

Physiology of Human Systems- Zool. 4280
Fall 2009
Office hours- M and W- 10:05-11:30 a.m.
3483

Dr. Watson
Office – N276
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Prerequisite: Biol 3310, Chem 3010/3012

Corequisite: Zool 4282

Satisfies the physiology elective for the biology major

Brief course description

The human body, its function and mechanisms, is the focus of this class- Physiology of Human Systems (Zool. 4280). This course provides the scientific foundation for the field of medicine and all other technologies related to human health and physical performance. The scope of topics included in this course is therefore wide-ranging. Subject matters included are: membrane transport, nerve excitation, muscle contraction, cardiovascular, respiratory, and renal physiology, neuro-endocrine functions, reproduction, and digestion. Each topic is covered in sufficient detail to provide a firm basis for future expansion and application.

To keep pace with today's rapid advances in the health sciences, students must be able to draw on their conceptual understanding of physiology. The course is designed to promote understanding of the basic principles and concepts of physiology instead of rote memorization. This course focuses on seven recurring general models that are used to explain most physiological systems. The verbiage may vary from organ system to organ system; however, the underlying mechanisms utilized by the organ systems are very similar. These general models are control systems, conservation of mass and heat flow, elastic properties of tissues, transport across membranes, inter- and intracellular communication and the law of mass action.

The mechanisms of body functions from cells to systems are organized around the central theme of homeostasis- how the body meets changing demands while maintaining the internal constancy necessary for all cells and organs to function. Furthermore, because anatomy is not a prerequisite course, enough relevant anatomy is integrated within the material to make meaningful the inseparable relation between structure and function. At the end of the course the students will be able to integrate related physiological concepts using the recurring general models, and understand the relationships between anatomical structures and their functions.

In addition to learning about the basic principles and concepts of physiology, the course will also provide students with opportunities to collaborate and cooperate in designing their own laboratory research. Research, writing and speaking skills will also be included in this course. Each student is required to present to the class in power point one lab

reports in the format of the scientific method and one library research presentation, topic of his/her choice.

Course objectives

The students will:

1. Describe how the body works, from the molecular level to organ systems and to the whole body
2. Explain the importance of physiology in modern medicine.
3. Examine the role of the scientific method in the study of physiology as it relates to evaluating evidences and drawing logical conclusions.
4. Examine the tissue level of organization and interpret the role of tissues in human systems. Compare and contrast the location, organization and function of the four basic classifications of human tissues.
5. Define homeostasis and explain how this concept is used in physiology and medicine.
6. Describe the nature of negative and positive feedback loops and explain how these mechanisms act to maintain homeostasis.
7. Distinguish between intrinsic and extrinsic regulation and the roles of nervous and endocrine systems.
8. Examine and describe the major features and functions of the cardiovascular, respiratory, muscular, digestive, immune, reproductive, and renal systems and their contributions to homeostasis.
9. Describe the relationship between homeostatic imbalance and diseases in each of the organ systems.

Method of Instruction

This course will involve lectures, class discussions and lab. Reading assignments are required for discussion during class. Active learning and problem solving skills will be developed during class discussion. Students are expected to develop important skills of applying physiological information and integrating the facts of physiology into conceptual models of physiological phenomena. Each phenomenon/problem is presented in stages. Students are expected to complete each section and discuss the solution to the part **before** proceeding to the next component of the problem. Two main tools for solving these physiological problems are the use of prediction tables and drawing of concept maps/flowcharts.

The prediction table is a simple way to make qualitative predictions (increase, decrease, no change) about the responses of specified components that result from a situation described in the problem. The construction of concept maps or flowcharts of physiological events

requires utilization of information and concepts acquired from lecture or the text to explain the described phenomenon.

Evaluation and Grades

There will be a mandatory power point presentation (40 points) focused on physiological homeostatic imbalances of a specific organ system. Library research topic, outline, and at least three journal references. This assignment is worth 10 points, and is due during lab periods on Monday Oct.5 or Wednesday Oct.7. The oral report will be graded according to presentation, information and discussion of chosen topic(s). Three questions pertaining to your presentation and their appropriate answers must be included with the power point presentation. These questions with answers should be entered in a file on the desk computer in lab. Failure to complete the power point presentation will result in a deduction of 50 points from your final grade.

