

9.14**Class #9: Process outgrowth I***Readings:*

Purves and Lichtman, pp. 94-130.

Marx, J., "Helping Neurons Find their Way", *Science*, 1995, 268: 971-973 [a "Research News" article].

Highly Recommended:

Raper, JA, and Tessier-Lavigne, M, "Chapter 18, Growth Cones and Axon Pathfinding", Zigmond, *Fundamental Neuroscience*. New York, Academic Press, 1999, (pp.519-546).

Wolpert, "chapter 8" [Good, easy introduction to this and a few later topics, but note:

The orderly topography of the retinotectal connection was known before Sperry; the motor control defect in the reeler mouse is probably not due to neocortical anomalies, but rather to cerebellar.](pp. 120-133).

Additional References:

Rehder, V, and Kater, SB, "Filopodia on Neuronal Growth Cones: Multifunctional Structures with Sensory and Motor Capabilities", *Seminars in Neurosciences*, 1996, 8: 81-88.

Challacombe, JF, Snow, DM, and Letourneau, PC, "Role of the cytoskeleton in Growth Cone Motility and Axon Elongation", *Seminars in the Neurosciences*, 1996, 8: 67-80.

Kapfhammer, JP, Grunewald, BE, and Raper, JA, "The Selective Inhibition of Growth Cone Extension by Specific Neurites in Culture", *Journal of Neuroscience*, 1986, 6: 2527-2534.

Kapfhammer, JP, and Raper, JA, "Collapse of Growth Cone Structure on Contact with Specific Neurites in Culture", *Journal of Neuroscience*, 1987, 7: 201-212.

Raper, JA, and Kapfhammer, JP "The Enrichment of a Neuronal Growth Cone Collapsing Activity from Embryonic Chick Brain", *Neuron*, 1990, 2: 21-29.

Kolodkin, AL, "Growth Cones and the Cues that Repel them", *TINS* 1996, 19: 507-513.

Culotti, JG, and Kolodkin, AL, "Functions of Netrins and Semaphorins in Axon Guidance", *Current Opinion in Neurobiology*, 1996, 6: 81-88.

Lander, A, and Calof, AL, "Chapter 31, Extracellular Matrix in the Developing Nervous System", *Molecular Genetics of Nervous System Tumors*, Wiley-Liss Inc., 1993, pp. 341-355.

Questions (see Purves and Lichtman unless otherwise noted):

1. Describe membrane incorporation in the growing axon (pp. 98-99).
2. What technical advances in neuroembryology can be attributed to Ross G. Harrison (p. 96)? How did Speidel's method (p. 105) differ from Harrison's? (see also Stirling and Dunlop).
3. Describe an experiment on the growth of sensory axons in the developing grasshopper leg: How can the axon be observed? How does the axon find its way to its target ganglion? (pp. 105-108)
4. What are the three main uses of the enzyme horseradish peroxidase in neuroanatomical studies? (pp. 114-115)

5. What is the major result in Hibbard's experiment on transplanted amphibian Mauthner cells? (pp. 118-119)
6. What are the four mechanisms of directed axon growth summarized by Purves and Lichtman? (pp. 119-129)
7. Recent studies have distinguished four types of chemical guidance, adding new detail to the above. What are they? (Marx) (p. 971)
8. What is the apparent role of Semaphorin III (collapsin) in the innervation of the spinal cord by dorsal root axons? (973 fig.)
9. Similarly, describe a role of the netrins in the formation of the spinothalamic tract (commisural axons from the dorsal horn neurons).