

9.14 class #22: Retinotectal system 2: Chemoaffinity; modes of axon growth.*Readings:*

Baier, H. and Bonhoeffer F., "Axon guidance by gradients of a target-derived component", *Science*, 1992, 255: 472-475.

Jhaveri, S. and Schneider G.E., "Chapter 35, Pathway navigation and target innervation in the visual system: Normal axon growth and some effects of brain injury", *Principles and Practice of Ophthalmology: Basic Sciences*, Albert, D.M. and Jakobiec, F.A. (Eds.), Philadelphia: Saunders, 1994, pp. 511-521.

O'Leary, D.D.M. and Wilkinson, D.G., "Eph receptors and ephrins in neural development", *Current Opinion in Neurobiology*, 1999, 9: 65-73.

Additional recommended readings:

O'Leary, D.D.M., Yates, P.A. and McLaughlin, T., "Molecular development of sensory maps: Representing sights and smells in the brain", *Cell*, 1999, 96: 255-269. [Includes review of the earlier names for ephrins and their receptors.]

Cheng, H.J., Nakamoto, M., Bergemann, A.D. and Flanagan, J.G., "Complementary gradients in expression and binding of ELF-1 and Mek4 in development of the topographic retinotectal projection map", *Cell*, 1995, 82: 371-381. [Note: ELF-1 and Mek4 are ephrins]

Nakamoto, M., Cheng, H.J., Friedman, G.C., McLaughlin, T., Hansen, M.J., Yoon, C.H., O'Leary, D.D. and Flanagan, J.G., "Topographically specific effects of ELF-1 on retinal axon guidance *in vitro* and retinal axon mapping *in vivo*", *Cell*, 1996, 86: 755-766.

Karlstrom, R.O., Trowe, T. and Bonhoeffer, F., "Genetic analysis of axon guidance and mapping in the zebrafish", *TINS*, 1997, 20 (1): 3-8.

Jhaveri, S., Erzurumlu, R.S. and Schneider, G.E., "The optic tract in embryonic hamsters: Fasciculation, defasciculation, and other rearrangements of retinal axons", *Visual Neuroscience*, 1996, 13: 359-374.

Cline, H., "Can there be growth without growth cones?" *Seminars in the Neurosciences*, 1996, 8: 89-95.

Trevarthen, C., "Obituary: Roger W. Sperry, 1913-1994", *TINS*, 1994, 17: 402-404.

Questions:

1. What is the membrane carpet preparation, and what is it used for ?
2. What is the basic finding with this preparation, concerning retinal axons growing on tectal membranes?
3. How might the growth cone respond to a concentration gradient of a guidance molecule?
4. Contrast the two modes of axonal growth as described by Jhaveri et al.
5. Describe some specific inhibitory effects known to play a role in axonal growth. (Oligodendrocyte membrane protein effects; axo-axonal interactive effects; contact with midline radial glia.)
6. Describe the phenomenon of collateral sprouting in the developing visual system.

7. Competitive interactions between different populations of developing axons: What is the evidence for these, and what kinds of specificity are the result?
8. Is Eph A1 a receptor or a ligand? Make sure you understand the meaning of these terms.
9. What is the consequence of knocking out the Ephrin A5 ligand in mice?
10. What is responsible for dorsal-ventral patterning [the representation of the superior-inferior retinal axis] in the tectum?
11. What ephrins and Eph receptors are responsible for the naso-temporal retinal axis representation in the tectum [superior colliculus]?

Discarded 2000:

Orike, N. and Pini, A. , "Axon guidance: Following the Eph plan, *Current Biology*, 1996, 6: 108-110.