

# Developmental Neurobiology

## ANAT 847; PHSY 847; NURO 847

Course Directors: Michael J. Werle, Ph.D.  
Doug Wright, Ph.D.

Week 1	Jan. 27	Introduction, scheduling, gross outline, course goals.
Week 2	Feb 3	Early events in neural development; Induction, Evolution, Ectoderm, Endoderm, Mesoderm, basic developmental biology.
Week 3	Feb. 10	Polarity and Regionalization. The anterior-posterior axis in vertebrates; Hox Genes; other signaling molecules; Organizing centers; Forebrain development (Pax Genes); Dorsal-Ventral organization.
Week 4	Feb. 17	Birth and Migration Cell cycle genes; control of glial neuronal number; Cerebral cortex histogenesis; subventricular zone; postembryonic and adult neurogenesis.
Week 5	Feb. 24	Cellular Differentiation. Transcriptional control of lineage; Position and determination; Asymmetric cell division; Glial cell fate; Neural crest cell fate; Neuronal fate in spinal cord; Laminal development; regulation of phenotype by target tissues.
Week 6	Mar 10	Neural Crest Formation, differentiation and migration of the neural crest. Cranial pathways, sensory pathways. Dorsal root ganglia, Schwann cells.
Week 7	March 17	Spring Break
Week 8	March 24	Axon Growth and Guidance I.

Axonal navigation; The growth Cone; The dynamic cytoskeleton; Growth cone guidance; Mechanical guidance; Adhesive guidance

Week 9	March 31	Axon Growth and Guidance II. Extracellular matrix and axon guidance; cell adhesion molecules; Pathways; Gradients of Tropic factors; Repulsive factors; Axon regeneration; Stop factors; Signal transduction. Target recognition; Multicellular targets; Secondary targets; Targeting to the correct layer; Topographic mapping;
Week 11	April 7	Survival and Growth Types of Neuron death; Neuronal death Numbers; Target derived neurotrophic survival; NGF; Neurotrophin family; Neurotrophin receptors; Endocrine control of cell survival; Cell Death; Intracellular signaling; Caspases; Regulation of cell death proteins.
Week 12	April 14	Synapse formation Description of synapse formation; Location of synaptic specializations; Presynaptic specialization formation; Postsynaptic specialization formation; Role of calcium in presynaptic differentiation; Second messengers in presynaptic differentiation; Molecular signals at presynaptic. Receptor clustering at the NMJ; Initial events in postsynaptic differentiation; Agrin; Receptor clustering in the CNS; Regulation of receptor expression and synthesis; ARIA; Neuronal activity and receptor expression; Synaptic transmission; Modulation of release and receptor function; Maturation of receptor subtypes; neurotransmitter reuptake; Synaptic inhibition; Electrical properties.
Week 13	April 21	Synapse elimination. Synaptic rearrangement; Synapse elimination; Axonal pruning; Terminal sprouting; Activity and synaptic connections; Sensory coding and synapse rearrangement; Activity and sensory maps; spontaneous activity and sensory maps; Critical period for plasticity; Postsynaptic receptor elimination; intracellular signaling; Silent synapses.

Week 14	April 28	Sensory Formation Formation of the specialized sensory systems; Focus on vision and hearing. Somatotopy; Visual Maps and the theory of chemospecificity; Olfactory Maps; Computational Maps.
Week 15	May 5	Behavioral Development. Development of Behavior; Cellular mechanisms of behavior; effect of environment on behavioral development; Motor behavior (first movements); Spontaneous and reflexive movement; Embryo specific behavior; Motor learning; Hormonal control of brain development; Sex specific behavior; development of memory; communication; complex tasks.

Lectures will consist of 2 hours of didactic instruction plus analysis of critical manuscripts for each topic. The manuscripts will be distributed in the week prior to the lecture and will be used to emphasize the importance of the subject material presented that week. The student is required to participate in discussions of the assigned manuscripts.

Grade Scale:	90 to 100 %	A
	80 to 89 %	B
	70 to 79%	C
	65 to 69%	D
	<64%	F

Examinations will be in class examinations consisting of questions that require short answers. Examinations will focus on critical thinking to demonstrate understanding of the presented material.