

## Physiology and Functional Anatomy I: (Bio 40000) – Syllabus, Fall 2007

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### Course Objectives: By the end of this course you should:

1. Understand how analysis of lever systems can explain how muscles create movement
2. Understand the anatomy and physiology of muscle and how muscle force production depends upon the level nervous system activity
3. Understand how action potentials occur, how they propagate within a neuron, and how they are communicated through synapses from one neuron to another
4. Understand how circuits of neurons can produce simple reflexes
5. Understand how the cerebral cortex and brain stem control posture and movement
6. Be able to use techniques for computerized data collection, analysis and presentation
7. Be able to simulate neuronal activity using computers
8. Be able to write a scientific paper summarizing current research
9. Be able to prepare an oral presentation.

	<b>Lecture</b>	<b>Assignment</b>	<b>Lab</b>
<b>Aug. 28</b>	Course organization; Biomechanics	handout	Anatomical and movement terminology, skeleton
<b>Sept. 4</b>	Bone; anatomy of muscle, cellular basis of muscle contraction	handout	Lecture review, Biomechanics I: torques, classes of lever systems, mechanical advantage
<b>Sept. 11</b>	Excitation-contraction coupling, force production, tension/length/velocity relationships	handout	<b>No lab</b>
<b>Sept. 18</b>	<b>No lecture (Fri. schedule)</b>		Biomechanics II., mechanical advantage, vector analysis, lab review
<b>Sept. 25</b>	Force transmission, muscle types, twitches, tetanus, motor units, recruitment, fatigue	NS 396-407	Lecture review; Muscle contraction in vitro.
<b>Oct. 2</b>	Intro to neurons, gradients and membrane transport, membrane potentials, excitable membranes	NS 1-11, 25-36	Physiology of frog muscle
<b>Oct. 9</b>	Excitable membranes, action potentials, propagation of electrical signals, synaptic transmission	NS 37-60	Computer simulations of electrochemical potential, neurosimulations, lecture review
<b>Oct. 16</b>	Temporal and spatial summation, neuron-neuron interactions, neural activation of muscle cells	NS 85-118	Neurosimulations (action potentials)
<b>Oct. 23</b>	Organization of central and peripheral nervous systems;	NS 12-22,	Neurosimulations (synaptic potentials) and lecture review
<b>Oct. 30</b>	<b>Midterm</b> (material through Oct. 16)		Arm EMGs <b>NO QUIZ</b>
<b>Nov. 6</b>	Proprioception and spinal reflexes, gamma motor neuron system, brainstem anatomy	NS 215-7, 408-414, 822-7	Midterm and lecture review
<b>Nov. 13</b>	Brainstem control of movement; vestibular system, posture, central pattern generators	NS 343-362, 414-431	Oral presentations 1-2

<b>Nov. 20</b>	<b>No lecture (Thurs. schedule)</b>		<b>Wed: No lab</b> <b>Thurs. (lab on Tuesday):</b> Oral presentations 3-4
<b>Nov. 27</b>	Locomotion	NS 432-451	Eye muscle and mvmts (read: NS 495-510), lec review
<b>Dec. 4</b>	Cerebral cortex and voluntary movement. Modulation of motor activity by basal ganglia.	NS 453-474	Wed: Oral presentations 3-4 Thurs: Oral presentations 5-6
<b>Dec. 11</b>	Cerebellum; Smooth muscle, Autonomic nervous system	handout, NS 475-94, 513-41	Wed: Oral presentations 5-6 <b>Thurs: no lab</b>

Text: *Neuroscience* (NS), 4<sup>th</sup> edition. Purves et al, Sinauer, 2007

Handouts: *Biomechanical Basis of Human Movement* (H&K), Hamill & Knutzen, Lippincott, 2003

Human physiology (R&P), Rhoades & Pflanzler, Thompson, 2003

### **Handouts, cyberreadings (tentative list)**

Aug. 28 – Hamill & Knutzen 13-25, 32-38, 52-54, 389, 391-393;

Sept. 4 – H&K 61-73, Rhoades & Pflanzler 478-486, 496-504;

Sept. 11 - R&P 489-96;

Sept. 25 – R&P 108-132;

Dec. 11 – R&P 476-515 (material on smooth muscle)

### **Laboratories (Rm. MR-805)**

There is a four hour lab section every week (see syllabus for exceptions). In the labs, you will gain familiarity with several experimental methodologies used by movement researchers as well as increase your skills in experimental design and data analysis. Several of the laboratories are designed to help you better understand the lecture material. You will also gain experience in making oral presentations. Finally, the labs will provide new material that will supplement the lectures. The laboratories will be of several different types:

- Gaining familiarity with movement anatomy and spatial terminology
- Modeling of biomechanics
- Experimental (in vitro muscle, frog muscle, arm EMG, eye movements)
- Computer simulations (diffusion, membrane potentials, action potentials, synaptic transmission)
- Lab oral presentations -- for the most part these will occur toward the end of the semester

Quiz: Beginning in the second week, every laboratory will start with a short 15-20 minute graded quiz on work covered in the previous lab, assigned readings from the current lab and that week's lecture, and material from the previous lab's oral presentations (if any). If you miss more than **two** lab quizzes you will be told to withdraw from the course. Make-up quizzes are not available.

Lecture review: Every two weeks or so there will be a lecture review section after the quiz. Come prepared with questions! You will be called upon!!

**Attendance – Missing more than two laboratories will require your withdrawal from the course!!!**

**Assessment** -- Grade assessments include one midterm, a comprehensive final exam, weekly quizzes, lab reports/ problem sets, a 15-20 minute oral presentation (PowerPoint), and a 5-7 pg.

term paper (see separate handout). Class and lab participation is very important and can make a difference if you're on the borderline between two grades!!!

All material covered in lectures and supplemental material covered in labs are examinable in the midterms and final exam. You will be informed if other material is to be covered. The final exam will be cumulative and will in part aim to integrate the various components of the course.

Tests and quizzes will have a heavy problem-solving component. Unless provided with a medical certified reason for missing a test or exam, there will be no opportunity to reschedule tests or any retakes.

**GRADING -- Midterm – 20%; FINAL – 33%; Lab quizzes – 12%; Lab reports/ problem sets – 12%; Oral presentation – 10%; Term paper – 10%; Participation – 3%**

In order to get an A or B grade you will have to work hard and put in at least 6 hours of study or preparation time per week in addition to classroom time.

**Plagiarism** -- This class has zero tolerance for plagiarism (see handout).