NSCI 701: FOUNDATIONS OF NEUROSCIENCE

2020-2021

Course Description: The NSCI 701 course provides a thorough overview of neuroscience over two semesters. It systematically covers neuroscience in an integrated fashion covering the following main topics: 1) neuroanatomy and cellular neurobiology; 2) intro to molecular neurobiology techniques; 3) molecular/structural biology of ion channels, electrophysiology, and neural potentials; 4) the synapse; 5) motor systems; 6) sensory systems; 7) regulatory systems; 8) developmental neurobiology; 9) neural networks and connectomics; 10) neuropharmacology; and 11) neurobiology of brain disorders. Block 2 and additional lectures scattered throughout the course cover aspects of "doing neuroscience". These lectures are meant to introduce modern neuroscience methods to the students so that primary literature can be more fully appreciated and understood. The course includes both didactic and primary literature-based content and is the keystone course required in the Program in Neuroscience.

COVID-19 response-related plans: Since there are only 4 graduate students taking this course for the year 2020-2021 it is possible for students and faculty to maintain a safety distance within the designated classroom (TR401) and thus face-to-face classes and exams will be held in room TR401. While in class, and generally within the building where the classroom is located, the students will be expected to wear face masks at all times. If the number of students increases over 5 or the rules in campus become more restrictive, classes will be conducted online using the BigBlueButton application and the exams will be also online using the Lockdown browser application. The two latter applications are within the Canvas learning management platform provided online by UMC. A new part of NSCI701 is a series of brain dissection labs. Our current plan is to meet in the old Histology lab on the 7th floor of the North Building. This is a very large room, so social distancing will again be possible. Instructors normally work closely with the students, so much of the initial demonstrations of the dissection will be done as pro-sections (i.e. done before class for examples for the students to follow). This will minimize the time that an instructor is in close contact with any individual student.

Credit Hours: 13 credit hours (7 credits Fall; 6 credits Spring)

Course Prerequisites: This course is tailored to 1st-year Program in Neuroscience (PIN) PhD students. Students outside of the PIN, but enrolled in another PhD program at UMMC should obtain permission of course director. All other students must enquire as soon as possible (at least one month prior to start of class) concerning permission, as this is granted only via the PIN Executive Committee. Please contact Dr. Miguel-Hidalgo in all cases related to required permissions and general questions.

Course Dates: We will meet between August 10, 2020 and April 30, 2021 (full Fall and Spring semesters). Note that there may be a few meeting dates/times that may be adjusted in the class schedule to allow for coordination with other courses, Faculty attendance at scientific meetings, etc. You will be polled for rescheduling to find the appropriate time for all rescheduled meetings, and such notifications will be provided as early as possible before the change needs to take effect.

Class Times: 9:00-11:00am MWF except when conflicts arise with other classes. These will be noted in time for students to adjust their schedule. Exams begin at 8:30am and end promptly at 10:50am.

Classroom Location: TR401

Course Director: Dr. Javier Miguel-Hidalgo, Ph.D., TR417, x4-5791, jmiguel-hidalgo@umc.edu
Program Coordinator: Ms. Sarah Downey, TR402. x4-5512, jdowney@umc.edu

Section Leaders:
1. Cellular Neurobiology- Douglas Vetter, Ph.D., dvetter@umc.edu
2. Intro to Molecular Neurobiology Techniques- Douglas Vetter, Ph.D., dvetter@umc.edu
3. Molecular/Structural Biology of Ion Channels- Douglas Vetter, Ph.D., dvetter@umc.edu
4. The Synapse- James Shaffery, D. Phil., jshaffery@umc.edu
5. Motor Systems- Parminder Vig, Ph.D., pvig@umc.edu
6. Sensory Systems- Douglas Vetter, Ph.D., dvetter@umc.edu
7. Regulatory Systems Neurobiology- Bernadette Grayson, Ph.D., bgrayson@umc.edu
8. Developmental Neurobiology- Javier Jose Miguel-Hidalgo, Ph.D., jmiguel-hidalgo@umc.edu
9. Neural Networks and Connectomics- Douglas Vetter, Ph.D., dvetter@umc.edu
10. Neuropharmacology- Sally Huskinson, shuskinson@umc.edu
11. Neurobiology of Central/Peripheral Nervous System Disorders- Douglas Vetter, Ph.D dvetter@umc.edu

Required Text and Other Learning Resources:
Core Text: Fundamental Neuroscience, 4th edition, (2013) Eds. Squire et al., Academic Press
Additional readings from other textbooks and primary research papers will be assigned as required and distributed via Canvas either by the section leader or the lecturer.

Course Goals: This course is intended to provide a thorough grounding in both basic concepts and current theory of modern neuroscience at the graduate studies level. Along the way, students will be exposed to various experimental and computational (statistical assessments, etc.) methods used in neuroscience research. The course is designed as a springboard to independent thinking and evaluation of current neuroscience theory, and is therefore composed of both didactic and discussion evoking presentations of primary literature. Most two-hour classes will be divided approximately equally into didactic and primary research paper presentations/discussion portions. The didactic portion of the course specifically focuses on elements central to a comprehensive understanding of neuroscience (yellow headings in class schedule). In the didactic portion of the class, the instructor will highlight or add to critical information from the required readings for that day's class. During the discussion portion of each lecture, students will be exposed to both classic primary research papers, which form the basis of these elements (the "knowns"), as well as primary research papers based on recent developments in the field (the "research edge"). Throughout the class, **students are expected to contribute** to the discussion led by the instructor. The effort made in a student's contributions makes up a portion of the grade. Don't be a wallflower (unless you like being called upon at the most inopportune time)! Faculty expect intelligent discussion, which can take the form of questions asked by students, and contributions to answering questions posed by the faculty (there is no deduction for being wrong, just be able to thoughtfully defend your ideas/answers!). Challenge yourself and challenge others.

