

PHYSIOLOGICAL PSYCHOLOGY (NS/PY 363)

Fall, 2010

Lecture: 8:00 MWF

Lab: 1-4 T or W

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REQUIRED TEXT:

Carlson, N. R. (2010). *Physiology of behavior* (10th ed.). New York: Allyn and Bacon.

Sept. 9 **Introduction:** What is physiological psychology? (Ch. 1)

Basics: Neuronal Transmission, Psychopharmacology, and Neuroanatomy

- 11 a. The neuron and axonal conduction (Ch. 2, 28-53; Ch. 15, 549-550; Fields, 2006)
- 14 b. Synaptic transmission: EPSPs, IPSPs, and synaptic integration (Ch. 2, 53-67)
- 16 c. Neuropharmacology (Ch. 4, 102-114; Ch. 5, 160-165)
- d. Psychopharmacology
 - 16 (1) Acetylcholine and Alzheimer's disease (Ch. 4, 114-118; Ch. 15, 534 & 543-548; Wolfe, 2006; Oddo et al., 2004)
 - 18 (2) Dopamine, Parkinson's disease, Huntington's disease, and schizophrenia (Ch. 4, 118-121; Ch. 8, 287-289; Ch. 15, 537-543)
 - 23 (3) Norepinephrine and depression (Ch. 4, 121-123)
 - 25 (4) Serotonin, glutamate, GABA, peptides, cannabinoids, and nucleosides (Ch. 4, 123-133; Kemp & McKernan, 2002; Redila & Chavkin, 2008; Kelsey et al., 2009)
- 29-30 (Lab) e. Neuroanatomy (Ch. 3; Ch. 5, 139-150)

30 **FIRST EXAM**

Oct. 2 **Input and Output: Sensory and Motor Systems** (Rosenzweig et al., 2005, 216-228)

- 5 a. Vision: Anatomy and coding (Ch. 6, 169-192; Ch. 5, 151-153)
- 9 b. Audition (Ch. 7, 212-234; Rauschecker & Shannon, 2002)
- 12 c. Somesthetic senses (Ch. 7, 237-249; Basbaum & Julius, 2006; Manzke et al., 2003)
- 14 d. Taste and smell (Ch. 7, 250-261)
- 16 e. Motor systems (Ch. 8; Ch. 15, 548-549; Miesenböck, 2008; Gradinaru et al., 2009)

19* **SECOND EXAM**

Motivation

- 26 a. Water intake (Ch. 12, 400-409)
- 28 b. Food intake (Ch. 12, 409-438; Badman & Flier, 2005)
- Nov. 2 c. Sexual behavior and sex differences (Ch. 10, 330-359; Kimchi et al., 2007; Cahill, 2005)
- 6 d. Reinforcement and addiction (Ch. 13, 461-464; Ch. 18; Nestler & Malenka, 2004; Deroche-Gamonet et al., 2004; Redila & Chavkin, 2008; Siegel et al., 1982; Rollema et al., 2007)
- 11 e. Sleep and arousal (Ch. 9; Rasch et al., 2007)

13 **Excitotoxicity, Strokes, Recovery of Function, Transplants, Growth Factors, and Neurogenesis** (Ch. 15, 527-532; Kemp & McKernan, 2002; Kraft, 2005; Lindvall & Kokaia, 2009; Gage, 2003; Specter, 2001; Bischofberger, 2007)

18 **THIRD EXAM**

Learning and Memory

- 20 a. Habituation and associative learning (Ch. 13, 439-465; Kandel, 2001; Tsien, 2000)
- 30 b. Memory (Ch. 13, 465-484; Ch. 15, 546; Riedel et al., 1999; Lee et al., 2004; Shema et al., 2007)

Mental Illness and Stress

- Dec. 4 a. Depression (Ch. 16, 572-584; Blier & de Montigny, 1998; Airan et al., 2007)
7 b. Schizophrenia (Ch. 16, 554-571; Javitt & Coyle, 2004; Conn et al., 2008)
11 c. Fear, anxiety, stress, health, and autism (Ch. 11; Ch. 17; Han et al., 2009; Bechara et al., 1995; Ramachandran & Oberman, 2006)

