Syllabus

Course title: Cellular Neuroscience & Disease

Course number: PCB 6849

Pre-requisites: PCB 3063 Genetics

Co-requisites: PCB 4023 Molecular and Cellular Biology

Instructor: Tanja A Godenschwege

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Office hours: Monday-Friday 9:15am-10:30am, SC209

Required textbook: From Neuron to Brain: A Cellular and Molecular Approach to the Function of the Nervous System, 2001, Fourth Edition by A. Robert Martin, Bruce G. Wallace, Paul A. Fuchs, and John G. Nicholls (Sinauer Associates ISBN-10: 0878934391 ISBN-13: 978-0878934393)

Supplementary texts: Recent research and review papers (see attached bibliography), which will be posted on blackboard or given as handouts**.**

Additional recommended textbook: Development of the Nervous System, Second Edition (2005) by Dan H. Sanes, Thomas A. Reh, William A. Harris, (Academic Press ISBN-10: 0126186219). Basic Neurochemistry- Molecular,Cellular and Medical Aspects, Seventh Edition (2005): (Academic Press, ISBN-10: 012088397X)

Course description, purpose and objectives: Cellular neuroscience with a focus on human neurological diseases and is a course that can be taken by graduate and undergraduate students. We will analyze different signaling pathways and connect developmental malfunctions in them to neurological disorders such as Alzheimer's,

Parkinson's, Down syndrome, and Lou Gehrig's disease. We will examine molecular mechanisms involved in axon/dendrite growth and guidance, synapse formation, regeneration and degeneration. Finally, we will also cover electrical properties of neurons and muscles and their connections to ailments like Myasthenia Gravis and Cardiac Arrhythmias. Lectures will provide the students with the basic knowledge about cellular and molecular Neuroscience and will help them critically read and analyze original research papers. Discussions, presentations and proposal writing are aimed to stimulate independent thinking about neuroscience research topics and enhance skills in scientific communication.

Method of instruction: Lectures, classroom exercises, single and group assignments, discussion, proposal writing and presentations.

Topics

1.) Introduction & Outline
2.) Neuron & Glia
3.) Neuron doctrine
4.) Ion channels and Action potential,
5.) Potassium channels and Long QT syndrome,
6.) Chemical Synaptic transmission,
7.) Acetylcholine receptors and Myasthenia gravis
8.) Motorneuron diseases
9.) Guidance of Axons & Dendrites
10.) Synapse formation & cell adhesion molecules
11) L1-CAM & CRASH syndrome
12) Review session
13.) Midterm Exam
14.) Test review
15.) Oxidative and Thermal Stress Part 1
16.) Oxidative and Thermal Stress Part 2
17.) Amyloid precursor protein & Alzheimer
18.) Alzheimer, Down syndrome and Patent
19.) Amyloid precursor protein & endogenous function
20.) Neurotransmitter & Dopamine

21.) Dopamine and Parkinson's

22.) CNS & PNS Regeneration

23.) Scientific communication & Proposal outline

24.) Autism & Example of Proposal

25.) Discussion Proposals Part 1

26.) Discussion Proposals Part 2

27.) Intro to Neuroscience Seminar Intro

28.) Proposal submission

29.) Review of Proposals

Assessment Procedures, Grading Criteria, Class Policies:

Dependent on the topics covered, may include attendance, midterm exam (class 13), homework assignments, presentations, class participation, and final proposal paper (class29).

Midterm Exam	20%
Attendance	10%
Assignments	20%
Participation	20%
Proposal Paper	30%

94-100%=A, 90-94%=A-, 86-90%=B+, 82-86%=B, 78-82%=B-, 74-78%=C+, 70-74%=C, 66-70%=C-, 62-66%=D+, 58-62%=D, 54-58%=D-, <54%=F; grades may be curved to adjust to 100%

It is the responsibility of the student to withdraw from this class, should that status be desired - the instructor cannot withdraw students from the course. The instructor will not give the grade of "I" in lieu of a grade of "D" or "F". The grade of "I" will be considered only in exceptional cases (such as serious illness) for students who are presently performing at a "C" or higher level in the course.

