

**PBIO 550/NeuB 550 Biophysics of Calcium Signaling**

**Spring 2011, first half of quarter (five weeks)**

**Meets: Mondays from 1:00 to 2:50 PM in room G-417 HSB**

**Instructors:** Bertil Hille ([hille@uw.edu](mailto:hille@uw.edu); 3-8639, H-310G HSB) and Luis Fernando Santana ([santana@uw.edu](mailto:santana@uw.edu); 3-0986, H-321 HSB))

**Course Web page:** <http://courses.washington.edu/calcium>

**Lecture schedule:**

Date	Instructor	Topic	Discussion Paper
March 28	Santana	Fundamentals of fluorescence and intracellular Ca <sup>2+</sup> indicators	Grynkiewicz et al. 1985. A new generation of Ca <sup>2+</sup> indicators with greatly improved fluorescence properties. <i>J Biol Chem</i> 260:3440-3450.
April 4	Hille	Genetically expressible calcium indicators	Canato M et al. 2010 Massive alterations of SR free calcium in skeletal muscle fibers lacking calsequestrin revealed by a genetically encoded probe. <i>PNAS</i> . 107:22326-22331.
April 11	Hille	Cellular calcium buffers and transport mechanisms. Kinetics and rates.	Neher E and Augustine GJ. 1992. Calcium gradients and buffers in bovine chromaffin cells. <i>J Physiol</i> 450: 273-301.
April 18	Santana	Calcium-induced calcium release	Fabiato A. 1985. Time and calcium dependence of activation and inactivation of calcium-induced release of calcium from the sarcoplasmic reticulum of a skinned canine cardiac Purkinje cell. <i>J Gen Physiol</i> 85: 247-289
April 25	Santana	Local calcium signaling	Cheng et al. 1993. Calcium sparks: elementary events underlying excitation-contraction coupling in heart muscle. <i>Science</i> 262:740-744
May 6	--	Paper is due.	see instructions--

**Evaluation:** Final grades will be given on the basis of student participation in weekly discussions and on a short paper (up to 10 pages) on a topic of their choosing.

**General instructions for weekly discussions of assigned paper.** As part of each lecture, a paper discusses in class. Please read it ahead of time and selected students will be assigned to specific figures. We will arrange to project your assigned figure on the screen for you, and you will lead a 5-minute discussion with the class. Start by proposing an interesting title for the figure and describe carefully what is plotted on each axis. Then by posing leading questions, try to elicit a class discussion of details revealed, the hypotheses tested by the experiment, and the conclusion. Ask whether the data presented support the claim made by the authors. Your principal job is to stimulate your colleagues to discuss rather than to answer all these issues for them yourself. However, it is quite possible that the discussants will not come to the conclusion that you come to, and then you should tell them what you think. PDF versions of all papers discussed in class will be available in the course web site.

**Instructions for the preparation of the paper.** In this paper students should outline a series of experiments designed to examine a particular issue in  $\text{Ca}^{2+}$  signaling using the techniques described in class. For example, you could decide to test the hypothesis that  $\text{Ca}^{2+}$  release via inositol 1, 4, 5 phosphate receptors ( $\text{IP}_3\text{Rs}$ ) can initiate  $[\text{Ca}^{2+}]$  waves in vascular smooth muscle cells. To test this hypothesis you could propose the simultaneous use of flash photolysis and  $\text{Ca}^{2+}$  imaging to examine the effects of the photo-release of caged  $\text{IP}_3$  on intracellular  $[\text{Ca}^{2+}]$ . Experiments would examine the relationship between  $\text{IP}_3$  levels and the probability of initiating a  $\text{Ca}^{2+}$  wave.

Your paper could start with a brief introduction (about 2 pages) providing the necessary background to support the validity of the proposed hypothesis. This introduction should then be followed by a description of the proposed experiments. It is expected that students would discuss possible outcomes -including potential pitfalls- of the experiments and how they would be interpreted. You are encouraged to contact the instructors to discuss ideas for the paper.

You can turn in a PDF version by EMail or give us two hard copies so both instructors can read. Bertil will comment on style in addition to science.

**Handouts and power point presentations for all lectures will be accessible in the course web page:** <http://courses.washington.edu/calcium>