

NB 200A; Synapses, cells & circuits (4 units)

Chair: Brecha (nbrecha@ucla.edu or 825-9556)

Co-chair: Fisher

Staff: Bisley, Chesselet, Clemente, Fisher, Hoffman, Micevych, Schweizer, Sofroniew, Sternini, Trachtenberg, Staba, Zampighi

Course description: The course is focused on fundamental topics concerning the subcellular and cellular organization, and circuitry of the nervous system. Specific topic areas will include neuronal and glial ultrastructure, cellular neurobiology, basic neural circuitry. These topic areas will be covered in both lecture and laboratory sessions.

This course will consist of:

A. Required reading from:

- *The Fine Structure of the Nervous System*, 3rd edition, by Peters et al. (1991).
- *Neuroscience*, , 4th edition, by Purves et al. (2007).

OR

- *Fundamental Neuroscience*, 3rd edition, by Haines (2002).

OR

- *The Human Brain: An Introduction to its Functional Anatomy*, 5th edition, by Nolte (2002).

B. Primary literature reading from both classic and recent papers, as appropriate.

C. Orientation and didactic presentations.

D. Laboratory sessions concerned with the fine structure and cellular organization, and neuroanatomical organization of the nervous system.

Course meetings and locations:

Monday 10:00-12:00; Faculty presentation 63-214 (Green Room)

Wednesday 10:00-12:00; Faculty presentation 63-214 (Green Room)

Friday 10:00-1:00; Faculty presentation & lab 63-214 (Green Room) & 63-127 (lab room)

Course requirements:

Students are expected to read assigned material and attend each class meeting, including participation in the laboratory sessions.

Student evaluation:

Students will be evaluated as follows;

- Midterm examination; Short answer and essay questions on all course material (weeks 1 through 4 including labs 1 and 2): Graded, 30% of final grade.
- Final examination; Essay questions on all course material (weeks 1 through 10): Graded, 50% of final grade.
- Laboratory practical; Short answer questions and identification of CNS and PNS structures and pathways, histology and ultrastructure. Graded, 20% of final grade. (See **Note #1**)
- **NOTE #1:** The laboratory practical must be passed with at least a 50% score to receive a grade in the course. A make up laboratory practical is usually administered during May or June to those students receiving less than 50% on the laboratory practical.

Grading:

Students should enroll for a letter grade

LECTURE & LABORATORY SCHEDULE

Required Textbooks and Laboratory Manual:

- NB 200A Laboratory Manual. (provided by the department)
- Peters et al., *The Fine Structure of the Nervous System*, 3rd edition, Oxford University Press, Oxford, 1991.
- Purves et al., *Neuroscience*, 4th edition, Sinauer Associates, Sunderland, MA 2007.
- OR
- Haines, *Fundamental Neuroscience*, 3rd edition, Churchill Livingstone, Philadelphia, PA 2002.
- OR
- Notle *The Human Brain: An Introduction to its Functional Anatomy*, 5th edition, Mosby, 2002.

Additional Textbook and CD Resources for Laboratory Sessions:

- Williams et al., *SylviusVG: Visual Glossary of Human*, Sinauer Associates, Sunderland, MA 2005.
- Haines, *Neuroanatomy: An atlas of structures, sections and systems* (6th edition), Lippincott Williams & Wilkins, 2004
- Notle and Angevine *The Human Brain in Photographs and Diagrams*, 2nd edition, Mosby, 2000.
- Vanderwolf and Cooley *The Sheep Brain: A photographic series*. 2nd edition, Kirby, 2002.

Additional Textbook Resources:

- Kandel et al., *Principles of Neural Science*, 4th edition, Elsevier, New York, NY, 2000.
- Squire et al., *Fundamental Neuroscience*, 2th edition, Elsevier, New York, NY, 2003.
- Waxman *Clinical Neuroanatomy*, 25th edition, Lange Medical Books, New York, NY, 2003.

Literature and Review Articles:

- Reviews and papers will be assigned at the beginning of the quarter.

	Instructor	Textbook Assignments				Lab Manual
		Peters	Purves	Haines	Notle	
WEEK 1 (1/7/08)						
<u>Monday (10:00-12:00)</u>						
Course organization & introduction.						
Cellular and structural organization of the nervous system; neurons, glia & other cell types (overview)						
Neuronal structure and ultrastructure; cellular diversity & cellular organelles (mitochondria, ER, lysosomes), microtubules, neurofilaments, vesicles, plasma membrane & associated proteins (ion channels, receptors, transporters)	Brecha	Ch 1, 2	Ch 1	Ch 1	Ch 1	
<u>Wednesday (10:00-12:00)</u>						
Ependyma, choroid plexus, meninges & vascular system	Brecha	Ch 8-10, 13	Appendix	Ch 6-8	Ch 4-6	

	Instructor	Textbook Assignments			Lab Manual
		Peters	Purves	Haines	
<u>Friday (10:00-12:00)</u> CNS glia; astrocytes, oligodendrocytes & microglia Neurostem cells	Sofroniew	Ch 7			
WEEK 2 (1/14/08)					
<u>Monday (10:00-12:00)</u> Classical and modern approaches for studying cellular ultrastructure -	Zampighi				
<u>Wednesday (10:00-12:00)</u> Soma & dendrites Axons	Trachtenberg	Ch 2, 3, 4			
<u>Friday (10:00-12:00)</u> Structure of peripheral nerves, Schwann cells & sensory ganglia. Peripheral receptors.	Brecha	Ch 6, 12		Ch 9	
Lab 2: Cellular structure; neurons, neuroglia, ependyma, meninges & choroid plexus. Sensory receptors (sensory cells, free nerve endings, encapsulated endings, muscle spindles). Peripheral nerves, and sensory, sympathetic & enteric ganglia	Brecha/Sternini				Ch 2
WEEK 3 (1/21/08)					
<u>Monday (10:00-12:00)</u> MLK Holiday					
<u>Wednesday (10:00-12:00)</u> Neuromuscular junction (NMJ)	Schweizer	Ch 5			
<u>Friday (10:00-1:00)</u> Central synapses. Ribbon synapses: photoreceptors, hair cells, lateral line.	Schweizer	Ch 5			
WEEK 4 (1/28/08)					
<u>Monday (10:00-12:00)</u> Regional organization of the CNS	Fisher		Appendix	Ch 1	Ch 3

