

## Course Syllabus

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### Course Directors

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### Additional Faculty & Guest Speakers

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John A. Thompson, PhD, <i>Neurosurgery</i>	<a href="mailto:john.a.thompson@ucdenver.edu">john.a.thompson@ucdenver.edu</a>

### Teaching Assistants

Two 2<sup>nd</sup> year MHA students will assist you in labs. Please contact them directly for assistance outside of scheduled class or lab time.

Brian Kelly	<a href="mailto:brian.kelly@ucdenver.edu">brian.kelly@ucdenver.edu</a>
Natasha Rousseau	<a href="mailto:natasha.rousseau@ucdenver.edu">natasha.rousseau@ucdenver.edu</a>

### Location

Lectures will be held in Ed2 South – Rm 2206. Labs will be held in various locations including Ed2S-2206, Ed1, 5<sup>th</sup> floor cadaver lab (badge access required), and Ed2N-2201AB. **Please follow the schedule carefully for our meeting day/time which varies week to week.**

### Credits

ANAT 6310 (Neuroanatomy) is a 4 credit course, with lecture and lab components, that fulfills a core requirement of the Masters of Science in Modern Human Anatomy program.

### Prerequisites & Enrollment Restrictions

Students must be enrolled in the Masters of Science in Modern Human Anatomy program, or have special permission from the course director.

## Learning Management System

All course materials will be posted on Canvas. In addition, Canvas will be used to make announcements to the class; it is your responsibility to monitor your Canvas notifications.

## Recommended Textbook

THIEME Atlas of Head, Neck and Neuroanatomy. 2<sup>nd</sup> Edition © 2016 by Thieme Medical Publishers, Inc. ISBN: 978-1-62623-120-7.

## Free (or nearly free) Online Resources

- *Brain Facts* © 2018 Society for Neuroscience, free download at <https://www.brainfacts.org/-/media/Brainfacts2/BrainFacts-Book/Brain-Facts-PDF-with-links.pdf?la=en&hash=281E690284FD748C93527F21DA8009C216B5F0B7>
- *Neuroscience Online*, an electronic textbook for the neurosciences <http://nba.uth.tmc.edu/neuroscience/index.htm>
- *University of Washington Digital Brain Atlas* <http://www9.biostr.washington.edu/cgi-bin/DA/PageMaster?atlas:Neuroanatomy+ffpathIndex:Splash^Page+2>
- *3D Brain for iTunes App*, <http://itunes.apple.com/us/app/3d-brain/id331399332?mt=8>
- *Brain Tutor HD App*, <https://itunes.apple.com/us/app/brain-tutor-hd/id392586830?ls=1&mt=8>

## Course Description & Learning Objectives

The purpose of this course is to provide you with a comprehensive overview of the field of neuroscience, with a focus on neuroanatomy. We will explore how the nervous system functions under conditions of normal health, as well as disease. Learning will take place through lecture, laboratory, digital imaging tools, and clinical case studies. The course is organized into three units with learning objectives listed below. Individual learning objectives specific for each lecture and lab will be listed in the course packet. **Please note: Learning objectives are a guide; they are not intended to restrict you from exploring and learning the material at a deeper intellectual level.**

- I. Unit I covers Lectures 1-14 and Labs 1-4. The major learning objectives are:
  - Describe the major organization of the nervous system, anatomical terms, and planes of section.
  - Explain the structure and function of neurons and glia.
  - Describe the anatomical and physiological properties that enable neurons to communicate with one another.
  - Describe the anatomy of the brain and identify the major external and internal structures, coverings, and fluids based on both 3D (gross tissue/models) and 2D (cross-sectional) images.
  - Differentiate different types of neuroimaging tools including CT and MRI (including T1, T2, T2-FLAIR, DTI and fMRI)
  - Describe the 8 major categories of neuropathological disorders.
- II. Unit II covers Lectures 15-28 and Labs 5-10. The major learning objectives are:
  - Describe the anatomy of the spinal cord and brainstem both 3D (gross tissue/models) and 2D (cross-sectional) images.
  - Draw major ascending and descending spinal cord pathways and identify in cross-section the structures through which they pass at all levels of the CNS.
  - Define the name and function of the cranial nerves, describe their nuclei location and draw their pathways in the CNS.
  - Describe the neurobiology and pathways of the special senses.
- III. Unit III covers Lectures 29-43 (and all disorders). The major learning objectives are:

