

Human Physiology PCB 4701 Spring 2025

Course credit: 3 hours

Lecture: Tu,Th 9:45am - 11am, KIN 1024

Professor: Dr. Tom Houpt

Email: houpt@bio.fsu.edu

Student Hours: 2067 King Building,
Wednesday, noon to 2pm (or by appointment)

Teaching Assistant:

Physiology is the study of the function of the human body. What do I mean by function? Things like: How do we get oxygen from the air around us to the cells deep inside us? How does the brain detect the environment and process information? How does our body respond to seeing a bear? (see "fight or flight" in lecture 15 -- I recommend flight).

We will go over most of the major organs and processes of the human body: the brain and nervous system, heart and lungs, hormones, and digestion. Needless to say, understanding how the parts of the body work together will be useful in all manner of health professions and the life sciences, and as a review for exams like the MCAT.

A key skill you will learn is how to analyze a pathway, from biological causes to bodily symptoms. You'll literally learn, forwards and backwards the steps of functions (like how the stomach makes and secretes acid, or nerves generate electrical impulses, or what makes the heart beat faster or slower).

Identifying cause and effect in the body is critical to diagnosing patient's diseases. After all, a patient will never go see their doctor and say, "My hemoglobin isn't binding enough oxygen", but rather they'll say "I have a headache, I'm turning bright cherry red, and I'm losing consciousness" -- you'll have to reason backwards to figure out what's wrong (we'll find out in lecture 20).

This is NOT a biochemistry course, although we'll draw on what you've learned in your earlier chemistry courses about concentrations, pH, and some basic chemicals.

This is NOT an anatomy course, but there will be some body parts and tissues that we have to know to understand how organs function. I will provide very explicit guides on what anatomy you'll need to know on each exam (for example, I'll tell you ahead of time that you'll need to label Figure X in chapter Y).

Quizzes and Exams

We'll use TopHat in class to encourage attendance, and to double-check that you're getting the key points. Weekly quizzes on Canvas will be low stakes, but use real exam questions -- you'll be able to practice the same type of questions which appear on the exams, so there shouldn't be anything radically different or more difficult on the exams.

Lecture Schedule

Skills to be acquired are listed along with the lecture topics: the quizzes and exams will be designed to practice and assess these skills along with knowledge of the topic. The textbook chapter to be read along with each lecture are also listed.

Section 1: Neurons and Muscle

Lecture	Date	Topic	Ch	Knowledge	Skills	
1	Tu	7-Jan	6	Transport & Cell membranes: diffusion, osmosis, passive transport, active transport	Calculate diffusion, calculate osmolarity, recognize diffusion vs transporter (passive vs. active)	
2	Th	9-Jan	6	Membrane potential), channels	Calculate Nernst Equation, Goldman Equation; concentrations of key ions	
3	Tu	14-Jan	7	Neurons and excitable tissue: morphology, peripheral vs. central, properties of neurons (surface area, connections, myelination/glia cells, growth/no growth)	identify parts of neuron; predict consequences of nerve damage	
4	Th	16-Jan	7	Action Potential; cable properties of axon; neural coding	describe AP; identify individual components of AP & channels responsible; how Goldman/Hodgman Huxley predicts AP; effects of TTX; interpret neural spike code	
5	Tu	21-Jan	7	Synapses and Neurotransmitters (give neurotransmitters its own)	compare/contrast/recognize chemical vs. electrical synapse; recognize/predict inhibition vs. excitation; interpret spatial/temporal summation	
6	Th	23-Jan	12	Skeletal Muscle; neuromuscular junction; actin-myosin contraction	know <u>histology</u> of muscles; trace the events of the neuromuscular junction from nerve impulse to acetylcholine release to muscle contraction. understand and explain actin/myosin cycle; predict effects of toxin based on what it interferes with (neuron, synapse, muscle)	
7	Tu	28-Jan	12	Spinal reflexes, afferent and efferent spinal pathways, descending control of reflexes.	identify afferent vs. efferent branches of spinal nerves; learn parts of monosynaptic reflex, especially stretch and response; recognize loss of corticospinal inhibition; interpret synaptic delays	
E1	Th	30-Jan	Exam 1: Lectures 1-7 (21%)			