	Instructor	Textbook Assignments			Lab Manual
		Peters	Purves	Haines	
<u>Wednesday (10:00-12:00)</u> Organizational principles of the autonomic nervous system. Enteric nervous system.	Sternini		Ch 21	Ch 29	
<u>Friday (10:00-1:00)</u> Origin, course & function of the cranial & spinal nerves. Brainstem & cranial nuclei	Clemente		Appendix	Ch 10, 14	Ch 11, 12, 15
Lab 1: Brain, spinal, cord & peripheral nervous system; surface features, major regions & subdivisions. Ventricular system, meninges, choroid plexus. Cranial & spinal nerves. Vascular system	Brecha/ Fisher				Ch 1A & B
WEEK 5 (2/4/08)					
<u>Monday (9:00-12:00)</u> MIDTERM EXAMINATION 2/4/08					
<u>Wednesday (10:00-12:00)</u> Somatosensory; Tactile and position	Bisley		Ch 9	Ch 17	
<u>Friday (10:00-1:00)</u> Somatosensory; Touch, temperature & pain. Descending pain systems	Bisley		Ch 10	Ch 18	
Lab 3: Spinothalamic & dorsal column systems	Bisley / Brecha / Fisher				Ch 3
WEEK 6 (2/11/08)					
<u>Monday (10:00-12:00)</u> Retina (microcircuitry) & visual system	Brecha		Ch 11, 12	Ch 20	Ch 17
<u>Wednesday (10:00-12:00)</u> Cochlea & auditory system	Hoffman		Ch 13	Ch 21	Ch 14
<u>Friday (10:00-1:00)</u> Vestibular system.	Hoffman		Ch 14	Ch 22	Ch 14
Lab 5: Special Senses; visual, auditory, vestibular & olfactory systems. Sensory & pyriform cortex	Brecha / Fisher				Ch 5

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		Peters	Purves	Haines	
WEEK 7 (2/18/08)					
<u>Monday</u> President's Day					
<u>Wednesday (10:00-12:00)</u> Chemical senses (taste, olfaction & visceral)	Schweizer		Ch 15	Ch 23	Ch 13
<u>Friday (10:00-1:00)</u> Spinal cord; cellular (microcircuitry) and functional organization)	Fisher		Ch 16	Ch 9	Ch 10
WEEK 8 (2/25/08)					
<u>Monday (10:00-12:00)</u> Motor systems: cortico-, tecto-, rubro-, vestibulo-spinal systems					
<u>Wednesday (10:00-12:00)</u> Basal ganglia; cellular (microcircuitry), afferents & efferents	Fisher		Ch 17	Chap24	Ch 18
<u>Friday (10:00-1:00)</u> Cerebellum; cellular (microcircuitry), afferents & efferents	Chesselet		Ch 18	Ch 26	Ch 19
<u>Friday (10:00-1:00)</u> Cerebellum; cellular (microcircuitry), afferents & efferents	Fisher		Ch 19	Ch 27	Ch 20
Lab 4: Motor systems 1: Corticospinal system, brainstem cerebellum & motor cortex.	Brecha / Fisher				Ch 4
WEEK 9 (3/3/08)					
<u>Monday (10:00-12:00)</u> Cholinergic systems Monoamine (serotonin, dopamine, norepinephrine) systems					
<u>Wednesday (10:00-12:00)</u> Cortex I; regional organization	Chesselet			Ch 11, 12	
<u>Wednesday (10:00-12:00)</u> Cortex I; regional organization	Trachtenberg		Ch 26, 27	Ch 16, 32	Ch 22
<u>Friday (10:00-1:00)</u> Cortex 2; microcircuitry, afferent, efferent and intrinsic projections	Trachtenberg		Ch 26, 27	Ch 16, 32	Ch 22
Lab 4: Motor systems 2: Basal ganglia, afferents & efferents	Brecha / Fisher				Ch 4

	Instructor	Textbook Assignments			Lab Manual
		Peters	Purves	Haines	
WEEK 10 (3/10/08)					
<u>Monday (10:00-12:00)</u>					
Hypothalamus; nuclear organization, major afferents & efferents; Pituitary gland	Micevych		Ch 21	Ch 30	Ch 23
<u>Wednesday (10:00-12:00)</u>					
Hypothalamus; circuitry mediating sex, stress, fever & circadian rhythms	Micevych		Ch 30		Ch 23
<u>Friday (10:00-1:00)</u>					
Hippocampus; cellular (microcircuitry), afferents & efferents. Basal forebrain, amygdala & associated structures.	Staba		Ch 29, 31	Ch 16, 31	Ch 23
Lab 6: Basal forebrain, amygdala, hippocampus & related structures	Brecha / Fisher / Staba				Ch 6

Final Examinations

Final Examination will be in two parts:

1. Lab practical on the ultrastructural, cellular & regional organization of the nervous system (Monday, 3/17 from 3:00-4:30)
2. Short answer / diagrams & essay questions (Wednesday, 3/20 from 10:00-2:00)

Laboratory Practical Re-examination

1. Friday, 5/25 from 3:00-4:30 (tentative)