- Compare and contrast the anatomy and function of the three major motor systems (corticospinal, cerebellum, basal ganglia).
- Describe the structure and function of the limbic system and autonomic system.
- Describe the biological basis of learning, memory, emotion, sleep, & reward.
- Apply principles of neuroanatomy to describe advances in neurosurgery.
- Identify major neurological disorders and mental health disorders and describe their biological basis, methods of diagnosis, and in some cases, current mechanisms of treatment.

## Grading Policy

At the end of the course, a final letter grade will be assigned according to the MHA program scale. As per program policy, a minimum grade of B- is required for successful completion of the course.

A	93-100%	B	83-86%	C	73-76%	D	63-66
A-	90-92%	B-	80-82%	C-	70-72%	D-	60-62
B+	87-89%	C+	77-79%	D+	67-69%	F	59% and below

Assessment	Final Grade Contribution (%)
<b>Exam 1</b> (covers Lectures 1-14 & Labs 1-4)	30
<b>Exam 2</b> (covers Lectures 15-28 & Labs 5-10)	30
<b>Exam 3</b> (covers Lectures 29-43 & all disorders) <i>Note: the basic science content of the final exam is not cumulative; However, all disorders are fair game. Moreover, any neuroanatomy from previous units that is critical to understanding the topics covered in this Unit may be required. For example, the cross-sectional anatomy of the basal ganglia (from Unit I) is relevant for questions on Parkinson's disease (Unit III).</i>	30
<b>LAB PREP:</b> videos/modules to prepare for select labs	3
<b>Presentation:</b> "Neuroscience in the News"	7
<b>TOTAL</b>	<b>100%</b>

### Makeups:

Makeups for missing an exam will **NOT** be allowed except in the case of documented severe illness, funeral of family member, or a personal, catastrophic, or religious event (as defined by the University policies). A missed exam for any reason other than those listed above will be assigned a zero. A late "LAB PREP" assignment or "Neuroscience in the News" assignment for any reason other than the above listed will be automatically docked 10 points; with an additional 10 points for each additional 24-hr day late.

### Exams (90% of grade each):

Exams will consist of multiple choice and short answer and will incorporate material from lecture and labs. There is not a separate practical exam for the labs. Lab material will be incorporated into the lecture exams in the form of diagrams, photographs, and pictures. Additional material from the textbooks that is not covered in class is helpful as a reference for learning but will not be tested. If a topic is listed as a learning objective, is covered in class or lab, and is included in the readings, then it will most likely be included on an exam.

### Practice Quizzes (not graded):

One key to success in graduate school is to learn how to self-evaluate your own learning. To assist you in this, there will be weekly non-graded practice quizzes posted on Canvas that test material from the previous week. Good scores on practice quizzes indicate high probability of success for the exam. Poor scores on practice quizzes indicate low probability of exam success. If a student consistently

performs poorly on practice quizzes, an appointment with the instructor or TAs should be arranged to discuss study strategies.

**Lab Prep Assignments (3% of grade):**

These assignments will be posted on Canvas and are designed to prepare you for lab. They will be due prior to lab.