FINAL PROJECT DUE

17 FINAL EXAM AT 8:00 A.M.

TENTATIVE LAB SCHEDULE

Week 1	(9/14)	Ethics of animal (and human) research (Ch. 1, 23-24; Bowd, 1980; Gallistel, 1981; Siegel et al., 1982; Airan et al. 2007)
Week 2	(9/21)	Psychopharmacology project: Use of EXCEL and RefWorks; Discussion of final projects
Week 3	(9/28)	Neuroanatomy lecture; Analysis of psychopharmacology project (continued)
Week 4	(10/5)	Sheep brain dissection and rat brains; Choose Final Project
Week 5	(10/12)	Use of stereotax; Demonstration of brain lesion (Ch. 5, 134-139)
Week 6	(10/19)	NO LAB (October break)
Week 7	(10/26)	Neurosurgery for final project
Week 8	(11/2)	Neurosurgery for final project: Work on final project
Week 9	(11/9)	Work on final project
Week 10	(11/16)	Work on final project
Week 11	(11/30)	Histology (Ch. 5, 139-150) and data analysis
Week 12	(12/7)	Neuroanatomy; FINAL PROJECT DUE ON DECEMBER 11

***I will be out of town on November 19, but we will still have the exam.**

GRADING PROCEDURE

The following percentages will be given to each assignment in computing your final grade.

First Exam	17%
Second Exam	10%
Third Exam	17%
Quizzes and Lab and Class Participation	14%
Final Lab Project	17%
Final Exam	25%
	100%

RESERVED READINGS

- Airan, R. D., Meltzer, L. A., Roy, M., Gong, Y., Chen, H., & Deisseroth, K. (2007). High-speed imaging reveals neurophysiological links to behavior in an animal model of depression. *Science*, 317, 819-823.
- Badman, M. K., & Flier, J. S. (2005). The gut and energy balance: visceral allies in the obesity wars. *Science*, 307, 1909-1914.
- Basbaum, A. I., & Julius, D. (June, 2006). Toward better pain control. *Scientific American*, 60-67.
- Bechara, A., Tranel, D., Damasio, H., Adolphs, R., Rockland, C., & Damasio, A. R. (1995). Double dissociation of conditioning and declarative knowledge relative to the amygdala and hippocampus in humans. *Science*, 269, 1115-1118.
- Bischofberger, J. (2007). Young and excitable: new neurons in memory networks. *Nature Neuroscience*, 10, 273-275.
- Blier, P., & de Montigny, C. (1998). Possible serotonergic mechanisms underlying the antidepressant and anti-obsessive-compulsive disorder responses. *Biological Psychiatry*, 44, 313-323.
- Bowd, A. D. (1980). Ethical reservations about psychological research with animals. *The Psychological Record*, 30, 201-210.
- Cahill, L. (May, 2005). His brain, her brain. *Scientific American*, 292, 40-47.
- Conn, P. J., Lindsley, C. W., & Jones, C. K. (2009). Activation of metabotropic glutamate receptors as a novel approach for the treatment of schizophrenia. *Trends in Pharmacological Sciences*, 30, 25-31.

