PHYL 5041
EXCITABLE MEMBRANES

SPRING 2017

CLASS DAYS and TIME: Tuesdays/Thursdays 8:00-10:00 a.m., through early February

CLASSROOM: Greehey Campus, STRF 300.03

COURSE FACULTY: Drs. Mike Beckstead (director), David Weiss, Mark Shapiro, Martin Paukert

OFFICE LOCATION and HOURS: STRF 207.5 (Beckstead), 300.37 (Weiss), 207.4 (Shapiro), 208.2 (Paukert)

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TELEPHONE: 24046 (Beckstead), 73709 (Weiss), 24092 (Shapiro), 24052 (Paukert)

READ THIS DOCUMENT CAREFULLY - YOU ARE RESPONSIBLE FOR ITS CONTENTS.

COURSE DESCRIPTION AND OBJECTIVES

This course addresses fundamental mechanisms of cell excitability in neurons and other excitable tissues. The format is a combination of lectures, readings, discussions, a laboratory demonstration, and online simulations (where available). Examples of the latter include activities to simulate the resting membrane potential and action potentials. The module will include analyses of the scientific literature as well as translational science where dysfunction in ion channels underlies common disorders such as Alzheimer's Disease, Myasthenia Gravis, Cystic Fibrosis, Long QT Syndrome, and Epilepsy to name just a few. PHYL 5041 is a co-requisite for Fundamentals of Neuroscience I as it is the first module of that course, but it also can be taken as a standalone one-hour course.

Pre-requisites – None, however some basic neuroscience knowledge is required to understand the course material. Please obtain permission from Dr. Beckstead and Tanya Davila in advance of signing up for the course.

Semester credit hours – 1 credit hour

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

- Describe in detail the biophysical factors and molecular players that determine the movement of ions across cell membranes in biological systems, and how they produce equilibrium potentials, membrane potentials, and action potentials
- Formulate realistic, hypothesis-based experiments to address scientific questions concerning ion channels and membrane excitability
- Evaluate and assess scientific literature describing studies that use single cell electrophysiology and related techniques to assess membrane potential and excitability

COURSE ORGANIZATION

The main teaching modalities used in this course include:

1) Textbook readings and didactic lectures will be used to introduce factual material

2) Paper discussions will be used to help the students integrate knowledge with relevant literature

3) A take home assignment and lab demo will help students apply their knowledge of course material to the lab

Materials – **Textbook Reading Assignments** are listed on the class schedule. Please read the assigned material before attending the lecture. **Slides** for each lecture will be available through CANVAS up to three days prior to lectures. Hard copies will not be provided. **Papers for discussion** will be available through CANVAS up to one week prior to its discussion.

Computer Access – CANVAS access is required for course materials and the Exam. Print copies of slides and other materials will not be provided to the students.

Reading Assignments – Please refer to the class schedule for readings.

ATTENDANCE

Students are required to attend every lecture, paper discussion and laboratory demonstration. If you are ill and unable to attend a class period, you must contact both the course director (beckstead@uthscsa.edu) and administrator Tanya Davila (Davilat3@uthscsa.edu) in advance by email.

TEXTBOOKS

Recommended: The recommended textbook for this course is the 2017 (third) edition of Walter Boron & Emile Boulpaep's *Medical Physiology.* If you do not wish to purchase the book, the readings are also available electronically through the library website and ClinicalKey. There are also hard copies of this edition in Dr. Beckstead's office (STRF 207.5), Tanya Davila's office (Physiology main), and at the front desk of the library. PDFs of manuscripts will be provided through CANVAS.

GRADING POLICIES AND EXAMINATION PROCEDURES

Your final grade will be determined by a single exam administered at the end of the course. It will be distributed through CANVAS and must be returned through CANVAS. You will be given seven days to return the exam. As there is only one exam there are no make ups, and if it is turned in late it will be subject to a 10% penalty for each day that it is late.

Grading System

The final grading scale will be at least as generous as the one listed below. In some past years the final distribution of grades has been used as justification to curve grades to the students' benefit up to 5%.

A = 90-100% B = 80-89% C = 70-79% F = < 69%

REQUESTS FOR ACCOMODATIONS FOR DISABILITIES

In accordance with policy 4.2.3, **Request for Accommodation Under the ADA and the ADA Amendments Act of 2008 (ADAAA)**, any student requesting accommodation must submit the appropriate request for accommodation under the American with Disabilities Act (ADA, form 100). to his/her appropriate Associate Dean of their School and a copy to the ADA Coordinator. Additional information may be obtained at http://uthscsa.edu/eeo/request.asp.

