DEVELOPMENTAL NEUROSCIENCE, FALL 2018

NEUR 601 / BIOL 691 / PSYC 592

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Introduction. The genome encodes the structure and function of the nervous system. Building a nervous system from genetic instructions requires embryological signaling and gene regulation, but it also requires directed cellular migration, axonal pathfinding, and formation and remodeling of specific synaptic connections. Finally, patterns of neuronal activity and behavioral experience are used to refine the numbers and types of neurons and their synaptic connections. This course will include an overview of all of these topics, in both vertebrate and invertebrate model systems, together with an overview of molecular and genetic methods for exploring neural development.

Prerequisites. The formal prerequisites for this class are PSYC 372 (Physiological Psychology), or BIOL 213 (Cell Structure and Function) and BIOL 303 (Animal Biology), or equivalent. However, because this course serves as part of the required core sequence for the Neuroscience Ph.D. program, students in this class are informally expected to have already taken 1-2 undergraduate-level courses in neurobiology, as well as courses in cell and molecular biology, and in chemistry (preferably including biochemistry). We do not include remedial background material on these subjects in the syllabus.

Contact Information

This course meets Thursdays, 4:30 - 7:10 pm in the Krasnow Institute, room 229.
Office hours: (Science & Technology campus) Fridays, 1-2 pm in Discovery Hall, room 305
E-mail: **(please label e-mails with the subject line "NEUR 601")** - kfryxell@gmu.edu
Telephone: 703-993-1069.
Course web site: lecture notes, study questions, etc. will be posted on Blackboard.

Readings. There is one required text for this course, "Development of the Nervous System" by Sanes, Reh & Harris (3rd edition, 2012). Copies of this book are available in the GMU Fairfax bookstore. These books may be shelved under any of the course numbers listed at the top of this page, so if you don't find it, try looking under another cross-listed course number. The reading list also contains a few articles from the scientific literature (for the last lecture), which are available in electronic form through the GMU library web site.

Dates, Times, Building and Parking Information. This course meets Thursdays at 4:30 - 7:10 pm, in the Krasnow Institute, room 229. The main entrance to this building locks automatically at 6:00 pm, so don't be late ☺. Also, please note that the Krasnow Institute parking lot (Lot D) is reserved for Faculty & Staff permits only, and GMU parking regulations are now enforced 24/7. If you park there, you may get a parking ticket. The closest available student parking lots include: Lot A, Lot C, the Rappahannock River Parking Deck, and the Shenandoah Parking Deck.

Grading summary: 45% midterm exam, 45% final exam, 10% participation. The participation grade is based on both attendance and participation during class (relevant questions, answers, and comments).
Exams: Midterm and final examinations will be closed book; a combination of short answer and short essay questions that cover the assigned reading and lecture notes. Each exam will cover one half of the course. Exam questions are patterned after the study questions posted each week on Blackboard.
Exam rules: Cell phone use of any kind (including texting) is not allowed during examinations. These and other Honor Code violations will result in a grade of zero for the exam. Excused absences from exams require permission from (two-way conversation with) the instructor prior to the exam. Makeup examinations are not given in this course.

Class Schedule & Reading List

Thursday, August 30 – Introduction, and neural induction (lecture 1)
Text, chapter 1.

Thursday, September 6 – Embronic polarity and segmentation (lecture 2)
Text, chapter 2.

Thursday, September 13 – Neurogenesis and cell migration (lecture 3)
Text, chapter 3.

Thursday, September 20 – Determination and differentiation of neural cells (lecture 4)
Text, chapter 4.

Thursday, September 27 – Axon growth and axon guidance (lecture 5)
Text, chapter 5.

Thursday, October 4 – Selection of synaptic targets (lecture 6)
Text, chapter 6.

Thursday, October 11 – Midterm Exam (covers lectures 1-6)

Thursday, October 18 – Naturally-occurring neuronal death (lecture 7)
Text, chapter 7

Thursday, October 25 – Synapse formation and synapse maturation (lecture 8)
Text, pp. 209-239

Thursday, November 1 – class does not meet (Society for Neuroscience meeting in San Diego)

Thursday, November 8 – Synaptic plasticity and synapse elimination (lecture 9)
Text, pp. 239-261

Thursday, November 15 – Synapse refinement and developmental critical periods (lecture 10)
Text, pp. 261-281

Thursday, November 22 (Thanksgiving holiday)

Thursday, November 29 – Behavioral development in infants and children (lecture 11)
Text, chapter 10

Thursday, December 6 – Behavioral development in adolescents (lecture 12)
Luna, B. et al. (2015) An integrative model of the maturation of cognitive control. *Annu. Rev. Neurosci.* 38, 151-170.
Steinberg, L. (2013) The influence of neuroscience on US Supreme Court decisions about adolescents' criminal culpability. *Nat. Rev. Neurosci.* 14, 513-518.

Thursday, December 13 – Final Exam (covers lectures 7-12)
Final exam will be held in Krasnow Institute, room 229, 4:30 pm to 7:15 pm.