

Syllabus

BIO 339

Molecular Development of the Nervous System

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Neurobiology and Behavior
College of Arts and Sciences
Stony Brook University

BIO 339**Molecular Development of the Nervous System
Course Syllabus****Spring '18**

Jan 23	Sirotkin	Course overview
Jan 25	Sirotkin	Model systems to study neurobiology
Jan 30	Sirotkin	Neural induction in flies, induction in vertebrates
Feb 1	Sirotkin	The Spemann organizer
Feb 6	Sirotkin	Molecular nature of the organizer
Feb 8	Sirotkin	BMP antagonists and neural induction
Feb 13	Sirotkin	Specification of Dopaminergic and Serotonergic neurons
Feb 15	Sirotkin	Dorsal ventral neural patterning
Feb 20	Sirotkin	Exam 1
Feb 22	Ge	Stem cells and Neural stem cells
Feb 27	Ge	Differentiation and control of cell fate
Mar 1	Ge	Genes, neurogenesis/migration
Mar 6	Ge	Defects in neurogenesis/migration
Mar 8	Levine	Cell death and neurotrophic hypothesis
Mar 20	Ge	Synapses: history and properties
Mar 22	Ge	Presynapse: Structure and Composition
Mar 27	Ge	Postsynaptic Structure and Composition
Mar 29	Ge	Synapse Formation, Maturation, Elimination, and Maintenance
April 3	Levine/Ge	Exam 2
April 5	Levine	Molecular biology of the cytoskeleton and axon growth
April 10	Levine	Axon guidance I: Basic mechanisms
April 12	Levine	Axon guidance II: Development of the spinal cord
April 17	Levine	Spinal cord injury and axon regeneration
April 19	Levine	Development of myelin: myelin diseases
April 24	Ge	Ca ²⁺ signaling in the nervous system: Synaptic transmission/plasticity and behaviors
April 26	Monestime	Genes and Behavior
May 1	Ge	Genes and Brain diseases I/II
May 3	Levine/Ge/Monestime	Exam 3
May 11th	11:15-1:45	Cumulative Final Exam (covers all lectures from lecture 1)

Content: An introduction to the molecular events that underlie development and plasticity of both the peripheral and central nervous systems, with a focus on neuronal mechanisms. Molecular and genetic approaches to the analysis of neural induction, neuronal differentiation, neuronal death and survival, neurotrophic factors, synapse formation and plasticity will be presented.

Bio 339 learning goals:

Upon completion of Bio339 students will be able to:

- 1) Explain the molecular mechanisms of neural induction.
- 2) Analyze epistatic relationships to order components in signal transduction pathways.
- 3) Describe the model systems and techniques used to study neural development.
- 4) Explain how morphogens influence cell fate.
- 5) Describe key inductive interactions that pattern the developing nervous system.
- 6) Explain the mechanisms of dorsal ventral and anterior posterior patterning within the developing neural tube.
- 7) Describe the basic workings of key signaling pathways involved in neural development include Notch, BMP and Hedgehog.
- 8) Explain the experimental basis for the "neurotrophic hypothesis"
- 9) Describe the molecular cascade required for apoptosis
- 10) Explain the role of cytoskeletal organelles in growth cone motility
- 11) Describe cell signaling via small G proteins
- 12) Describe the function of cell adhesion molecules in axon growth and guidance
- 13) Explain the mechanisms of axonal guidance in the developing spinal cord
- 14) Describe the cellular changes that occur after spinal cord injury and how these changes affect injured neurons
- 15) Explain the cellular basis of demyelinating diseases such as multiple sclerosis
- 16) Describe the basic properties of neural stem cells
- 17) Explain the proliferation, differentiation and de-differentiation of stem cells
- 18) Describe neuronal migration and the formation of different cortical layers and functional areas.
- 19) Explain synaptic structure of pre-synapse and post-synapse
- 20) Describe synapse formation
- 21) Explain some brain disorders from gene level.

