

NSC 4354.001 INTEGRATIVE NEUROSCIENCE — FALL 2016

TUESDAY & THURSDAY 1:00 PM – 2:15 PM FN 2.102

Instructor Contact Information

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Prerequisites:

None.

Course Description:

Examines the collective behavior of neuronal systems with respect to motor control, sensory processing and regulation of more advanced behavioral, motivational and cognitive functions.

Student Learning Objectives:

After completing the course, students should be able to:

1.1 Describe the historical development of neuroscience as a cross-disciplinary science.

1.2 Describe and analyze the contributions of anatomical, physiological, behavioral, pharmacological, developmental, and cell and molecular biological studies to the bases of neuroscience, and: a) describe the principles of (1) feedback, (2) reciprocal connectivity, and (3) distributed processing fundamental to self-organizing neural systems, b) describe neural mechanisms of (1) motor control, (2) sensory processing, (3) homeostatic maintenance, and (4) higher cognitive functions (including learning, memory and emotions), c) describe the anatomical and functional organization of the autonomic nervous system and neuroendocrine systems.

2.1 Identify and explain why research questions rather than methods ideally drive advances in neuroscience, and: a) describe and analyze common behavioral methods used to interpret neuronal function in current studies, and limits of these techniques, b) describe and analyze use of different lesions (natural, accidental and induced) in nervous systems to infer function, & limits of these techniques, c) describe and analyze non-invasive imaging techniques used to assess nervous system structure and function, and the temporal and spatial limits of these techniques compared to other available methodology.

2.2 Describe how current methods sometimes limit our understanding of the nervous system, and drive innovation to develop new and better methods.

2.3 Describe why multiple research techniques & multiple levels of analysis (systems, network, cellular, synaptic, etc.) are preferred to address basic questions in the neurosciences, not reliance on a single technique or level.

3.1 Students will be able to describe basic components of the laws of nature as developed in the various scientific courses in the core program.

3.2 Students will be able to set up scientific problems in feasible and solvable ways as illustrated in the various subjects in the core curriculum.

3.3 Students will be able to make reasoned arguments about major issues of a scientific nature.

A course in the neurosciences takes aim at a constantly moving target. This course covers three core areas of neuroscience: (1) cellular properties of different types of neurons that suit them to (and/or limit) the specific tasks they carry out; (2) organization of functional neural systems that determine the behavioral and cognitive properties of living organisms; (3) critical evaluation of the research methods used to assess (1) and (2). The aim is to familiarize you with systems analyses of brain function, which must take into account all known neurobiological and psychological data. Since no current framework fully meets these comprehensive goals, you will be trained to critically evaluate current and future theories that purport to do so. Class discussion is strongly encouraged.

Required Textbook and Materials:

- D. Purves et al., (eds) *Neuroscience* 5th edition (2011) ISBN-10: 0878936955 **(required)**.
- Also **recommended**: E.R. Kandel, J.H. Schwartz, and T.M. Jessell (eds) *Principles of Neural Science* (2012) ISBN-10: 9780071390118.

E-learning:

To comply with FERPA regulations, all email discussions to and from me MUST be through e-learning. This is to protect your privacy. Discussion boards and Chat are available for your use. I will not routinely monitor them unless I receive complaints about inappropriate posting. Grades will be posted as soon as they are available. Announcements will be made from time to time in class.

Exams and Assignments:

Exams: Students will be evaluated with 4 tests during the semester, and a comprehensive final exam. Tests will consist of multiple choice questions and short answer questions covering the preceding lessons. **Each Test will count 30 points toward the final grade and the Final Exam counts 60 points for a total of 180 points** (see below).

Grading Policy: Grading is based on a set of a priori criteria: 90% (or 163+ points) correct for A (A- = 163-168 pts.; A = 169-174 pts.; A+ = >175 pts.), ~80% (or 145+ points) for B (B- = 145-150 pts.; B = 151-156 pts.; B+ = 157-162 pts.), ~70% (or 127+ points) for C (C- = 127-132 pts.; C = 133-138 pts.; C+ = 139-144 pts.), and ~60% (or 109+ points) for D (D- = 109-114 pts.; D = 115-120 pts.; D+ = 121-126 pts.), less than ~60% (109 points) is automatically an F.

Sometimes e-learning calculates percentages differently than the brackets/ranges listed here. In these rare cases the grade is based on the points and grades listed above!

