

# Course Syllabus

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## Course Directors

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## Additional Faculty & Guest Speakers

Rives Binford, MS, *STEM - NWCC*  
Christy Niemeyer, PhD, *Neurology*  
Tom Finger, PhD, *Neuroscience, CDB*  
Ethan Hughes, PhD, *Neuroscience, CDB*  
Brian Moore, MD, *Pathology*  
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## Teaching Assistants & Student Educators

A 2<sup>nd</sup> year MHA student will assist you in this course. Please contact him directly for assistance outside of scheduled class or lab time.

Rory Haas, MHA class of 2022

[Rourke.Haas@CUanschutz.edu](mailto:Rourke.Haas@CUanschutz.edu)

## 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 and announcements will be posted on Canvas. It is your responsibility to monitor your Canvas notifications.

## Required Software

VH Dissector Pro – “The Visible Brain” App – free for MHA students

## 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. A copy of this textbook is available for use in the MHA suite.

## Free (or nearly free) Online Resources

- *University of British Columbia Functional Neuroanatomy* <http://www.neuroanatomy.ca/>
- *The Neurosurgical Atlas* <https://www.neurosurgicalatlas.com/neuroanatomy>
- *Brain Facts* © 2018 Society for Neuroscience, <https://www.brainfacts.org/the-brain-facts-book>
- *Neuroscience Online* <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 Format

ANAT 6310 is a hybrid course with the following components:

- **Video “Micro-Lecture” Podcasts:** Each week you are required to watch 2-4 hours of pre-recorded microlectures (5-20 minutes long each) chunked by topic. These videos will prepare you for In-Person Lab and must be viewed by the end of each Wednesday.
- **IN-PERSON Thursdays:** Every Thursday from 9am – 10:50am will be an in-person session for review, practice questions, Q&A, guest speakers and/or Neuroscience in the News Presentations. Attendance is mandatory.
- **IN-PERSON Lab Fridays:** Every Friday afternoon from 1pm – 2:50 pm will be a live in-person lab. These will be held in Ed2N-1107 OR Ed1, 5<sup>th</sup> Fl labs (badge access required).
- **On-Campus Exams:** Examinations will be held on campus in Ed2N-2201 Computer Labs (A,B,D,E) and administered via Canvas.

## 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 in health and 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, and in your 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 1-15 and Labs 1-3. The major learning objectives are:
  - Describe the organization of the nervous system, anatomical terms and planes.
  - 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)

- II. Unit II covers Lectures 16-29 and Labs 4-8. 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.
  - Apply your knowledge of neuroanatomy to describe the cranial nerve exam and lesion localization.
- III. Unit III covers Lectures 30-45 and Labs 9-11. The major learning objectives are:
- Compare and contrast the anatomy and function of the three major motor systems (Motor Cortex, 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.
  - Describe the 8 categories of neuropathology (VITAMIN-C) with examples of each.
  - Identify major neurological disorders and mental health disorders, and describe their biological basis, methods of diagnosis, and in some cases, current mechanisms of treatment.
  - Apply your knowledge of neuroanatomy to describe advances in neurosurgery.

## 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 1-15 & Labs 1-3)	30
<b>Exam 2</b> (covers Lectures 16-29 & Labs 4-8)	30
<b>Exam 3</b> (covers Lectures 30-45 & Labs 9-11, & 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>Weekly Lab Prep:</b> videos, modules, & quizzes to prepare for labs	5
<b>Presentation:</b> "Neuroscience in the News"	5
<b>TOTAL</b>	<b>100%</b>

## Makeups:

Makeups for missing an exam will **NOT** be allowed except in the case of 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 reduced by 10% points, with additional 10% points for each additional 24-hr day late.

**Exams (90% of grade):**

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 self-evaluate your own learning. To assist you in this, there will be weekly non-graded practice quizzes 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 (5% of grade):**

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

**“Neuroscience in the News” (NIN) Presentation (5% 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 will present as teams of 2. 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. 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)

**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 points) 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 points) and pastes the URL (1 point) of the original research article.