Course Objectives:

1. Students will be able to accurately identify components of the nervous system from the cellular level (neurons, glia) to the anatomical level (brain structures, major fiber tracts) and describe their major functions.
2. Students will be able to describe the major cellular components responsible for transmission of nerve signals (action potentials), synaptic transmission between neurons and post synaptic signaling mechanisms.
3. Students will be able to describe the major events and milestones of central nervous system development.
4. Students will be able to identify functional subsystems in the nervous system (sympathetic, parasympathetic systems, motor and sensory pathways) and describe their function and some of the consequences of dysfunction of these systems.
5. Students will be able to illustrate the interaction of multiple components in a neural system that produce a specific output.
6. Students will develop the ability to analyze and question the primary literature in order to interpret the contribution of that literature to our knowledge of neuroscience.

Grading Policy and Rubric: Grading will be based on 10 exams (5 each semester) plus participation in the discussion portion of each lecture. Final grades for each semester will be weighted as follows:

Exams- 85% of final grade, graded 0-100%
Discussion Participation- 15% of final grade; each lecture session will be graded on a 1-4 point scale, which is converted to a 100% scale (thus a 3 = 75%) at the end of each semester.
Optional paper- The points earned via the optional paper will be added onto the final numerical score for each semester.

Exam Format- Exams will be essay style exams. Expect one question based on material from each lecture, but the question may have multiple parts. The exception to the style of exam questions are the neuroanatomy exam questions in which students will be expected to understand and draw/label various structures and their relationship within the brain. Each exam question is equally weighted and therefore worth the same number of points. Material for an exam question can come from the didactic lecture and/or from discussions of the primary research paper covered. Synthesis/evaluation will be the hallmark of a properly written response. Expect to write 1-2 paragraphs in response to each question. Laptops may be used to write answers.

Optional paper- Students have the *option* of writing one paper per semester to increase their final semester grade. This paper will be worth up to **6** points added on top of the final semester average. Thus, an 84% (mid B grade) can be advanced to a 90% (low A grade) with an excellent paper. As such, this could represent a significant method of increasing one's final grade. **The paper should be at least 6 pages, but no more than 8 pages, in length (not counting references) with a 1.5 line spacing and 12-point Arial font (or other font of similar size) and ½" margins all around.** The paper should be on a subject of particular interest to the student and must be associated with any of the lecture topics covered during that semester. The intent is to provide the student with an opportunity to cover any aspect of the lectures to a greater depth. The paper should be written as a critical review of current research of the subject matter covered. Thus, the paper is not meant to be a description of a single research paper, but rather it is intended to allow the student an opportunity to *explore controversies and/or major recent advancements* in the field as it stands today. Expect to read, understand, and synthesize at least 3-4 primary research papers for your paper. The grading will reflect the subjective opinion of the faculty grading the paper- be persuasive! Keys to successful writing (and highest grades) will include (but not be limited to): 1) a critical exposition of the subject matter (list pros and cons of research approaches described, it's significance, and evaluate opposing research wherever possible); 2) a brief description of the historic context the current research rests on; 3) a description of future research paths as you might envision it (describe what might continue to hinder further progress and what can be done to surmount such problems). The paper can be turned in at any time during the semester, but not later than 2 weeks prior to the last class of the semester. **email Dr. Miguel-Hidalgo with a short proposal for the paper (subject matter to be covered and tentative title)**, and when cleared to write, also e-mail Dr. Miguel-Hidalgo the final paper.

Human Brain dissection- In addition to the Neuroanatomy block lectures, students will participate in hands-on in-depth human brain dissection exercises. The time of the dissection labs will be determined by polling the students. Through demonstration, and then their own practice, students will be led through dissection exercises designed to further acquaint them with general anatomical and functional aspects of the human brain.

Course Policies: Course attendance is mandatory. Requests for exceptions must be made to the Section Leader *and* Course Director at least one week prior to the expected absence, or in the case of an emergency, notification to the Course Director is expected as soon as possible. Make-up exams will be considered on an individual basis in the case of unavoidable and significant hardships (major illness, death in family, etc.). **Your UMMC e-mail address is regarded as your official e-mail address.** Course content will be listed on the Canvas website. Check it and your UMMC e-mail for any updates, class info, assignments, etc. If you use another e-mail address as your primary e-mail, it is *your* responsibility to check and/or automatically forward all e-mails sent to your UMMC address. Finally, **prompt response to all e-mails is expected**. Often times, e-mails contain time-sensitive requests for information (such as a need to find an alternative class time). Delinquency in response may be reflected in poor participation grades for the course.

University Policies: Students with disabilities (ADA) statement: Refer to UMMC policy. Academic honesty statement: Refer to UMMC policy.