Tests will not be curved. However, the instructor reserves the right to change the evaluation criteria (grade brackets) at his discretion, even from test to test. No extra test or "extra credit" will be available for any reason.

Course and Instructor Policies

Attendance of classes is strongly recommended, as tests will be based on material taken from the classes and will not be restricted to the topics and textbooks indicated in this syllabus, which serves predominantly as a guideline to the course. Finally, the instructor reserves the right to adjust the final grade based on the student's participation in the classroom.

Excused absences for exams will be given only if: (a) you are seriously ill and have verifiable documentation from a physician, or (b) you were detained by law at the exam time, or (c) you made prior arrangements to attend a verifiable religious or family event. In ALL of these cases except (b), you must notify the instructor in advance of the scheduled exam by email; for (b), your court order will suffice. Otherwise, you will receive a zero (0) for that exam. A maximum extension of one week (7 days) beyond the scheduled exam date can be granted, except for the final exam, which must be taken on the final exam date. Please DO NOT make early travel arrangements during Finals week!

I do not own copyright to the graphics used in lectures, so I cannot post PowerPoints for your use (please do not ask). You remember information better if you write it down yourself, rather than passively view it, so please take good notes in class!

DATE	TOPIC	ASSIGNMENTS
Tue Aug. 23	Introduction	review Kandel 1-2, Purves 1-3
Thurs Aug. 25	Sensory systems I: somatic I	Purves 9; Kandel 21-23
Tue Aug. 30	Sensory systems II: somatic II - pain	Purves 10; Kandel 24
Thurs Sept. 1	Sensory systems III: visual I	Purves 11; Kandel 26
Tue Sept. 6	No class	
Thurs Sept. 8	No class	
Tue Sept. 13	Sensory systems IV: visual II	Purves 12; Kandel 25, 27
Thurs Sept. 15	Sensory systems V and VI: auditory / vestibular	Purves 13, 14; Kandel 30, 31, 40
Tue Sept. 20	Sensory systems VII: chemical	Purves 15; Kandel 32
Thurs Sept. 22	Review	
Tue Sept. 27	Exam 1: Sensory systems	
Thurs Sept. 29	Motor systems I: spinal cord and motor units	Purves 16; Kandel 33-36
Tue Oct. 4	Motor systems II: upper motor neurons and brain stem (descending systems)	Purves 17; Kandel 17, 18, 36-38
Thurs Oct. 6	Motor systems III: basal ganglia	Purves 18; Kandel 43
Tue Oct. 11	Motor systems V: cerebellum	Purves 19; Kandel 42
Thurs Oct. 13	Autonomic nervous system (visc. motor system)	Purves 21; Kandel 47
Tue Oct. 18	Review	
Thurs Oct. 21	Exam 2: Motor systems	
Tue Oct. 25	Homeostatic systems I: eating & drinking I	Purves 21; Kandel 49
Thurs Oct. 28	Homeostatic systems II: eating & drinking II	Purves 21; Kandel 49
Tue Nov. 1	Homeostatic systems III: sleep & waking	Purves 28; Kandel 51
Thurs Nov. 3	Homeostatic systems IV: sleep & waking	Purves 28; Kandel 51
Tue Nov. 8	Homeostatic systems V: emotion	Purves 29; Kandel 48
Thurs Nov. 10	Exam 3: Homeostatic systems	
Tue Nov. 15	Plasticity I: Motivation and addiction	Purves 26; Kandel 15, 18
Thurs Nov. 17	Plasticity II: association cortex / cognition	Purves 24, 31; Kandel 65, 67
Tue Nov. 22	Plasticity III: learning and memory	Purves 24, 31; Kandel 65, 67
Thurs Nov. 24	No class Thanksgiving break	
Tue Nov. 29	Plasticity IV: learning and memory II	
Thurs Dec. 1	Plasticity III: language	Purves 27; Kandel 60
Tue Dec. 6	Exam 4: Plasticity	
Dec. 9 -15	Finals week - FINAL comprehensive Exam	

Schedule:

This schedule is *tentative*. There may be unforeseen outside factors (e.g. school closings due to inclement weather) that necessitate adjustments to this schedule, including the dates of reviews and tests. Any such adjustments will be announced in class and/or via e-learning.

All descriptions of the didactic material and the timelines are subject to change at the discretion of the instructor.

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus:

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.