2 points: Student lists 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 & by whom the research was done).

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

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

**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 presents without reading verbatim from PowerPoint slides).

2 points: Student has good “Zoom presence” (professionally dressed, speaks clearly and loudly enough for the class to hear, smiles at the screen/camera to engage the class)

## **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.
- 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 act professionally in accordance with the Graduate School's Student Academic Honor & Conduct Code and the MHA Honor Code, as well as policies outlined in the MHA Student Handbook. 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 age, race, sex, gender, marital status, religion, national origin, veteran status, or disability. 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 add/drop courses in UCDAccess until September 10, 2021. Discontinuing enrollment in this course after the add/drop date will result in a withdrawal, a “W” grade will be posted on the student’s transcript for that course, and the student will pay tuition. A grade of “W” does not impact a student’s grade point average. **Withdrawals from an ANAT course must be done on or before Friday, November 19<sup>th</sup>, 2021.**

## **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.

## SCHEDULE: ANAT 6310 - Neuroanatomy FALL 2021

Black font is asynchronous video lectures - students watch on their own time

Blue font is live on-campus lab/active learning - ATTENDANCE MANDATORY

Green font is live on campus special lectures, NIN or Review Q&A - ATTENDANCE MANDATORY

Yellow Highlight is exams - on campus computer labs - ATTENDANCE MANDATORY

\*\*\*Schedule and room location may change. Please check Canvas regularly for updates.\*\*\*

### UNIT I

DATE	DAY	START	END	#	TOPIC	WHO	WHERE
<b>WEEK 1</b>							
31-Aug	Tues	11:00 AM	11:50 AM	0	Course Info & Orientation	Stabio	Ed2N-1107
Watch these lectures by Thurs 9am →				1	Nervous System Overview	Stabio	podcast
				2	Neurons	Caldwell	podcast
				3	RMP	Stabio	podcast
2-Sep	Thurs	9:00 AM	9:50 AM	4	Glia	Hughes	Ed2N-1107
		10:00 AM	10:50 AM	R1	Discussion on how to critically review literature in prep for NIN	Caldwell	Ed2N-1107
<b>WEEK 2</b>							
Watch these lectures by Thurs 9am →				5	Action Potential	Stabio	podcast
				6	Synapse and Summation	Stabio	podcast
				7	Neurotransmitters	Caldwell	podcast
				8	Receptors; Agonists/Antagonists	Caldwell	podcast
9-Sep	Thurs	9:00 AM	9:50 AM	NIN 0	Intro to VHD & Sample NIN	Weinkle & Stabio	Ed2N-1107
		10:00 AM	10:50 AM	R2	Review Q/A	Stabio & Haas	Ed2N-1107
<b>WEEK 3</b>							
Watch these lectures by Thurs 9am →				9	Telencephalon	Stabio	podcast
				10	Diencephalon	Stabio	podcast
				11	Neurofluids: Meninges, Ventricles, CSF	Stabio	podcast
				12	Neurofluids: Blood & Stroke	Stabio	podcast
16-Sep	Thurs	9:00 AM	9:50 AM	NIN 1&2	NIN Presentations	Caldwell	Ed2N-1107
		10:00 AM	10:50 AM	R3	Review Q/A	Caldwell & Haas	Ed2N-1107
17-Sep	Fri	1:00 PM	3:00 PM	Lab 1	Whole Brain ID & Slicing (wet lab) <i>(Pre-lab due prior to lab)</i>	Stabio, Salcedo, Caldwell, Finger & Haas	Ed 1: 5th floor cadaver labs
<b>WEEK 4</b>							
Watch these lectures by Friday 1pm →				13	Neuroimaging: CT & MRI	Stabio	podcast
				14	Neuroimaging: Forebrain in 2D & 3D	Stabio	podcast
					no review this week		
24-Sep	Fri	1:00 PM	3:00 PM	Lab 2	3D Brain Modeling (computer lab)	Stabio & Haas	Ed2N-1107
<b>WEEK 5</b>							
Watch this lectures by Thurs 9am →				15	Neuroimaging: fMRI & DTI	Stabio	podcast
30-Sep	Thurs	9:00 AM	9:50 AM	NIN 3&4	NIN Presentations	Caldwell	Ed2N-1107
		10:00 AM	10:50 AM	R4	Review Q/A	Caldwell & Haas	Ed2N-1107
1-Oct	Fri	1:00 PM	3:00 PM	Lab 3	White Matter Tractography (wet lab dissection & computer lab) <i>(Pre-lab due prior to lab)</i>	Stabio, Salcedo, Finger, Caldwell & Haas	Ed2N-1107
<b>WEEK 6</b>							
5-Oct	TUES	9:00 AM	11:00 AM	Exam 1	Exam 1 covers Lects 1-15 & Labs 1-3	Proctors	Ed2N 2201 ABDE