ACADEMIC INTEGRITY AND PROFESSIONALISM

Any student who commits an act of academic dishonesty is subject to discipline as prescribed by the UT System Rules and Regulations of the Board of Regents. Academic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an exam for another person, signing attendance sheets for another student, and any act designed to give unfair advantage to a student or the attempt to commit such an act. Additional information may be obtained at http://catalog.uthscsa.edu/generalinformation/generalacademicpolicies/academicdishonestypolicy/

TITLE IX AT UTHSCSA

Title IX Defined:
Title of the Education Amendments of 1972 is a federal law that prohibits sex discrimination in education. It reads "no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance."

University of Texas Health Science Center San Antonio's Commitment:
University of Texas Health Science Center San Antonio (UTHSCSA) is committed to maintaining a learning environment that is free from discriminatory conduct based on gender. As required by Title IX, UTHSCSA does not discriminate on the basis of sex in its education programs and activities, and it encourages any student, faculty, or staff member who thinks that he or she has been subjected to sex discrimination, sexual harassment (including sexual violence) or sexual misconduct to immediately report the incident to the Title IX Director.

In an emergency, victims of sexual abuse should call 911. For non-emergencies, they may contact UPD at 210-567-2800. Additional information may be obtained at http://students.uthscsa.edu/titleix/

EMAIL POLICY

As graduate students your goal should be to learn the material in depth and not simply well enough to pass the exam. If you are struggling with any aspect of this class or have any questions please do not hesitate to contact individual faculty members in person, by phone or over email. Due to conferences, out of town seminars, and grant deadlines please understand that email replies may not be immediate. During the exam period please direct inquiries to the course director and administrator and do not contact individual faculty.

USE OF RECORDING DEVICES

Lectures may only be recorded with the permission of each individual instructor, **obtained in advance**. Please do not show up to class and ask if you can record that day's lecture.

ELECTRONIC DEVICES

Cell phones should be turned off or put away during class. Computers and tablets may be used to follow along with slides, take notes, look up the occasional unfamiliar term, and perform other activities directly related to the course material.

TENTATIVE CLASS SCHEDULE
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WEEK	DATE	TOPIC	Assignment (all textbook readings are from Boron and Boulpaep, 3rd edition, 2017)	Instructor
Week 1	Jan 10	INTRODUCTION TO MEMBRANE TRANSPORT, RESTING MEMBRANE POTENTIAL Includes computer simulation assignment	Chapter 5: Pages 102-106 (up to "At equilibrium…") Pages 108-110 ("In simple diffusion" up to "Gated channels, which…") Pages 115-136 ("The physical structure" up to "Transport of solutes…") *This last section (Pages 115-136) is well beyond what we will cover in class. Read it, but don't be too concerned with details we do not discuss.* Chapter 6: Pages 141-154 (up to *"The Patch Clamp…")*	Shapiro
	Jan 12	RESTING MEMBRANE POTENTIAL (continued), THE ACTION POTENTIAL Includes computer simulation assignment	Chapter 7: Pages 173-182 Pages 199-203	Shapiro
Week 2	Jan 17	THE ACTION POTENTIAL (continued), THE GREATEST PAPER EVER WRITTEN Paper discussion	Manuscript distributed via CANVAS	Shapiro
	Jan 19	VOLTAGE GATED ION CHANNELS	Chapter 5: Pages 110-115 Chapter 6: Pages 154-157 (up to *"Molecular Physiology…")* Chapter 7: Pages 182-199	Paukert
Week 3	Jan 24	OTHER ION CHANNELS, ION CHANNEL REGULATION	Chapter 3: Pages 47-72 Chapter 6: Pages 157-172	Shapiro
	Jan 26	ION CHANNEL REGULATION (continued), CHANNELOPATHIES	Chapter 6: Page 161, box (*"Genetic defects… connexins")* Chapter 7: Boxes on Pages 188, 192, and 195 (*"Genetic defects… Na channels," "Consequences…,"* and *"Congenital…")*	Shapiro

Week 4	**Jan 31**	**No class/make up day**		
	Feb 2	**FIRING PROPERTIES OF NEURONS I**	**Chapter 12: Pages 295-306** **Chapter 16: Pages 390-399 (up to *"Spatial representations…")***	**Beckstead**
Week 5	**Feb 7**	**No class/make up day**		
	Feb 9	**FIRING PROPERTIES OF NEURONS II** **Paper discussion and lab demo (take home exam will be distributed via CANVAS the day following the final class)**	**Manuscript distributed via CANVAS**	**Beckstead**