**“Neuroscience in the News” (NIN) Presentation (7% of grade):**

Researchers continue to advance the field of neuroscience to further our understanding of how the nervous system functions and what happens when parts of this system fail. As these breakthroughs occur, science writers take primary science literature and compose news articles that enable the general public to understand these discoveries and their significance to society. In order to help you draw parallels between inside and outside the classroom, you will present to the class a news article (from the local news source or magazine, BBC, NPR, CNN, etc.) that reports a story involving some aspect of the nervous system related to health or disease. You can choose a topic covered in class or a topic related to the nervous system that will not be covered in class, but is of interest to you. You must post on Canvas (under “Discussions”) the title, link, and short description of your article one week BEFORE your designated presentation. You may present as an individual or in a group of two. The NIN presentation should be 15 minutes with an additional 5 minutes for questions and include the following:

1. What is the title of the article or news report? Where and when was it published? If you were to describe this article in a few words, what keywords or phrases would you use?
2. What is the major finding in the news story? Give a brief synopsis of the report and/or discovery.
3. What is the basic science underlying the finding? What part of the brain or nervous system involved? What is the pathway or mechanism? You may need to *teach* the class a new anatomical relationship and/or a neural pathway that was *not* covered in class. If the topic was already covered in class, then you should acknowledge when the topic was covered and *review* the information for the class. In addition, you must look up the **original research article** (NOT a review article) on pubmed.gov, read the article, and then use this article to describe the scientific aspects of the study in further detail than what was provided in the news report.
4. Identify and highlight one controversy or discussion question for the class associated with the science in your article. Lead a discussion based on your questions.
5. The presentation overall should be clear, prepared, and well-organized.

**“Neuroscience in the News” Grading Rubric (100 points total)**

*(Student = team, if a group presentation)*

**Part 1 (5 points) Title/Intro of News Article**

4 points: News Article Intro: Student mentions title (1 point), news source (1 point), the publication date (1 point) and pastes the URL (1 point) of the news article.

1 point: Student gives 2-3 keywords or phrases that describe the topic.

**Part 2 (15 points) Synopsis of News Article**

10 points: Student gives thorough and clear synopsis of the main points of the news story as it was presented to the public.

5 points: Student relates the topic back to information that was taught in class (reminding students when that material was taught and reviewing it). The student acknowledges if the material was not yet taught in class and teaches it new to the class.

**Part 3 (60 points) The Original Research and the Science Behind It**

4 points: Original Article Intro: Student has gone to [www.pubmed.gov](http://www.pubmed.gov) and found the original article.

Student mentions title (1 point), journal name (1 point), the publication date (1 point) and pastes the URL (1 point) of the original research article.

2 points: Student describes the scientists (1 point) and institutions (1 point) where the research was performed (note: this is not the author of the news article; this is where and by whom the research was done).

10 points: Student correctly identifies the *part of the brain or nervous system* involved in the news article.

10 points: Student correctly describes the *mechanism involved*. This may include a description of a biochemical pathway, a reaction, or a physiological circuit. You will likely have to look up additional information for this section! Do your research! Teach the class!

10 points: Student presents relevant tables and/or figures from the original article that enhances our understanding of the research. The tables and/or figures are described clearly and succinctly.

4 points: References (including the figure #) are listed below any tables or figures that come straight from the original article.

10 points: Student critiques the original research article for strengths and weaknesses. Student is able to identify potential flaws or excellence in the experimental design and/or the way it was presented to the public.

10 points: Student demonstrates mastery of the article and the neuroscience material.

**Part 4: (10 points) Discussion**

5 points: Student identifies at least ONE discussion question related to the research or scientific discovery.

5 points: Student stimulates class participation and discussion on the research or scientific discovery.

**Part 5: (10 points) Overall preparedness**

2 points: Student submits the title and link of both the news article and the original research article to Canvas at least one week before the scheduled presentation. A succinct description is also included.

2 points: Student's PowerPoint presentation is well-organized and well-designed (order of slides is logical, text is not too small, figures are legible, etc.).

2 points: Student starts and finishes on time (and stays within the 15 minute time limit).

2 points: Student (or group) is presents without reading verbatim from PowerPoint slides).

2 points: Student has good stage presence (speaks clearly and loudly enough for the class to hear, stands up straight, does not turn back to class or hide in a corner).

**Student Responsibilities & Expectations:**

- Attend class, labs, and examination days. In the case of an emergency or illness, please contact the instructor as soon as possible by email or phone.
- Arrive on time. In exchange, the instructor will finish on time.
- Turn off/silence cell phones before class. Use phones only during the break.
- Stay curious and ask questions. If you do not understand something, it is likely that someone else in the class doesn't understand either. Help your classmates and ask!
- Pay attention. This class proceeds at a rapid pace. Study regularly. It is expected that you will do 1-2 hours of studying outside of class for every hour of lecture. Keep up with the material on a daily basis, take practice quizzes and attend review sessions.