- Deroche-Gamonet, V., Belin, D., & Piazza, P. V. (2004). Evidence for addiction-like behavior in the rat. *Science*, 305, 1014-1017.
- Fields, R. D. (June/July, 2006). Beyond the neuron doctrine. *Scientific American*, 20-27.
- Gage, F. H. (September, 2003). Repair yourself. *Scientific American*, 47-53.
- Gallistel, C. R. (1981). Bell, Magendie, and the proposals to restrict the use of animals in neurobehavioral research. *American Psychologist*, 36, 357-360.
- Gradinaru, V., Mogri, M., Thompson, K. R., Henderson, J. M., & Deisseroth, K. (2009). Optical deconstruction of parkinsonian neural circuitry. *Science*, 324, 354-359.
- Han, J. H., Kushner, S. A., Yiu, A. P., Hsiang, H. L., Buch, T., Waisman, A., Bontempi, B., Neve, R. L., Frankland, P. W., & Josselyn, S. A. (2009). Selective erasure of a fear memory. *Science*, 323, 1492-1496.
- Javitt, D. C., & Coyle, J. T. (January, 2004). Decoding schizophrenia. *Scientific American*, 290, 48-55.
- Kandel, E. R. (2001). The molecular biology of memory storage: a dialogue between genes and synapses. *Science*, 294, 1030-1038.
- Kelsey, J. E., Harris, O., & Cassin, J. (2009). The CB₁ antagonist rimonabant is adjunctively therapeutic as well as monotherapeutic in an animal model of Parkinson's disease. *Behavioural Brain Research*, 203, 304-307.
- Kemp, J. A., & McKernan, R. M. (2002). NMDA receptor pathways as drug targets. *Nature Neuroscience*, 5, 1039-1042.
- Kimchi, T., Xu, J., & Dulac, C. (2007). A functional circuit underlying male sexual behaviour in the female mouse brain. *Nature*.
- Kraft, U. (2005). Mending the spinal cord. *Scientific American Mind*, 16, 68-73.
- Lee, J. L., Everitt, B. J., & Thomas, K. L. (2004). Independent cellular processes for hippocampal memory consolidation and reconsolidation. *Science*, 304, 839-843.
- Lindvall, O., & Kokaia, Z. (2009). Prospects of stem cell therapy for replacing dopamine neurons in Parkinson's disease. *Trends in Pharmacological Sciences*, 30, 260-267.
- Manzke, T., Guenther, U., Ponimaskin, E. G., Haller, M., Dutschmann, M., Schwarzacher, S., et al. (2003). 5-HT₄(a) receptors avert opioid-induced breathing depression without loss of analgesia. *Science*, 301, 226-229.
- Miesenböck, G. (October, 2008). Lighting up the brain. *Scientific American*, 299, 52-59.
- Nestler, E. J., & Malenka, R. C. (March, 2004). The addicted brain. *Scientific American*, 290, 78-85.
- Oddo, S., Billings, L., Kesslak, J. P., Cribbs, D. H., & LaFerla, F. M. (2004). Abeta immunotherapy leads to clearance of early, but not late, hyperphosphorylated tau aggregates via the proteasome. *Neuron*, 43, 321-332.
- Rasch, B., Buchel, C., Gais, S., & Born, J. (2007). Odor cues during slow-wave sleep prompt declarative memory consolidation. *Science*, 315, 1426-1429.
- Ramachandran, V. S., & Oberman, L. M. (June, 2007). Broken mirrors: a theory of autism. *Scientific American Mind*, 17, 20-29.
- Rauschecker, J. P., & Shannon, R. V. (2002). Sending sound to the brain. *Science*, 295, 1025-1029.
- Redila, V. A., & Chavkin, C. (2008). Stress-induced reinstatement of cocaine seeking is mediated by the kappa opioid system. *Psychopharmacology*, 200, 59-70.
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- Rollema, H., Coe, J. W., Chambers, L. K., Hurst, R. S., Stahl, S. M., & Williams, K. E. (2007). Rationale, pharmacology and clinical efficacy of partial agonists of $\alpha_4\beta_2$ nACh receptors for smoking cessation. *Trends in Pharmacological Sciences*, 28, 316-325.
- Rosenzweig, M. R., Breedlove, S. M., & Watson, N. V. (2005). *Biological psychology: an introduction to behavioral and cognitive neuroscience* (4th ed.). Sunderland, MA: Sinauer Associates.
- Shema, R., Sacktor, T. C., & Dudai, Y. (2007). Rapid erasure of long-term memory associations in the cortex by an inhibitor of PKM zeta. *Science*, 317, 951-953.
- Siegel, S., Hinson, R. E., Krank, M. D., & McCully, J. (1982). Heroin "overdose" death: Contribution of drug-associated environmental cues. *Science*, 216, 436-437.
- Specter, M. (July 23, 2001). Rethinking the brain. *The New Yorker*, 42-53.
- Tsien, J. Z. (2000). Linking Hebb's coincidence-detection to memory formation. *Current Opinion in Neurobiology*, 10, 266-273.
- Wolfe, M. S. (May, 2006). Shutting down Alzheimer's. *Scientific American*, 72-79.