Due to the quantity and complexity of this subject, students need to attend class and lab on a regular basis. **Unannounced** quizzes, approximately 15% of the grade, will be given in class. Bonus points may be given during these quizzes. These quizzes are to encourage students to be present and prepared for class. No other extra credit will be available in this class.

Exams will be combinations of multiple-choice questions, fill in the blanks, and essays. You need Scantron Form No. 882-E for each exam and a number-2 pencil and a good eraser. It is the students' responsibility to transfer the correct answers from the exam to the scantron; **only the answers from the scantron will be accepted**. Both lecture materials and information assigned from the textbook will be included in the exams. The given schedule is a **tentative outline and is subject to change**. The final exam will be comprehensive. Information presented from students' Power Point will also be included in the final exam.

You may not leave the room during an exam without the instructor's permission. You must turn off cell phones and remove baseball caps during exams. Taking out a cell phone during an exam is considered as cheating. You will receive a grade of F for that exam. No food or drinks are permitted during exams.

Grading is based on unannounced quizzes, a Power Point presentation, three exams, lab report, and lab exams. **NO make-up quizzes will be given**. You may drop one quiz at the end of the semester. Please let me know ahead of time (preferably a week in advance) if you cannot take the exams as scheduled. If you are sick or have family emergency, please let me know before the exam. You need to provide official documentation and an essay make-up exam will be scheduled.

There is zero tolerance for academic dishonesty. Any form of academic dishonesty will result in an F grade for the course.

Grading scale:

100-94% =	A	93-90% =	A-	89-87% =	B+
86-84% =	B	83-80% =	B-	79-77% =	C+
76-74% =	C	73-70% =	C-	69-67% =	D+
66-64% =	D	63-60% =	D-	Below 60% =	F

Please include the following table with your lab report

Grading for lab report:

Your grade

Abstract	5 points	
Introduction	5 points	
Methods	5 points	
Results-text	5 points	
Results- figures/tables	5 points	
Discussion	8 points	
Conclusion	3 points	
Clarity, general grammar and mechanics	5 points	
References	4 points	
Peer reviewer	20 points	
Power Point	20 points	
TOTAL	85 POINTS	

Evaluation for power point presentation:

Statement of research topic/hypothesis	4 points
Information from recent journal(s)**	12 points
In depth discussion of topic. Clear explanation of physiological mechanisms	16 points
Overall oral presentation--organization/clarity	8 points
Overall understanding of his/her materials	
Total	40 points

** **More** information will be given in class

Tentative grading- subject to change!

6-7 quizzes (lab and lecture) @ 15 points each	90-105 pts
Two exams @ approximately 90 (+/- 10) points each	180-200 pts
One final exam @ approximately 200 (+/- 20) points	180 pts
Student presentation questions given at final exam	48 pts
Library research topic and outline by Oct. 5/7	10 pts
1 research Power Point presentation	40 pts
1 lab reports with power point + 2 reviews (10 points each)	85 pts
Lab (3) abstracts/reports <u>from three labs</u>	30 pts
Lab exams (3)	170 pts
Total (+/- 20) =	853 pts

Physiology of Human Systems (Zool 4280) Lecture Schedule
Fall 2009

Course objectives: To study human physiology at cellular and organ system levels: Membrane transport, nerve excitation, muscle contraction, cardiovascular, respiratory, renal physiology, neuro-endocrine function, reproduction, and digestion.

Text: HUMAN ANATOMY AND PHYSIOLOGY, Eighth Edition by Elaine Marieb and Katja Hoehn

Tentative lecture schedule

DATE	TOPIC	CHAPTER
9-9	Introduction: The Meaning of Physiology The Human Body-Levels of Organization Homeostasis	1
9-11	Chemical Compositions of the Body Enzymes and Energy	2
9-14	The Plasma Membrane: Functions Tissues: The Living Fabric	3
9-16, 18	Fundamentals of the Nervous System	11
9-21, 23	Central Nervous System	12
9-25, 28	The Autonomic Nervous System	14
9-30	<u>EXAM 1 (October 6 -last day to drop a course)</u>	
10-2, 5	The Endocrine System	16
10-7, 9	The Reproductive System	27
10-12, 14	The Cardiovascular System- Blood	17
10-16, 19, 21	The Heart	18

