (see link in course documents on black board)</p>	

	9	F		<p>Glutamate finale Article 5 Scannevin and Huganir, 2000 http://www.nature.com/nrn/journal/v1/n2/full/nrn1100_133a.html or MacGillavry et al., 2011 http://www.sciencedirect.com/science/article/pii/S1044743111001965</p>	HW: Description of Article 5 (take home message from each figure and 3 questions to address when reading the text) NOTE that these are review papers
	12	M		Spring Break	
	14	W		Spring Break	
	16	F		Spring Break	
	19	M	20	Group Presentations (3)	
	21	W	21	Discussion of Article 5	HW: Critical Review of Article 5
	23	F	22	Glutamate finale (make up)	
	26	M		GABA and Glycine (Read Chapter)	
	28	W	24	GABA and Glycine continued	
	30	F		<p>Quiz 2 Article 6 http://ajpregu.physiology.org/content/300/2/R272.full.pdf+html</p>	HW: Description of Article 6 (take home message from each figure and 3 questions to address when reading the text)
April	2	M	25	Discussion of Article 6	HW: Critical Review of Article 6
	4	W	26	Purinergic Systems (read chapter)	
	6	F	27	Purinergic Systems	
	9	M	28	<p>Exam II Read Magistretti 2009 low cost travel in neurons http://www.sciencemag.org/content/325/5946/1349.full</p>	
	11	W	29	Energy Metabolism in the Brain (Read chapter)	
	13	F		<p>Hypoxic-Ischemic Brain Injury (read chapter) The Treasure Hunt Submitted by Shiree Heath, BS http://www.sfn.org/index.aspx?pagename=bavideo_winners How it feels to have a stroke (Jill Bolte Taylor) http://www.youtube.com/watch?v=UyyjU8fzEYU Campos et al., 2011 http://www.sciencedirect.com/science/article/pii/S1357272511003013</p>	
	16	M	30	Hypoxic-Ischemic Brain Injury continued	HW: Hand-in 3 original research papers to consider for group presentation. Indicate impact factor of journal for each paper.
	18	W	31	Peptides (Read chapter)	
	20	F	32	<p>Peptides continued Read Harwood 2011 http://www.sciencedirect.com/science/article/pii/S0028390811005144</p>	Group meeting/select paper. Title, time line and copy of paper due by end of class.

	23	M	33	Endocannabinoids	
	25	W	34	Endocannabinoids and energy regulation Gamage and Lichtman, 2012 http://onlinelibrary.wiley.com/doi/10.1002/pbc.23367/pdf	
	27	F	35	Gaseous neurotransmitters (NO, CO, H ₂ S) Kilduff et al., 2011 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3014438/?tool=pubmed	
	30	M	36	Group Presentations (3)	
		W	37	Quiz 3	
		F	38	Review	
May	7	3:15-5:15		Comprehensive Final Exam	
May	14			Optional final project	Final project is due, 10:00 am Grades must be posted by May 16, 12:00pm