

# HCS 6346—Systems Neuroscience—Fall 2016

CRA12.120 Tues-Thurs 10–11:15 AM

Professor

**Dr. Tres Thompson**

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Office hours: Thurs. 11:15 – 12:15 PM

(other times by appt.)

**Prerequisites:** Admission to the Cognition & Neuroscience doctoral program, or permission of the instructor.

**Course Description:** Examines the collective behavior of neuronal systems with respect to motor control, sensory processing and regulation of more advanced 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:
  - c) describe the principles of (1) feedback, (2) reciprocal connectivity, and (3) distributed processing fundamental to self-organizing neural systems,
  - d) describe neural mechanisms of (1) motor control, (2) sensory processing, (3) homeostatic maintenance, and (4) higher cognitive functions (including learning, memory and emotions),
  - g) 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,
  - c) describe and analyze use of different lesions (natural, accidental and induced) in nervous systems to infer function, & limits of these techniques,
  - f) 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.
- 30.1 Describe basic components of the laws of nature developed in this course.
- 30.2 Evaluate & critique studies published in the scientific literature.
- 30.3 Make and defend reasoned arguments about major scientific issues.

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. 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 participation is required.

**Supplementary Texts (not required but strongly suggested):**

*Principles of Neural Science (Kandel et al.), 5th Ed. [K]*

*Neuroscience (Purves et al.), 5th Ed. [P]*

Readings will be posted on my website and/or eLearning.

**Graded evaluations:** There will be three (3) multiple choice exams, each worth 25 points toward your final grade (a total of 75 points). Material for these exams will be taken from class discussion, so attendance is strongly encouraged. The format of the exam questions is designed to be challenging and to encourage integrative thought about the material. No texts are required, but Kandel & Purves are readily available. Additional assigned readings will serve as background material for class discussion and everyone is required to read the papers selected for oral presentations. Master's students will make one oral presentation on a topically-related peer-reviewed research paper; doctoral students will make two oral presentations, with different formats for each. These oral presentations will be peer-reviewed, to earn an additional 20% of your grade (20 points total). The final 5% (5 points) will be based on your participation in class discussions—you cannot earn these 5 points without being actively engaged in the class, i.e. attending, questioning, and speaking up.

**Grading** Grading is based on a set of a priori criteria: 90 pts. for A's, 80 for B's, 70 for C's, and 60 for D's. Grades will be based on the total number of points across the course.

**Course & Instructor Policies** PLEASE DON'T BE LATE! Discussion begins promptly, and lateness is rude to your instructor and fellow students. 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 verified religious or family event. In ALL 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 evaluation. A maximum extension of one week (7 days) beyond the scheduled exam date can be granted. Oral presentations must be made as scheduled.

Grades will be posted on eLearning, and exams will be reviewed in a timely fashion to give you feedback to study for your next exam. Your instructor will answer questions in class, but exams MUST be returned when requested to earn credit for the exam. Audio recordings are allowed, but cell/smart phone use and any form of photography/video recording is prohibited during class. Laptops and tablets are allowed at the discretion of the instructor. Bring only writing instruments on exam days—books, papers etc. cannot be used on those days.

I do not own copyright to the graphics used in lectures, so I do not post or distribute my PowerPoints (please do not ask). Research clearly demonstrates that information is better remembered if you write it down yourself rather than passively view it (engaging and rehearsing more brain systems), so take good notes, and go back and add to or rewrite them while fresh!



## Class schedule

(subject to change at the discretion of the instructor, or the dictates of Texas weather)

Date	Topic	Suggested Chapters
Aug. 23	Introduction to neural systems	(review K1-2, P1-3)
25	Motor systems I: motor units and ANS	P16; K34,47
30	Motor systems II: spinal cord	P17; K33-36
Sept. 1	Motor systems III: descending systems	P17; K17-18, 37-38,41
6	Motor systems IV: basal ganglia	P18; K43, 44
8	Motor systems V: cerebellum	P19; K42
13	<b>Exam 1: Motor systems</b>	
15	ORAL PRESENTATIONS 1 (5 + 2 min talks)	8 papers: see eLearning
20	Sensory systems I: somatic I	P9; K21-22
22	Sensory systems II: somatic II	P10; K23-24
27	Sensory systems III: visual I	P11; K26
29	Sensory systems IV: visual II	P12; K25, 27-29
Oct. 4	Sensory systems V: auditory/vestibular	P13-14; K30-31,40
6	Sensory systems VI: chemical	P15; K32
11	<b>Exam 2: Sensory systems</b>	
13	ORAL PRESENTATIONS 2 (5 + 2 min talks)	8 papers: see eLearning
18	Homeostatic systems I: eating & drinking I	K49
20	Homeostatic systems II: eating & drinking II	P21
25	Homeostatic systems III: sleep & waking	P28; K51
27	Homeostatic systems IV: sleep & waking	P28; K51
Nov. 1	Homeostatic systems V: emotion & motivation	P29; K47-48
3	Homeostatic systems VI: sex & language	P30, 27; K58,60
8	<b>Exam 3: Homeostatic systems</b>	
10	ORAL PRESENTATIONS 3 (5 + 2 min talks)	8 papers: see eLearning
15, 17	<b>SfN Meeting, San Diego</b>	No classes
22, 24	<b>FALL BREAK</b> / Thanksgiving	No classes
29	ORAL PRESENTATIONS 4 (5 + 2 min talks)	8 papers: see eLearning
Dec 1	ORAL PRESENTATIONS 5 (5 + 2 min talks)	8 papers: see eLearning
6	Research related oral presentations (15 + 3 min talks)	Ph.D. students see eLearning

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.