10-23, 26	Blood Vessels	19
10-28	<u>EXAM 2</u>	
10-30 11-2,4,6	The Lymphatic and Immune System	20, 21
11-9, 13, 16	The Respiratory System	22
11-18, 20, 23	The Muscular System	9
11-25, 30 12-2	The Urinary System	25
12-4, 7, 9	The Digestive System	23
12-11	Nutrition, Metabolism, and Body Temperature	24
12-15	<u>Final exam (8:30A - 10:30A)</u>	

Due to budget cuts imposed upon the CSU, the department of Biological Sciences Faculty and Staff will be observing unpaid furlough days throughout the semester. No classes will be held on furlough days; however, you are responsible for materials assigned on these dates. Below is the tentative furlough day schedule for this course: 9-25-09 (Friday), 10-12-09 (Monday), 11-23-09 (Monday), and 11-25-09 (Wednesday). Furlough days may subject to change.

Objectives: To analyze physiological systems using the seven recurring general conceptual models.
In addition, exercises and experiments will be conducted to study the principals of physiology with special reference to the human body.

Tentative lab schedule

<u>Biopac Student Laboratory Guide</u>	Biopac Systems Inc. Manual
<u>Physiology of Human Systems Laboratory Guide</u>	F. Watson
PhysioEX 8.0 Laboratory Simulations in Physiology	P. Zao, T. Stabler, G. Peterson

<u>DATE</u>	<u>TOPIC</u>	<u>SECTION</u>	<u>PhysioEx</u>
9- 9, 14	Getting Started - Laboratory safety guidelines Introduction of general conceptual models Homeostasis and Negative Feedback Tissues (Monday lab)	Video-Human Body Biopac Tutorial Homeostasis.htm Tissues.htm	
9-16, 21	Dissection Tissues (Marieb text- Ch 4) Introduction of Biopac	Intro.htm Tissues.htm	
9-23, 28	The Scientific Method Concept mapping, flow charts, prediction tables, graphs & tables Tissues and organs Transport mechanisms	Tissues.htm	PhysioEx1 #2,3,5,and 6
9-28, 30	Diffusion, Osmosis, and Tonicity <u>Submit topic of your library</u>	Transport.htm	

research

10-5, 7	Lab exam on tissues		
	<u>Research topic/outline/References (10 pts)</u>	Plasma glucose.htm	
	Cell Functions and Biochemical Measurements		
	Neurophysiology	Vision.htm	PhysioEx 3
	Nervous System (Mon lab)	Ear.htm	#1 to 7
	Hearing and Equilibrium		
10-12, 14	Nervous System	Vision.htm	PhysioEx 4
	Hearing and Equilibrium	Ear.htm	# 5,6,7
	Mammalian Eye		
	The Endocrine System		
	10-12-09 Furlough Day		
10-19, 21	Cardiovascular system		
	Blood Pressure and Heart Sounds	Biopac 7	PhysioEx 6
	Components of the ECG, ECG and Pulse		#1 to 8
10-26, 28	Exam 2		
	Respiratory Cycle	Pulmonary.htm	
	Lab/library research presentation	Biopac 12	
		Biopac 13	
11-2, 4, 9	Respiratory Cycle		PhysioEx 2
	Lab/library research presentation		#1 to 7
11-16, 18	The Muscular System	Biopac 1	
	Lab/library research presentation	Biopac 2	
11-23, 25	Acid/Base Balance		PhysioEx 10
	Furlough Days		# 4-9
11-30, 12-2	Renal Regulation of Fluid and electrolyte Balance,	Renal.htm	

Urinalysis
**Lab/library research
presentation**

12- 7, 9 **Final exam
Lab/library research
presentation**

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There will be a total of 3 **abstracts/reports per group of three students and one lab report (PI system) per student**. The abstracts and report must be **typed** and are due two weeks after the experiment is finished. This lab report should include an oral (Power Point) presentation and a written report, which **must be typed and presented in the format of the scientific method, which includes an abstract, background research, hypothesis, methods, materials, data presentation, discussion, conclusion, and references.** Oral presentations should not exceed 15 minutes (if necessary, a timer will be used to limit the presentation to 15 minutes). Late lab reports are **penalized 10 points a day**. Lab report that is not received by the end of the semester will be penalized by 100 points.

