# Neurobiology: ZOO 4744 and ZOO 5785, Fall 2018, 3 credits

class: Tue, Thur, 12:30-1:45, VH 131
prereq: General Biology I & II
text 1: *Principles of Neural Science*, 5th ed.
Kandel, Schwartz, Jessell, Hudspeth, Siegelbaum
McGraw-Hill, New York, 2013
text 2: *An Anthropologist on Mars*
Oliver Sacks, Picador, 1995
web: *http://faculty.fiu.edu/~theobald/courses/neurobiology/*

Jamie Theobald, PhD
Biological Sciences
Office: OE 204
Hours: Tue, Thur, 10:00a-noon
phone: 305 348 7319
email: *theobald@fiu.edu*

**Description and learning goals**
Neurobiology—the of study what nervous systems do and how they do it—is one of the great frontiers in modern science. How does a honeybee land on a flower, or a turtle find the beach of its birth decades later? Why do you sleep and dream? How does a pitcher throw in the strike zone, or a hitter attempt to connect? Why are things blue, or warm, or bitter? And how is someone suffering from schizophrenia experiencing the world, and is there any way we can help? These questions sample the enormous field of neural science. This course will examine neural function at the levels of molecules and cells, systems and physiology, and finally development and behavior. We will discuss the history of experiments and model organisms that have brought us to our current level of understanding. By the end of this course you should be able to: explain the physical, molecular, and cellular basis of active membranes; predict how molecular changes affect large scale function; compare transduction and encoding in different sensory systems; understand the production of coordinated movement; follow developmental processes that build the nervous system; and assess the role of experience, learning, and other high level processes in shaping behavior. Depending on questions and interest, I may add topics, or drop some that we don't get to. I would rather skip sections than rush through material.

**Grading**
ZOO 4744: 3 exams (25, 30, and 35%) + in class written questions (10%)
ZOO 5785: 3 exams (20, 25, and 30%) + in class written questions (10%) + presentation (15%)
The exams will be short answer and plotting. 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. The intent is to get you to think hard about the material and ask questions when you don't understand. **Nothing is more important than regular attendance and asking questions.** I'll curve exams by scaling all 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. Graduate credit requires a presentation on a topic in the neurobiology literature given to the whole class. Meet with me early in the term to discuss.

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.

Most importantly, try to have fun as you study the nervous system, a field that has become the most awe-inspiring scientific endeavor in human history!

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| week | date | topic | reading |
|---|---|---|---|
| 1 | 21 Aug | Introduction and structure | |
| | 23 Aug | Ion channels | Kandel 4, 5 |
| 2 | 28 Aug | Membrane potential | Kandel 6 |
| | 30 Aug | Passive signaling | Sacks 1 |
| 3 | 4 Sept | Action potential generation | Kandel 7 |
| | 6 Sept | Action potential propagation | Sacks 2 |
| 4 | 11 Sept | Synaptic transmission | Kandel 8, 9 |
| | 13 Sept | Synaptic integration | Kandel 10 |
| 5 | 18 Sept | Review | |
| | 20 Sept | **Exam 1 - Structure and transmission** | |
| 6 | 25 Sept | Sensory coding | Kandel 21 |
| | 27 Sept | Touch, temperature, pain | Kandel 23 |
| 7 | 2 Oct | Hair cells, balance, and hearing | Kandel 30 |
| | 4 Oct | Smell and Taste | Kandel 32, 26 |
| 8 | 9 Oct | Vision, color, motion detection | Sacks 3 |
| | 11 Oct | Muscle contraction and biomechanics | Kandel 34 |
| 9 | 16 Oct | Motor units, force, and fatigue | Kandel 33 |
| | 18 Oct | Motor planning and motor learning | Sacks 4 |
| 10 | 23 Oct | Review | |
| | 25 Oct | **Exam 2 - Sensory and motor systems** | |
| 11 | 30 Oct | Neurogenesis | Kandel 53 |
| | 1 Nov | Axon growth and synapse formation | Kandel 54 |
| 12 | 6 Nov | Synapses and experience | Kandel 55, 65 |
| | 8 Nov | Learning and Memory | Sacks 5 |
| 13 | 13 Nov | Sleep and dreams | Kandel 60 |
| | 15 Nov | Language | Sacks 6 |
| 14 | 20 Nov | Mental health and disorders | Kandel 51 |
| | 22 Nov | *Thanksgiving* | Sacks 7 |
| 15 | 27 Nov | Review | |
| | 29 Nov | **Exam 3 - Development and behavior** | |