Section 2: The Nervous System

Lecture	Date	Topic	Ch	Knowledge	Skills	
8	Tu	4-Feb	8	Central vs. peripheral nervous system; majors part of the brain and spinal cord; cranial nerves; cortical lobes.	Identify the major lobes of the brain; interpret spinal cord injury affects on sensation	
9	Th	6-Feb	10	Touch receptors, motor cortex; object feature extraction;	learn somatosensory and auditory anatomy; understand function of receptor cells, and interpret effects of deficits in factors contributing to their function; recognize and explain stimulus transduction by receptors vs. cortical feature extraction	
10	Tu	11-Feb	10	inner ear anatomy, hair cell function, cochlear and auditory cortex coding; auditory feature extraction		
11	Th	13-Feb	10	Photoreception by rods and cones; wiring of the retinal neural network; responses of photoreceptors, bipolar cells, and ganglion cells to light	learn parts of retina; understand photoreceptor pathway; be able to predict effects of light vs. dark on photoreceptor currents; identify types of ganglion cells (on-center, off-center) from their electrical responses to light; understand retinal edge detection	
12	Tu	18-Feb	10	central visual pathways; simple vs complex V1 neurons; dorsal pathway (size, orientation) vs. ventral pathway (semantic content)	understand cortical feature extraction, identify simple vs. complex V1 neuron from responses to light; diagnose defects in visual pathways from visual field symptoms; distinguish ventral vs. dorsal pathway way (and effects of respective lesions).	
13	Th	20-Feb	9	anatomy and function of sympathetic and parasympathetic nerves. Autonomic synapses; cholinergic vs. noradrenergic G-protein coupled receptors	learn general anatomy of autonomic nervous system; predict effects of stimulating/inhibiting spinal cord/ganglia/target organs with ACh or Norepi	
14	Tu	25-Feb	9	Examples of Autonomic Nervous System: Pupil dilation & contraction; Sweating; Horner's Syndrome; Organophosphate Poisoning; Central Regulation of Autonomic Nervous System: brainstem; hypothalamus; Thermoregulation & Fever	Recognize symptoms of autonomic disorders, and diagnose the disease; identify toxins from their effects on target organs (reasoning backwards)	
E2	Th	27-Feb	Exam 2: Lectures 8-14 (21%)			

Section 3: Endocrinology and Cardiovascular Physiology

Lecture	Date	Topic	Ch	Knowledge	Skills
15	Tu 4-Mar	Endocrinology 1	11	The prerequisites for hormone action (presence of hormone, hormone receptors on target organ).types of endocrine diseases; parabiotic preparation	Know the action of leptin, and recognize db vs ob mice. Be able to explain and interpret a parabiotic experiment, to identify missing hormone or missing receptors.
16	Th 6-Mar	Endocrinology 2	11	The nature and function of hypothalamic pituitary axis; stress and the adrenal gland; metabolism and the thyroid gland.	Understand the diagnosis of Cushing's syndrome, Addison's disease, and thyroid disorders; practice probing feedback loops to identify the site of a deficit (hypothalamus, pituitary, gland, or target organ).
	Tu 11-Mar	<i>Spring Break – no classes</i>			
	Th 13-Mar	<i>Spring Break – no classes</i>			
17	Tu 18-Mar	Endocrinology 3	11		
18	Th 20-Mar	Heart	13	Anatomy of the heart, arteries, veins; understand the cardiac cycle	Learn the general anatomy of the circulatory system. Interpret an EKG; correlate events of cardiac cycle (sounds, pressure, electrical)
19	Tu 25-Mar	Blood and Vessels	13		
20	Th 27-Mar	Cardiac Output	14	The factors that determine cardiac output: heart rate, systolic volume, venous return	understand chronotropic vs. inotropic modulation of heart rate; role of sympathetic and parasympathetic nervous system in blood pressure; interpret manipulations on baroreceptor reflex; predicted effects of cardiac drugs
21	Tu 1-Apr	Blood Pressure	14	The factors that determine blood pressure: vasoconstriction and dilaton, oxygen needs	how to measure blood pressure; describe events of exercise
E3	Th 3-Apr	Exam 3: Lectures 15-21 (21%)			

Section 4: Respiration, GI, and Renal Physiology

Lecture	Date	Topic	Ch	Knowledge	Skills
22	Tu	8-Apr	Respiratory Physiology	16	
23	Th	10-Apr	Respiratory Physiology	16	
24	Tu	15-Apr	Gastrointestinal Physiology	18	
25	Th	17-Apr	GI Physiology, Glucose Dynamics	18 (19)	
26	Tu	22-Apr	Renal Physiology	17	
27	Th	24-Apr	Renal Physiology	17	
E4	Tu	29-Apr	Final Exam: Lectures 22-27		

Course Description

Physiology is the study of the physical and chemical bases of function of cells, tissues, organs, and their interactions. The focus of this course is mammalian systems with an emphasis on human physiology. The goal of the students is to learn the basic principles of physiological function. Such understanding will provide students the necessary preparation for advanced graduate/professional training and the entrance exams for these programs.

Prerequisites

General chemistry and 2,000-level core sequence in Biological Science. PCB 3134 Cell Structure & Function is highly recommended. You should be familiar with, and/or review, the information in chapters 1-5 of the Fox textbook.