**Honor Code**

Students are expected to abide by the Graduate School's Student Academic Honor & Conduct Code, as well as policies outlined in the MHA Student Handbook. Students are expected to act in a professional manner. Academic dishonesty, including cheating or sharing exam details will not be tolerated. In your laboratory sessions, you will have the opportunity to work with human cadavers and fixed brain tissue. Please adhere to all lab rules and guidelines. Furthermore, treat all cadavers and brain tissue with gentleness and respect.

## **Religious Accommodation Policy**

Students who anticipate the necessity of being absent from class due to the observation of major religious observance must provide advance notice to the Course Director in writing, by the end of the second week of class.

## **Disability Accommodation Policy**

Students with documented learning and/or physical disabilities should inform the Course Director as soon as possible to discuss and arrange for reasonable accommodations. All reasonable efforts will be made to accommodate students with regard to note taking, reading assignments, and test taking.

## **Equal Opportunity Policy**

It is the goal of the University to maintain a work and study environment free of discrimination on the basis of race, color, sex, gender, marital status, religion, national origin, veteran status, handicap or age. It is a goal of this course to maintain an environment of respect for all.

## **Recording Policy**

You are permitted to use tablets or laptop computers to take notes. In addition, you are permitted to video or audio record any or all lectures for the purpose of self-study. However, you are not permitted to use notes, tapes or other recorded data for the purposes of sale or web distribution. Photos of donated human tissue may never be posted on social media.

## **Resolution of Conflicts Policy**

Good faith efforts will be made by students, faculty, and program and university administration to settle all appeals, complaints and grievances on an informal basis. Such efforts include conferences between the persons directly involved and others who may help solve the problems. Formal conflict resolution policies are detailed in the policies and procedures of the Graduate School, University of Colorado Denver.

## **Withdrawal Policy**

Students may withdraw from a course with an ANAT prefix no later than April 22, 2019. Please contact the Course Director to discuss possibility of a course withdrawal.

## **Incomplete Policy**

Incomplete (I) grades are not granted for low academic performance. To be eligible for an "I" grade, you must:

- 1) Successfully complete a minimum of 75% of the course
- 2) Have a special circumstance(s) beyond your control that prevents you from attending class and/or completing coursework. Documentation is required.
- 3) Make arrangements to complete missing coursework with the original instructor
- 4) If the missing coursework is not completed within 1 year from the end of the semester in which the original course was scheduled, the "I" grade will convert to an "F" grade on your official transcript.

## Course Schedule

\*\* Schedule and room locations may change; please check Canvas regularly for updates\*\*

Color Key: Black font = lecture. Blue font = lab. Red font = lab prep. Yellow highlight = exam.

