Ion channels of excitable membranes  Spring 2013

Course Number: 580.632/580.425
Instructor: Prof. David Yue (955-0078, dyue@jhmi.edu)
Teaching Asst: Lingjie Sang (955-0079; sanglingjie@gmail.com)
Place: See postings on the web site.
Course web site: http://web1.johnshopkins.edu/csl/academics/ionchannels/IonChannels.htm
Time: W 3:30-5:00 pm, F 3:30-5:00 pm Talbot Library, Traylor Building 7th floor, SOM

SYLLABUS

1/30   Course overview.
       Ion channels 1-2-3: Extreme synthesis of HH view for cardiac action potential genesis.
       Reading for week 1: Chapters 1-2 in Hille, Ion Channels 1-2-3.pdf, circuits chapter.pdf

2/1,6   OFF for Biophysical Society Meeting

2/8    In-class review of introductory problems.

2/13   Ch. 1 Classical view of permeation and gating: two important issues introduced by review of the Hodgkin-Huxley models of Na and delayed K currents. Explicit derivation of GHK current equation.

2/15,20 Ch. 2.1 – 2.3 The Big Deal About Single-Channel Info: Introduction of a state-diagram view of gating by way of a single-channel look at Na channel gating.
       Ch. 2.4 – 2.5 Power of single-channel information and barebones continuous-time Markov processes.


2/27   Ch. 4.1 – 4.2 Markov models of ion channel gating I: Motivation from modern view of voltage-dependent activation and Ca\(^{2+}\) regulation of potassium channels. Relation to linear systems theory.

3/1,6,8 Ch. 4.3 – Markov models of ion channel gating I.


3/20,22 Hopkins Spring Break


3/29   Ch. 5 Markov models of ion channel gating II. (continued)

4/3    MATLAB expm cookbook session.

4/10 Noise analysis to infer single-molecule behavior from summed records from many molecules

4/12 Noise analysis (continued)
Paper presentation to illustrate use of noise analysis (student)

4/17 Optical FRET methods to understand molecular mechanisms of ion channels I

4/19 FRET meets chemical biology to understand molecular mechanisms of ion channels II

4/24 FRET/chemical biology paper presentation (student)

4/26 X-ray crystallographic methods to resolve ion channel structure I

5/1 X-ray crystallographic methods to resolve ion channel structure II

5/3 X-ray crystallographic insight into ion channel function (paper presentation)

5/10 Final exam. Distributed 5/09, due at end of day on 5/10. 24 hours.