Course Objectives

By the end of this course, the student will be able to:

- describe the anatomy of neurons and how neurons generate electrical and chemical signals, and be able to analyze mechanisms such as the action potential and neurotransmitter release, and the action of drugs on neuronal receptors.
- describe major sensory systems and motor output pathways by which the nervous system responds to stimuli and produces behavioral responses.
- describe the autonomic nervous system by which the brain monitors and controls unconscious physiological responses, and be able to analyze disorders or manipulations of the autonomic nervous system.
- describe some major endocrine systems (eg hypothalamic-pituitary-adrenal axis, insulin/glucagon, leptin, thyroid hormone) and be able to analyze the cause of endocrinological disorders.
- understand the cardiac and pulmonary systems, and be able to analyze changes in heartrate, cardiac output and blood flow to different organ systems, and changes in respiration and the flow of O₂ and CO₂ from atmosphere to tissues and back.
- describe the anatomy of the gastrointestinal tract, liver, pancreas and and kidneys, and how nutrients are digested, absorbed, processed, and waste products are eliminated from the body.
- analyze example clinical case studies for their underlying pathophysiology.

Textbook

Human Physiology (2021), 16th edition, by Stuart Ira Fox (the 13-15th editions are also acceptable).

FSU course-website

Assignments, lecture outlines, handouts, and practice exams will be posted on Canvas. Lectures may be updated on the evening before class, so it's worth checking. Recordings of lectures will be posted at <https://houptlab.org/courses/humanphys>

Top Hat

We will be using the Top Hat (www.tophat.com) classroom response system in class. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message. You can visit the Top Hat Overview

<https://success.tophat.com/s/article/Student-Top-Hat-Overview-and-Getting-Started-Guide>

within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system.

An email invitation will be sent to you by email, but if don't receive this email, you can register by simply visiting our course website: <https://app.tophat.com/e/054499>

Note: our Course Join Code is **922162**

Top Hat will require a paid subscription, and a full breakdown of all subscription options available can be found here: www.tophat.com/pricing.

Should you require assistance with Top Hat at any time, due to the fact that they require specific user information to troubleshoot these issues, please contact their Support Team directly by way of email (support@tophat.com), the in app support button, or by calling 1-888-663-5491.

Expectations & Requirements

All lectures will be in person (face-to-face), except in the event of illness or university closure. Attendance at lecture will not be recorded. However, the examinations will cover the lecture material, including material not in the posted Powerpoint presentations and not in the book. Therefore, attendance at the lectures is highly recommended! The text is also required reading, and may be covered on the exams.

Please turn off pagers, cell phones, etc. and refrain from talking when attending lecture (although questions are always welcome). Recordings are permitted for personal use only

Syllabus Change Policy

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

Grade Determination

Top Hat Participation (4% of final grade)

Beginning the 3rd lecture of class, periodic quizzes or discussion points will be raised in class using Top Hat. Because these in-class questions are designed to help track your understanding of the lecture, you won't be graded on your correct/incorrect responses -- but you will get credit just for participating. Because not everyone can attend every lecture every day, you can miss 1 out of every 5 lectures without penalty.

Quizzes/Problem Sets (12% of final grade)

There will be periodic Quizzes/Problem Sets posted on the course website on Canvas, in the Assignments section, before each weekend. Each problem set will cover 2-3 lectures worth of material. Answers to Quizzes/Problem Sets will be due before each upcoming exam.

Exams (84% of final grade)

There will be four exams throughout the semester. If a discrepancy develops between the material covered in the lecture, and the scheduled topics, the examinations will be only on the topics actually covered. Exams may include short answer or multiple choice questions. Bring a No. 2 pencil to exams! Exams will be held in KIN 1024. Note the Final is at 7am!

Date	% of Final Grade	Material Covered
30-Jan Thursday	21%	Lectures 1-7
27-Feb Thursday	21%	Lectures 8-14
3-Apr Thursday	21%	Lectures 15-21
29-Apr Tuesday 7am	21%	Lectures 22-27

Grade Assignment

Grades will be posted on Canvas. Grades will be assigned as follows:

A	100-93
A-	92-90
B+	89-87
B	86-83
B-	82-80
C+	79-77
C	76-73
C-	72-70
D+	69-67
D	66-63
D-	62-60
F	59-0

Exam grades may be adjusted by throwing out badly-formed questions, or by applying an (upwards) curve. Any adjustments will be announced to the entire class. Final grade

percentages are calculated to the nearest 0.01%, and then rounded to the nearest integer percent. For example, if the final grade percent is 89.45%, it is rounded to 90%; if the final grade percentage is 89.44%, it is rounded to 89%.

