

PCB 4717 U03, BSC 6936 U01: Motor Neurobiology, Spring 2018, 3 credits

Class: Tue, Thur, 12:30-1:45p, GL 165
prereq: General Biology I & II
text: *Principles of Neural Science*, 5th ed.
Kandel, Schwartz, Jessell, Hudspeth, Siegelbaum
McGraw-Hill, New York, 2013
website: <http://faculty.fiu.edu/~theobald/courses/motor-systems/>

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Description and learning goals

Your body has over 600 skeletal muscles, and all the walking, chewing, driving, breathing, gazing, and playing as you get through the day will require you to execute many millions of perfectly gauged and timed muscle contractions. Even tiny errors cause you to trip, choke, crash your car, or get caught by predators. The daunting task of producing and organizing these motions involves limbs, joints, muscles, motor neurons, and remarkable computation from the central nervous system. To understand how animals move, we will study the cellular and molecular process of muscular force production, the operation of motor neurons, kinematics and dynamics of joint motion, and the planning and execution of complex motions. By the end of this course you should be able to define all the technical terms that describe motor systems, explain the forces that produce muscle contractions and joint movements, and predict the outcome of variations, disorders, and experiments that alter motor control by the nervous system. Your aim is to be able to read, understand, and explain a published, scientific article in this field, and further to appreciate how your own body generates work and action.

Grading

3 exams (20, 25, and 30%) + homework (10%) + presentation (15%)

The exams will be short answer. They aren't explicitly cumulative, but understanding previous material is necessary. They will only cover topics that I've done in lecture, but doing well will require you to think through problems you might not have seen before—in other words, rote memorization won't carry you through by itself. The intent is to get you to think hard about the material and ask questions when something doesn't make sense. To do well, nothing is more important than completing the homework, reading ahead, attending class, and asking questions when you don't understand something. I'll curve exams by scaling the scores to the top score. For example, if the top score is 90%, I'll divide every score by 0.9 to get the recorded score. You can make up a missed exam only if you provide written documentation of the emergency that kept you away. Everyone will give an oral presentation on a topic in the motor neurobiology literature. Meet with me early in the term to discuss a presentation to be given to the whole class.

Finally, grade assignments will follow a simple scale of: 90% or better = A, 80% or better = B, 70% or better = C, 60% or better = D, otherwise fail. Scoring within 1% of 90 or 80 will get you a +, for example 89% will earn a B+. Please make yourself aware of the university policies on academic misconduct and sexual harassment, and then don't do those things.

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Schedule

week	date	topic	reading
1	9 Jan	Introduction to motor neurobiology	
	11 Jan	Ion channels	Kandel 100-110
2	16 Jan	Membrane potential	Kandel 126-135, 138-148
	18 Jan	Action potentials	Kandel 148-158, 162-164
3	23 Jan	Electrical and chemical synapses	Kandel 177-178, 189-208
	25 Jan	Motor units and muscle fiber contraction	Kandel 768-780
4	30 Jan	Other systems, catch muscle, asynchronous muscle	
	1 Feb	<i>Article</i>	TBA
5	6 Feb	<i>Review</i>	
	8 Feb	Exam 1 – Muscle electrophysiology	
6	13 Feb	Activation strategies	Kandel 780-788
	15 Feb	Joints and forces	
7	20 Feb	Muscle types, force and fatigue	
	22 Feb	Muscle physics and biomechanics	
8	27 Feb	Spinal reflexes	Kandel 790-810
	1 Mar	Pattern generation	Kandel 812-821
9	6 Mar	Locomotion	Kandel 821-833
	8 Mar	<i>Article</i>	TBA
10	13 Mar	<i>Spring break</i>	
	15 Mar	<i>Spring break</i>	
	20 Mar	<i>Review</i>	
	22 Mar	Exam 2 – Activation and biomechanics	
11	27 Mar	Motion planning and feedback	Kandel 743-761
	29 Mar	Motor learning	Kandel 760-766
12	3 Apr	Gaze and posture	Kandel 894-906, 935-943
	5 Apr	Motor control	Kandel 835-843
13	10 Apr	Motor commands	Kandel 843-863
	12 Apr	Muscle and movement disorders	
14	17 Apr	Play and sports	
	19 Apr	<i>Article</i>	
15	24 Apr	<i>Review</i>	TBA
	26 Apr	Exam 3 – Motor control and coordination	