

**BISP194: NEUROBIOLOGY OF THE SYNAPSE**  
**Fall Quarter, 2009**

- Instructor:** Darwin K. Berg (dberg@ucsd.edu)
- Website:** <http://www.biology.ucsd.edu/classes/bisp194-2.FA09>  
[Username: bisp1942fa09; Password: 9FrogLegs]
- Class Meetings:** Tuesdays, 2-4 pm. Lectures: 2130 Bonner Hall; Discussions: 3502 Pacific Hall.
- Format:** Lectures and critical group discussion of published papers.
- Prospectus:** We will cover the basic principles of synaptic function, formation, and plasticity in lecture. Original research manuscripts will be assigned for discussion in class to analyze their findings and to consider the scientific process in some depth. Our goal is not only to understand current views of synaptic neurobiology but also to gain experience in thinking critically about experiments and results.
- Prerequisites:** Upper division course in biochemistry, genetics, or cell/molecular biology; lower division course having some neurobiology (e.g. BILD 2).
- Texts:** None required but highly recommend is *Neuroscience*, Purves et al. (4<sup>th</sup> edition, Sinauer Associates Publishers). Chapters will be referenced for each of the lectures.
- Additional Sources:** Chaps 8, 9, 11, & 50 in Fundamental Neuroscience by Squire et al., 2<sup>nd</sup> edition, 2003 (Academic Press).  
Chaps 1-12 in Synapses by Cowan, Sudhof, & Stevens, 2001 (Johns Hopkins University Press).  
Chaps 9-15, 59, & 65 in Principles of Neural Science by Kandel, Schwartz, & Jessell, 3<sup>rd</sup> edition, 1991 (Elsevier Science Publishing).
- Exams and grading:** Grading will be based primarily on performance in the discussion of papers, and to a lesser extent on responses to questioning about lecture material. If necessary, a final exam (possibly oral) will be given at the scheduled time, location to be announced later.
- Attendance:** Pretty much have to be there if (a) a student wants to get anything out of the course via analysis of papers and (b) a grade is to be assigned based on discussion. (If a student has to miss a meeting, a one-time make-up oral exam may be possible.)
- Office hours:** D. Berg - office hours: Tues 11-12 pm, Fri 2-3 pm.  
3212A, Pacific Hall. Email: dberg@ucsd.edu; phone: 534-4680.

## **COURSE SCHEDULE:**

**Sept 29: Lecture #1. Synaptic Transmission I.**

[*Neuroscience*, Purves et al: Chap 5]

**Oct 6: Lecture #2. Synaptic Transmission II.**

[*Neuroscience*, Purves et al: Chap 6]

**Oct 13: Discussion #1: Synaptic Transmission.**

1. Bollman, J.H., Sakmann, B., and Borst, J.G. (2000). Calcium sensitivity of glutamate release in a calyx-type terminal. *Science* 289: 953-957.
2. Wilson, R.I., and Nicoll, R.A. (2001). Endogenous cannabinoids mediate retrograde signalling at hippocampal synapses. *Nature* 410:588-592.

**Oct 20: Lecture #3. Synaptic Plasticity I.**

[*Neuroscience*, Purves et al: Chap 7]

**Oct 27: Lecture #4. Synaptic Plasticity II.**

[*Neuroscience*, Purves et al: Chap 8; parts of Chap 24 (pp 625-633) & 31 (pp 791-800).]

**Nov 3: Discussion #2. Synaptic Plasticity – Some basic findings.**

3. Isaac, J.T.R., Nicoll, R.A., and Malenka, R.C. (1995). Evidence for silent synapses: implications for the expression of LTP. *Neuron* 15: 427-434.
4. Frey, U., and Morris, R.G.M. (1997). Synaptic tagging and long-term potentiation. *Nature* 385: 533-536.

**Nov 10: Discussion #3. Synaptic Plasticity- Some recent mechanisms.**

5. Okada, D., Ozawa, F., and Inokuchi, K. (2009) Input-specific spine entry of soma-derived Ves1-1S protein conforms to synaptic tagging. *Science* 324: 9904-909.
6. Wang, D.O., Kim, S.M., Zhao, Y., Hwang, H., Miura, S.K., Sossin, W.S., and Martin, K.C. (2009) Synapse- and stimulus-specific local translation during long-term neuronal plasticity. *Science* 324: 1536-1540.

**Nov 17: Discussion #4. Synapses in Learning & Memory.**

7. Rumpel, S., LeDoux, J., Zador, A., and Malinow, R. (2005). Postsynaptic receptor trafficking underlying a form of associative learning. *Science* 308:83-88.
8. Teng, E., and Squire, L.R. (1999). Memory for places learned long ago is intact after hippocampal damage. *Nature* 400: 675-677.

**Nov 24: Discussion #5. Synapse Formation and Competition.**

9. Maffei, A., Nataraj, K., Nelson, S.B., and Turrigiano, G.G. (2006). Potentiation of cortical inhibition by visual deprivation. *Nature* 443: 81-84.

10. Kerschensteiner, D., Morgan, J.L., Parker, E.D., Lweis, R.M., and Wong, R.O.L. (2009) Neurotransmission selectively regulates synapse formation in parallel circuits in vivo. Nature 460: 1016-1020.

**Dec 1: Discussion #6. Synaptic Activity and CNS development.**

11. Liu, Z., Neff, R.A., Berg, D.K. (2006). Sequential interplay of nicotinic and GABAergic signaling guides neuronal development. Science 314: 1610-1613.

12. ....holding open for the "latest and greatest" .....