Attendance. Students are expected to attend all scheduled classes. If you miss a class you are responsible for ALL the material covered during that class, including

lecture material and rules and regulations about the course (such as penalties for late assignments, etc.).

Homework assignments and papers. The papers and homework are due on the dates assigned. These will be accepted up to 1 week late, but they will be penalized. None will be accepted over 1 week late.

Midterm Exam. The material covered will include the material covered in class and the assigned readings. All students are expected to take the exams on the days they are scheduled. Makeup exams will be given only in exceptional circumstances and only if the student contacts the instructor BEFORE the exam. Some of the material covered in the lectures (and included on the exams) is NOT in the required texts

Final Exam. The final exam will be a 5-page proposal paper excluding references and figures about a topic in cellular neurosciences. Due date will usually be first week of December or 2 weeks before the semester ends. Only in exceptional circumstances proposals after due dates will be accepted up to 3 days late, but they may be penalized.

Accommodations for students with disabilities. In compliance with the Americans with Disabilities Act (ADA), students who require special accommodations due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) located in Boca Raton - SU 133 (561-297-3880), in Davie - MOD I (954-236-1222), in Jupiter - SR 117 (561-799-8585), or at the Treasure Coast - CO 128 (772-873-3305), and follow all OSD procedures.

Honor Code. Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty, including cheating and plagiarism, is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see http://www.fau.edu/regulations/chapter4/4.001_Honor_Code.pdf.

Bibliography:

Course book:

From Neuron to Brain: A Cellular and Molecular Approach to the Function of the Nervous System, Fourth Edition by A. Robert Martin, Bruce G. Wallace, Paul A. Fuchs, and John G. Nicholls (Sinauer Associates (2001).ISBN-10: 0878934391 ISBN-13: 978-0878934393)

Chapters of other books used:

1.) Development of the Nervous System, by Dan H. Sanes, Thomas A. Reh, William A. Harris, Academic Press; 2 edition (June 10, 2005) ISBN-10: 0126186219

Chapter 5; Axon Guidance and growth

Chapter 6: Target Selection

Chapter 9: Refinement of synaptic connections

2.) Basic Neurochemistry- Molecular, Cellular and Medical Aspects, by George J. Siegel, R. Wayne Albers, Scott T. Brady, Donald L. Price, Publisher: Academic Press; 7 edition (October 31, 2005), ISBN-10: 012088397X

Chapter 2: Intracellular signaling.

Chapter6: Inherited and neurodegenerative diseases

Original and review papers used:

Aoto J, Chen L (2007) Bidirectional ephrin/Eph signaling in synaptic functions. Brain Res 1184:72-80.

Bharadwaj R, Kolodkin AL (2006) Descrambling Dscam diversity. Cell 125:421-424.

Bullock TH, Bennett MV, Johnston D, Josephson R, Marder E, Fields RD (2005) Neuroscience. The neuron doctrine, redux. Science 310:791-793.

Clark IE, Dodson MW, Jiang C, Cao JH, Huh JR, Seol JH, Yoo SJ, Hay BA, Guo M (2006) Drosophila pink1 is required for mitochondrial function and interacts genetically with parkin. Nature 441:1162-1166.

Craig AM, Graf ER, Linhoff MW (2006) How to build a central synapse: clues from cell culture. Trends Neurosci 29:8-20.

Dauer W, Przedborski S (2003) Parkinson's disease: mechanisms and models. Neuron 39:889-909.

Dawson-Scully K, Armstrong GA, Kent C, Robertson RM, Sokolowski MB (2007) Natural variation in the thermotolerance of neural function and behavior due to a cGMP-dependent protein kinase. PLoS ONE 2:e773.