Prerequisite: Bio 202 or Bio 203

Staff: Dr. Sirotkin is the course director, and Dr. Ge is the co-director. Dr. Sirotkin's office is located in Room 512 Life Sciences Building (LSB). Dr. Shaoyu Ge's

office is (Room 520 LSB). The course is taught jointly with Dr. Joel Levine (Room 514, LSB) of the Department of Neurobiology and Behavior.

Office Hours:

The course TA is Camillia Monestime. She will have office hours on Wednesdays from 1:00-2:00 PM in LSB 505 and by appointment.

Dr. Sirotkin's office hours will be Tuesdays from 11:30- 12:30 PM and by appointment in LSB 512.

Dr. Levine's office hours will be Mondays from 10:00-12:00 AM and by appointment in LSB 514.

Dr. Ge's office hours will be on Fridays from 12:00-1:00 PM in LSB 520.

Textbook: The textbook assigned for this course is *Foundations of Neural Development* (1st edition) by S. Marc Breedlove, Sinaur, 2017. This can be purchased in the Campus Bookstore. Research journal publications and reviews will be posted on the Web (blackboard).

Lectures: Class meets on Tuesday and Thursday from 10:00 to 11:20 AM in Javitz 103.

Examinations: There will be 4 examinations over the course of the semester. The first three exams are during regularly scheduled classes. The fourth exam will be held during finals week and will cover material from all lectures (from the first lecture to the last one). The final exam grade will be averaged from the best TWO grades from the first three tests and the final exam as detailed below: The final grade= (best two scores of exams 1-3*30% each) + 35%*Final Exam+ clicker points (5%, see below).

Please note that there are no make-up exams and the final exam cannot be dropped.

Clickers: The course will utilize the clicker system. There will be 2-4 clicker questions for each lecture. Generally correct clicker answers will be awarded (4) pt and incorrect answers (2) pt. The sum of the clicker points will be tallied over the course of the semester.

Exam attendance:

Any person arriving late to an exam will not be able to take the exam if one of the other students has already finished and left the exam room. The late student will receive a zero for the exam. This includes the final exam. As some students finish the exams quickly, you must arrive on time for the start of the exams. Please

bring photo ID to every exam. If you miss an examination, a written excuse must be submitted as soon as possible (ordinarily no later than one day after the exam). For any exam, if you believe an error was made in scoring, see the appropriate instructor within one week of receiving the graded exam; no changes will be made after this time. The full exam will be regraded.

Grades:

Letter grades will not be assigned for each individual examination, rather grades will be determined from the cumulative curve based on the weighted sum of scores from the final exam grade and the quizzes. For borderline grade situations, consideration will be given to class participation and to improvement in grades during progression of the course.

Cell Phones: All cell phones should be turned off during lectures. During examinations, it is University Policy that all cell phones and beepers shall be turned off and put away in a bag or pack. Under no circumstances may a cell phone or beeper be on the person of any student taking an examination. Use or activation of a cell phone during an exam will be considered academic dishonesty. The student will receive a zero on the exam and the matter will be referred to the academic judiciary.

Access Blackboard site:

You can access class information on-line at: <http://blackboard.sunysb.edu> If you have used Blackboard in the past, your login information (Username and Password) has not changed. If you have never used Stony Brook's Blackboard system your initial password is your ID# and your username is the same as your Stony Brook (sparky) username, which is generally your first initial and the first 7 letters of your last name.

For help or more information see:

<http://www.sinc.sunysb.edu/helpdesk/docs/blackboard/bbstudent.php>

For problems go to the helpdesk in the Main Library SINC Site or the Union SINC Site, you can also call: 631-632-9602 or e-mail: helpme@ic.sunysb.edu

Disabilities: If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services (631) 632-6748 or <http://studentaffairs.stonybrook.edu/dss/>. They will determine with you

what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website:

<http://www.stonybrook.edu/ehs/fire/disabilities/asp>.

ACADEMIC INTEGRITY STATEMENT:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instance of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at

<http://www.stonybrook.edu/uaa/academicjudiciary/>

CRITICAL INCIDENT MANAGEMENT :

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, and/or inhibits students' ability to learn.