<b>UNIT I</b>					
<b>DATE</b>	<b>TIME</b>	<b>#</b>	<b>TOPIC</b>	<b>LECTURER or NIN Presentations</b>	<b>LOCATION</b>
<b>WEEK 1</b>					
22-Jan	10:00 AM	0	Course Info: Neuro in the News	Stabio	Ed2S-2206
	11:00 AM	1	Organization of the nervous system	Stabio	Ed2S-2206
<b>WEEK 2</b>					
23-Jan	10:00 AM	2	Neurons	Stabio	Ed2S-2206
	11:00 AM	3	RMP	Stabio	Ed2S-2206
24-Jan	10:00 AM	4	Glial Cells (Clinical: Tumors/inflammation)	Hughes	Ed2S-2206
<b>WEEK 3</b>					
29-Jan	10:00 AM	5	Action Potential	Stabio	Ed2S-2206
	11:00 AM	6	Synapse and Summation	Stabio	Ed2S-2206
30-Jan	10:00 AM	7	Neurotransmitters	Caldwell	Ed2S-2206
	11:00 AM	8	Receptors; Agonists/Antagonists	Caldwell	Ed2S-2206
<b>WEEK 4</b>					
5-Feb	10:00 AM	9	Telencephalon	Stabio	Ed2S-2206
	11:00 AM	10	Diencephalon	Finger	Ed2S-2206
6-Feb	10:00 AM	11	Neurofluids: Meninges, Ventricles, CSF	Stabio	Ed2S-2206
	11:00 AM	12	Neurofluids: Blood, BBB, Stroke	Stabio	Ed2S-2206
8-Feb	9am-11am	LAB 1	Wet Lab: Whole Brain, Brain Slicing & White Matter Dissections. LAB PREP #1 DUE BEFORE LAB.	Finger, Caldwell & TAS	Ed 1: 5th floor cadaver labs
<b>WEEK 5</b>					
12-Feb	10:00 AM	13	Neuroimaging: Types of imaging for the brain	Stabio	Ed2S-2206
	11:00 AM	14	Neuroimaging: Forebrain in 2D and 3D	Stabio	Ed2S-2206
13-Feb	9:30-10am	LAB 2a	Build a Brain	Stabio, Caldwell & Tas	Ed2S-2206
	10am-12pm	LAB 2b	3D MRI	TAs & Stabio	Ed2N-2201AB
14-Feb	9am-11am	Lab 3	DTI and White Matter Tractography LAB PREP #2 DUE BEFORE LAB.	TAs & Stabio	Ed2N-2201AB Computer Lab
<b>WEEK 6</b>					
20-Feb	10am-12pm	Lab 4	Neuropath lab. LAB PREP #3 DUE BEFORE LAB.	Moore, Salcedo, Caldwell, Finger,	Ed 1: 5th floor cadaver labs
22-Feb	10am-12pm		EXAM 1 (covers Lectures #1-14 and Labs 1-4)	Finger	Ed2S-2206

UNIT II					
<b>WEEK 6</b>					
26-Feb	10:00 AM	15	Brainstem Gross Features & Cross-section	Stabio	Ed2S-2206
	11:00 AM	16	Spinal Cord Gross- Features & Cross-sections	Stabio	Ed2S-2206
27-Feb	10:00 AM	17	Spinal Cord Reflexes	Stabio	Ed2S-2206
	11:00 AM	18	Corticospinal pathway; UMN vs. LMN	Stabio	Ed2S-2206
28-Feb	9am-11am	Lab 5	Spinal Cord and Brainstem Wet Lab; LAB PREP #4 DUE BEFORE LAB.	Salcedo, Caldwell & TAS	Ed 1: 5th floor cadaver labs
<b>WEEK 7</b>					
5-Mar	10:00 AM	19	DCML (fine touch) pathway	Stabio	Ed2S-2206
	11:00 AM	20	Anterolateral (Pain/temp) pathway/Reflexes	Stabio	Ed2S-2206
6-Mar	10am-12pm	Lab 6	Case Studies: Spinal Cord Lesions	Caldwell & TAS	Ed2S-2206
7-Mar	9am-11am	Lab 7	Cranial Nerve Exam, CN Reflexes & CN Nuclei; LAB PREP #5 DUE BEFORE LAB	Stabio & TAS	Ed2S-2206
<b>WEEK 8</b>					
12-Mar	10:00 AM	21	Cranial Nerve Pathways: Corticobulbar	Stabio	Ed2S-2206
	11:00 AM	22	Cranial Nerve Pathways: Trigeminal	Stabio	Ed2S-2206
13-Mar			no class - CU Ed Symposium		
14-Mar	9am-11am	Lab 8	Case Studies: Brainstem Lesions	Finger & TAS	Ed2S-2206
<b>WEEK 9</b>					
SPRING BREAK - NO CLASS					
<b>WEEK 10</b>					
27-Mar	10:00 AM	23	Special Senses: Visual System	Stabio	Ed2S-2206
	11:00 AM	24	Special Senses: Visual System	Stabio	Ed2S-2206
28-Mar	9:00 AM	25	Special Senses: Auditory System	Meredith	Ed2S-2206
	10:00 AM	26	Special Senses: Vestibular System	Meredith	Ed2S-2206
<b>WEEK 11</b>					
2-Apr	10:00 AM	27	Special Senses: Olfactory System	Finger	Ed2S-2206
	11:00 AM	28	Special Senses: Gustatory System	Finger	Ed2S-2206
3-Apr	10am-12pm	Lab 9	Case Studies: Special Senses; LAB PREP #6 DUE BEFORE LAB.	Finger & TAS	Ed2S-2206
4-Apr	9am-11am	Lab 10	Case Studies: Weird and Rare disorders; LAB PREP #7 DUE BEFORE LAB.	Stabio & TAS	Ed2S-2206
<b>WEEK 12</b>					
9-Apr	10am-12pm		Exam 2 Lectures 15-28, Labs 5-10	Caldwell	Ed2S-2206