Deng H, Dodson MW, Huang H, Guo M (2008) The Parkinson's disease genes pink1 and parkin promote mitochondrial fission and/or inhibit fusion in Drosophila. Proc Natl Acad Sci U S A 105:14503-14508.

Dickson BJ (2002) Molecular mechanisms of axon guidance. Science 298:1959-1964.

Dodson MW, Guo M (2007) Pink1, Parkin, DJ-1 and mitochondrial dysfunction in Parkinson's disease. Curr Opin Neurobiol 17:331-337.

Feany MB, Bender WW (2000) A Drosophila model of Parkinson's disease. Nature 404:394-398.

Godenschwege TA, Kristiansen LV, Uthaman SB, Hortsch M, Murphey RK (2006) A conserved role for Drosophila Neuroglian and human L1-CAM in central-synapse formation. Curr Biol 16:12-23.

Gong B, Cao Z, Zheng P, Vitolo OV, Liu S, Staniszewski A, Moolman D, Zhang H, Shelanski M, Arancio O (2006) Ubiquitin hydrolase Uch-L1 rescues beta-amyloid-induced decreases in synaptic function and contextual memory. Cell 126:775-788.
Goodman BE (2008) Channels active in the excitability of nerves and skeletal muscles across the neuromuscular junction: basic function and pathophysiology. Adv Physiol Educ 32:127-135.
Kim S, Chiba A (2004) Dendritic guidance. Trends Neurosci 27:194-202.
Kummer TT, Misgeld T, Sanes JR (2006) Assembly of the postsynaptic membrane at the neuromuscular junction: paradigm lost. Curr Opin Neurobiol 16:74-82.
Lin AC, Holt CE (2007) Local translation and directional steering in axons. Embo J 26:3729-3736.
Millard SS, Zipursky SL (2008) Dscam-mediated repulsion controls tiling and self-avoidance. Curr Opin Neurobiol 18:84-89.
Priller C, Bauer T, Mitteregger G, Krebs B, Kretzschmar HA, Herms J (2006) Synapse formation and function is modulated by the amyloid precursor protein. J Neurosci 26:7212-7221.
Sanguinetti MC, Tristani-Firouzi M (2006) hERG potassium channels and cardiac arrhythmia. Nature 440:463-469.
Stutzmann GE (2007) The pathogenesis of Alzheimers disease is it a lifelong "calciumopathy"? Neuroscientist 13:546-559.
Sulzer D (2007) Multiple hit hypotheses for dopamine neuron loss in Parkinson's disease. Trends Neurosci 30:244-250.
Tabuchi K, Blundell J, Etherton MR, Hammer RE, Liu X, Powell CM, Sudhof TC (2007) A neuroligin-3 mutation implicated in autism increases inhibitory synaptic transmission in mice. Science 318:71-76.
Takeichi M (2007) The cadherin superfamily in neuronal connections and interactions. Nat Rev Neurosci 8:11-20.
Tanzi RE, Bertram L (2005) Twenty years of the Alzheimer's disease amyloid hypothesis: a genetic perspective. Cell 120:545-555.
Waxman SG (2007) Channel, neuronal and clinical function in sodium channelopathies: from genotype to phenotype. Nat Neurosci 10:405-409.
Yiu G, He Z (2006) Glial inhibition of CNS axon regeneration. Nat Rev Neurosci 7:617-627.
Zhang Y, Yeh J, Richardson PM, Bo X (2008) Cell adhesion molecules of the immunoglobulin superfamily in axonal regeneration and neural repair. Restor Neurol Neurosci 26:81-96.
Ziv NE, Garner CC (2004) Cellular and molecular mechanisms of presynaptic assembly. Nat Rev Neurosci 5:385-399.
Zou Y, Lyuksyutova AI (2007) Morphogens as conserved axon guidance cues. Curr Opin Neurobiol 17:22-28.