Make-Up Examinations

Any anticipated conflict with the hour examination (weddings, field trips, family obligations, etc.) must be discussed with the instructor during the first week of classes, so that alternate arrangements for taking the examination(s) can be made in advance. After the first week of classes, only legitimate emergencies will be accepted as valid excuses. A make-up exam may be arranged if: (1) the student contacted the instructor **prior** to the examination (houpt@bio.fsu.edu) and the student documents the fact that a legitimate emergency will prevent her/him from taking the examination - -if the instructor cannot be reached, a message must be left with the departmental office at 644-3700; or (2) the student documents the fact that a legitimate emergency prevented her/him from taking the examination (for example, a written notice from the Health Center indicating the student could not take the exam on the scheduled date) and contacts the instructor within 2 days after the exam date (if the instructor cannot be reached, a message must be left with the departmental office at 644-3700). If the above conditions are not met, the student will receive a "0" for the missed examination. Make-up exams should be taken within 1 week after the time of the missed examination.

UNIVERSITY ATTENDANCE POLICY:

Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

ACADEMIC HONOR POLICY:

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to "...be honest and truthful and...[to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at <http://fda.fsu.edu/academic-resources/academic-integrity-and-grievances/academic-honor-policy>)

AI and CELL PHONE POLICY

While AI can be helpful for studying and review of material, AI apps (ChatGPT, CoPilot, etc.), are **NOT** allowed on exams. Access to cell phones and computers are not allowed during exams. If the instructor or proctor catches a student using a cell phone during an exam, the exam will be confiscated and the academic honor violation procedure will be followed.

AMERICANS WITH DISABILITIES ACT:

Florida State University (FSU) values diversity and inclusion; we are committed to a climate of mutual respect and full participation. Our goal is to create learning environments that are usable, equitable, inclusive, and welcoming. FSU is committed to providing reasonable accommodations for all persons with disabilities in a manner that is consistent with academic

standards of the course while empowering the student to meet integral requirements of the course. Students with disabilities needing academic accommodation should:

- (1) register with and provide documentation to the Office of Accessibility Services; and
- (2) request a letter from the Office of Accessibility Services to be sent to the instructor indicating the need for accommodation and what type; and,
- (3) meet (in person, via phone, email, skype, zoom, etc...) with each instructor to whom a letter of accommodation was sent to review approved accommodations.

Please note that instructors are not allowed to provide classroom accommodations to a student until appropriate verification from the Office of Accessibility Services has been provided. This syllabus and other class materials are available in alternative format upon request. For the latest version of this statement and more information about services available to FSU students with disabilities, contact the:

Office of Accessibility Services
874 Traditions Way
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
oas@fsu.edu
<https://dsst.fsu.edu/oas>

ACADEMIC SUCCESS:

Your academic success is a top priority for Florida State University. University resources to help you succeed include tutoring centers, computer labs, counseling and health services, and services for designated groups, such as veterans and students with disabilities. The following information is not exhaustive, so please check with your advisor or the Department of Student Support and Transitions to learn more.

Free Tutoring from FSU

On-campus tutoring and writing assistance is available for many courses at Florida State University. For more information, visit the Academic Center for Excellence (ACE) Tutoring Services' comprehensive list of on-campus tutoring options –see <https://ace.fsu.edu/tutoring> or contact tutor@fsu.edu. High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.

CONFIDENTIAL CAMPUS RESOURCES:

Various centers and programs are available to assist students with navigating stressors that might impact academic success. These include the following:

Victim Advocate Program
University Center A, Rm. 4100
(850) 644-7161
Available 24/7/365
Office Hours: M-F 8-5
<https://dsst.fsu.edu/vap>

Counseling and Psychological Services
Askew Student Life Center, 2nd floor
942 Learning Way
(850) 644-8255
<https://counseling.fsu.edu/>

Services at UHS are available to all enrolled students residing in Florida:

The mission of University Health Services (UHS) is to promote and improve the overall health and well-being of FSU students. UHS provides a coordinated continuum of care through prevention, intervention, and treatment. Services include general medical care, priority care, gynecological services, physicals, allergy injection clinic, immunizations, diagnostic imaging, physical therapy, and a medical response unit. The Center for Health Advocacy and Wellness (CHAW) assists students in their academic success through individual, group, and population-based health and wellness initiatives. Topics include wellness, alcohol and other drugs, hazing prevention, nutrition and body image, sexual health, and power based personal violence prevention. For more information, go to <https://uhs.fsu.edu>.

University Health Services
Health and Wellness Center
960 Learning Way
Tallahassee, FL 32306
Hours: M-F, 8 am – 4 pm
(850) 644-6230
<https://uhs.fsu.edu/>