## UNIT III

DATE	DAY	START	END	#	TOPIC	WHO	WHERE
<b>WEEK 11 - Continued</b>							
Watch these lectures by Thurs 9am ➡				30	Intro to Motor Systems	Caldwell	podcast
				31	Basal Ganglia	Caldwell	podcast
11-Nov	Thurs	9:00 AM	9:50 AM	32	Cerebellum	Niemeyer	Ed2N-1107
		10:00 AM	10:50 AM	33	Cerebellum	Niemeyer	Ed2N-1107
12-Nov	Fri	1:00 PM	3:00 PM	Lab 9	Case Studies: Motor System Disorders <i>(Pre-lab due prior to lab)</i>	Caldwell & Niemeyer	Ed2N-1107
<b>WEEK 12</b>							
Watch these lectures by Thurs 9am ➡				34	Mesolimbic & Mesocortical Pathways	TBD	podcast
				35	Sleep & sleep disorders	Binford	podcast
				36	Hypothalamus & ANS	Salcedo	podcast
18-Nov	Thurs	9:00 AM	9:50 AM	R9	Patient Presentation	Stabio	Ed2N-1107
		10:00 AM	10:50 AM	R10	Review Q/A	Binford	Ed2N-1107
					no lab		
<b>WEEK 13</b>							
Watch these lectures by end of week ➡				37	Limbic System: Emotion	Salcedo	podcast
				38	Limbic System: Memory	Salcedo	podcast
				39	Disorders of memory (Alz)	Stabio	podcast
25-Nov					Thanksgiving		
					no lab		
<b>WEEK 14</b>							
Watch these lectures by Thurs 9am ➡				40	MH Disorders: Depression, Bipolar & Anxiety Disorders	Stabio	podcast
				41	MH Disorders: Schizophrenia	Stabio	podcast
2-Dec	Thurs	9:00 AM	9:50 AM	42	Pediatric Neuro & Epilepsy	Koh	Ed2N-1107
		10:00 AM	10:50 AM	R11	Review Q/A	Caldwell & Haas	Ed2N-1107
3-Dec	Fri	1:00 PM	3:00 PM	Lab 10	Case Studies: Rare Disorders <i>(Pre-lab due prior to lab)</i>	Stabio	Ed2N-1107
<b>WEEK 15</b>							
Watch these lectures by Thurs 9am ➡				43	Developmental Disorders	Caldwell	podcast
				44	Neuropathology	Moore	podcast
9-Dec	Thurs	9:00 AM	9:50 AM	45	Neurosurgery & DBS	Thompson	Ed2N-1107
		10:00 AM	10:50 AM	R12	Review Q/A	Caldwell & Haas	Ed2N-1107
10-Dec	Fri	1:00 PM	3:00 PM	Lab 11	Neuropathology (wet lab) <i>(Pre-lab due prior to lab)</i>	Stabio, Salcedo, Finger, Caldwell & Haas	Ed 1: 5th floor cadaver labs
<b>WEEK 16</b>							
15-Dec	Wed	9:00 AM	11:00 AM	Exam 3	Exam 3 covers Lects 30-45 & Labs 9-11	Proctors	Ed2N 2201 ABDE