Be sure to read and download your lab assignment before coming to lab. At the beginning of each lab, organize your lab space and get all necessary instruments and reagents. Be aware of what you and your lab partner(s) are doing. You **may not** use the lab computer to download your lab or lab report. At the end of each lab, clean and dry your glassware, place them in the proper drawers, and return all supplies to their proper locations. Clean your lab area with soap and water. You are responsible for any missing and broken items in lab. **You will NOT receive a grade** until you pay your bill for any missing/broken items.

NO FOOD OR DRINK is allowed in lab. Attendance is required in this class. Due to the complexity of the experiments, no make-up labs are available. **Ten points per lab will be deducted from your grade if you miss more than one lab.**

Library research Power Point presentation assignment

This presentation should focus on physiological homeostatic imbalance of a specific organ system. The literature should be from scientific refereed journals within the last five years. The research presentation (40 points) will be presented to the class on assigned dates in lab (sign up sheets will be circulated in class).

You need to familiarize yourself with the subject matter. Power-point presentation should include a recent article from the journals you used in your paper. The method, results and

discussion of the paper should be summarized and presented to the class. This serves to inform the class and me the latest research in the specific physiological mechanism. The presentation should be about 10-15 minutes in length. Information from your presentation will be included in the final examination, so be sure to make your presentation simple, precise, and understandable by your colleagues. Please encourage the class to discuss the physiological mechanisms involved in your topic of research (use one of the seven general conceptual models discussed in lab). Handout of your outline would be helpful to your classmates. Furthermore, your fellow colleagues have the opportunity to critique your presentation. The goal of this assignment is to give you an opportunity to research in a specific area of your choice, improve verbal communication, and critical thinking skills. Failure to complete the presentation will result in a deduction of 50 points from your final grade.

Steps for carrying out the assignment:

Scientific Article Selection:

Spend some time in choosing an organ system that you are interested in, then decide on a specific topic (from one of the journal articles in the binder) you would like to study. Go to the library and research the topic you have chosen.

Collect and read a few (at least three) articles that emphasize the topic of your interest from three different scientific journals available from the library at CSUSTAN or other libraries. Only select journal issues published since 2004. By using current journals the students are exposed to the most current research that is not found in the textbook. ***The date you need to have a topic is September 28th (Monday Lab), or September 30th (Wednesday Lab).***

Submit an outline (October 5th or 7th):

The next assignment is to submit an outline for your research presentation. Be sure to include the physiological mechanisms/ homeostatic imbalances that are unique to your research topic. List the references you have chosen for this research paper. ***The date you need to have this assignment finished is October 5 or 7, 2009.*** You may add more references as you finish your paper. If you failed to turn in your outline, 10 points will be deducted.

How to document literature cited?

When citing references in the text, use --“Watson (2004)”. If there are more than two authors use -- ”Watson et al. (2004)”; however, cite all names in the Literature Cited section. Provide multiple citations in alphabetical order, for example, Ashe (2002), Baylor (1999), and Watson (2004). When quoting journals, do not use abbreviations in the Literature Cited section. Pay close attention to the use of punctuation and capital letters. There are periods that follow name(s), year, and title. The title is followed by two blank spaces after the year. In all book citations include the total number of pages. A few examples are given below:

Bold, H. C. and J. W. La Claire. 1987. The plant kingdom. Fifth edition. Prentice-Hall, Englewood Cliffs, New Jersey, 309 pages.

Carlisle, D. B. and F. Knowles. 1959. Color change. (Chapter 3). Pages 40-69, in Endocrine control in crustaceans. Cambridge University Press, 119 pages.

Slatis, H. M., M. B. Katznelson, and B. BonneTamir. 1976. The inheritance of fingerprint patterns. American Journal of Human Genetics, 28:280-289.

Sunderland, N. and M. Roberts. 1997. New approach to pollen culture. Nature 270:236-238.

Final touches on your presentation:

Two days after you finished your presentation, reread and revise your Power Point. You may have more questions on your topic and may want to do more research at this point. Proof read your final draft. Let your colleague or lab partner proofread it as well. **Email your final Power Point** to me at the assigned date of your presentation. Each student will have his/her own date. Any postponement will be penalized 5 points per day.

Evaluation criteria (PowerPoint presentation)

The presentation will be evaluated according to the following questions.