UNIT III					
<b>WEEK 12 - continued</b>					
10-Apr	10:00 AM	29	Intro to Motor Systems	Caldwell	Ed2S-2206
	11:00 AM	30	Basal Ganglia (Parkinson's and Huntington's)	Caldwell	Ed2S-2206
12-Apr	9:00 AM	31	Cerebellum	Niemeyer	Ed2S-2206
	10:00 AM	32	Cerebellum	Niemeyer	Ed2S-2206
<b>WEEK 13</b>					
16-Apr	10:00 AM	33	Neurosurgery - DBS for Parkinson's and Motor	Thompson	Ed2S-2206
	11:00 AM		NIN Presentations	Stabio (#1, #2)	Ed2S-2206
17-Apr	10:00 AM	34	Mesolimbic and Mesocortical Pathways	guest?	Ed2S-2206
	11:00 AM		NIN Presentations	Stabio (#3, #4)	Ed2S-2206
<b>WEEK 14</b>					
23-Apr	10:00 AM	35	Hypothalamus and ANS	Salcedo	Ed2S-2206
	11:00 AM		NIN Presentations	Salcedo (#5, #6)	Ed2S-2206
24-Apr	10:00 AM	36	Limbic System: Memory	Salcedo	Ed2S-2206
	11:00 AM		NIN Presentations	Salcedo (#7, #8)	Ed2S-2206
25-Apr	9:00 AM	37	Limbic System: Emotion	Salcedo	Ed2S-2206
	10:00 AM		NIN Presentations	Salcedo (#9, #10)	Ed2S-2206
<b>WEEK 15</b>					
30-Apr	10:00 AM	38	Disorders of Memory: Alzheimer's Disease	Stabio - maybe athena?	Ed2S-2206
	11:00 AM		NIN Presentations	Caldwell (#11, #12)	Ed2S-2206
1-May	10:00 AM	39	Disorders of Affect: Depression, Anxiety and Bipolar Disorders	Stabio	Ed2S-2206
	11:00 AM		NIN Presentations	Caldwell (#13, #14)	Ed2S-2206
2-May	9:00 AM	40	Disorders of Social Behavior: Schizophrenia and psychosis	Stabio	Ed2S-2206
	10:00 AM		NIN presentations	Caldwell (#15, #16)	Ed2S-2206
<b>WEEK 16</b>					
7-May	10:00 AM	41	Sleep & Sleep Disorders	Binford	Ed2S-2206
	11:00 AM		NIN Presentations	Salcedo (#17, #18)	Ed2S-2206
8-May	10:00 AM	42	Disorders of Development: Autism, Epilepsy, Down Syndrome, ADHD	Caldwell	Ed2S-2206
	11:00 AM		NIN Presentations	Caldwell (#19, #20)	Ed2S-2206
9-May	9:00 AM	43	Review of Disorders	Stabio	Ed2S-2206
	10:00 AM		NIN Presentations	Stabio (#21, #22)	Ed2S-2206
<b>WEEK 17</b>					
16-May	10am-12pm		Exam 3 (covers Lectures #29-43) - ALL DISORDERS	Salcedo	Ed2S-2206