

9.14 class #23: Retinotectal system 3: CNS axonal regeneration.*Readings:*

- So, K.-F. & Aguayo, A.J., " Lengthy regrowth of cut axons from ganglion cells after peripheral nerve transplantation into the retina of adult rats", *Brain Research* ,1985,328: 349-354.
- Chen, D.F., Jhaveri, S. & Schneider, G.E., " Intrinsic changes in developing retinal neurons result in regenerative failure of their axons", *Proc. Natl. Acad. Sci. USA* ,1995, 92: 7287-7291.
- Chen, D.F., Schneider, G.E., Martinou, J.-C. & Tonegawa, S. , "Bcl-2 promotes regeneration of severed axons in mammalian CNS", *Nature*,1997, 385: 434-439.
- Barde, Yves-Alain., " Help from within for damaged axons [News and Views]", *Nature*, 1997,385: 391-393. [See also the review by Holm & Isacson in 1999, listed below.]

Also recommended:

- Holm, K. & Isacson, O., "Factors intrinsic to the neuron can induce and maintain its ability to promote axonal outgrowth: a role for BCL2?", *Trends in Neuroscience* ,1999, 22: 269-273.
- David, S. & Aguayo, A.J. , " Axonal elongation into peripheral nervous system "bridges" after central nervous system injury in adult rats", *Science* ,1981,214: 931 - 933.
- So, K.-F., Schneider, G.E. & Ayres, S., "Lesions of the brachium of the superior colliculus in neonate hamsters: correlation of anatomy with behavior", *Experimental Neurology*,1981,72: 379-400.
- Schnell, L. & Schwab, M.E., " Axonal regeneration in the rat spinal cord produced by an antibody against myelin-associated neurite growth inhibitors", *Nature*,1990,343: 269-272.
- Cheng, H., Cao, Y. & Olson, L., "Spinal cord repair in adult paraplegic rats: partial restoration of hind limb function", *Science*,1996, 273: 510 - 513.

Questions:

1. Compare and contrast: Schwann cells and oligodendrocytes. What are they, where are they located, and what roles can they play in axonal regeneration?
2. After Ramon y Cajal's studies of regeneration and degeneration in the mammalian CNS after injury (book published 1928), it appeared that most CNS axon regeneration was abortive. How did the Aguayo findings lead to a renewal of interest in (and hope for) CNS regeneration?
3. Describe the paradigm invented by Kwok-fai So, which has become one of the major experimental paradigms for studying CNS axon regeneration.
4. What is the basic finding of Martin Schwab's laboratory concerning oligodendrocytes that appears to fit well with the theories of Aguayo *et al.* ?
5. What is the Olsen *et al.* paradigm, and what have these investigators recently claimed?
6. The MIT study by Chen *et al.* (1995) presented a fundamentally different view of CNS axon regeneration. What is it, and how does it explain the Aguayo *et al.* findings ?
7. What is Bcl-2, and how did Chen *et al.* show its possible importance for axonal growth and regeneration?
8. The need for a multifactor approach to the problem of obtaining functionally useful CNS axon regeneration: What is the meaning of each of the "four P's" of regeneration? (**P**reserve, **P**ermit, **P**romote, and **P**lasticity) *In class we will discuss the current status of this field.*