- Did the student clearly state the purpose and subject of the paper?
- Did the student know the subject matter he/she is presenting?
- Is the physiological mechanism adequately explained?
- Did the student explain **clearly (easy to understand)** the physiological mechanisms that affect the homeostatic imbalance of the organ system?
 - Did the student finish within 15 minutes?
 - Did the student answer questions confidently and adequately?
 - In the presentation, are all data sources carefully documented?
 - Is the presentation scientifically correct, logical, coherent, and well organized? (For example: Is there a distinct introduction, body, and conclusion? Is the material organized for best emphasis?)
 - Is the Power Point carefully proofread and edited so that errors of grammar, spelling, and punctuation are minimal?

Abstract writing:

Write your abstract as a comprehensive, objective summary of the scientific study. This should include-- who did the study, the purpose of the study, and the method of the study, details about the results (graphs and tables), statistical results (if any), and the researcher's conclusions. The abstract should be written in the past tense using the third person (do not use "I" or make references to yourself or your beliefs). Quotations should be limited and

even avoided. Use careful attention to keep mechanical errors (spelling, grammatical and punctuation) to a minimum. These errors will be considered in the overall grade. An abstract will NOT be accepted if ANY portion of the content is found to be plagiarized. Each abstract must be presented on a separate sheet of paper. The length of each abstract is limited to one page, and it must be typed. Examples of abstract are posted on the side cabinet doors in N229.

General Models in Physiology

General models are paradigms or tools that can be utilized to explain a variety of physiological mechanisms. The concepts from these models can be applied repeatedly to virtually all physiological systems albeit the verbiage used for each organ system is different. The ability to understand how these general models operate will permit the students to solve specific physiological problems and develop an understanding of integrated physiology instead of rote memorization as we move from organ system to organ system. For example, a saw can be used to cut wood, plastic or metal, and depending on the job, different blades are used. The procedure for operating the saw remains very similar. Similarly, these general models in physiology can be used as basic tools to understand the complexity of many physiological mechanisms.

<u>General Model</u>	<u>Components</u>	<u>Relevant topics</u>
Control systems	Sensor, comparator, controller, "set-point", feedback signal	Regulation, negative feedback, positive feedback
Conservation of mass Reservoir	"compartment" with input and output	Mass balance, indicator dilution
Mass and heat flow	Driving force, resistance, flow	Pressure-flow relationships, diffusion, osmosis, ion flow, heat flow
Elastic properties of tissues	Transmural pressure, compliance (1/recoil)	Pressure volume relationships, length-recoil relationships
Transport across membranes	Driving force, phospholipid bilayer, "permeability"	Simple diffusion, osmosis, carrier-mediated transport (facilitated diffusion, cotransport, primary active transport)
Cell-to-cell communication	Signal molecules (or ions), receptor	Chemical synapses, electrical synapses, hormone action, paracrines
Molecular interaction (mass action)	Reactant, products	Mass action, equilibrium/dissociation constants, ligand binding

Lab Policies

Infractions of any of these policies will result in the docking of 5% of your total lab points for each incident.

You are required to stay until your lab group has finished the exercise and your workspace and glassware has been cleaned and returned to its appropriate place.

You are required to stay during student presentations, leaving early will result in an absence for the day.

The printer in the lab is for recording data from BioPac and PhysioEx exercises only, you will not be allowed to keep other materials printed using the laser printer.

Broken glass belongs in the labeled glass disposal containers and paper and plastic in the regular trash.

You are responsible for the equipment checked out to you for each lab. Lost or broken equipment will be charged to the group and must be paid for before grades will be released.

No Food or Drinks will be consumed in the lab.

Cell phones must be turned off and put away during lab, leaving lab to talk on the phone is considered an absence.

Computers are to be used for laboratory exercises, Biopac and PhysioEx, not checking email or surfing the net. No programs, files, or pictures may be downloaded to the computers in lab. You need to bring a flash drive if you want to save your data. Once the computer is turned off, whatever you saved prior to shut down will be gone.

Bare feet are not allowed, and shoes with tops (vs. thongs or sandals) are recommended.

Microscopes, regardless of the condition they were previously put away in, must be put away properly and have clean optics.

Attendance is mandatory; you may miss one laboratory period without affecting your grade. Most labs will last three hours. All further missed labs and/or partially missed lab--including lab periods when you leave while your partners are still working, or when students are presenting (Power Point), or when you are working/studying on courses other than physiology, will result in a loss of 10 lab points per lab.

