Neurobiology and Human/Animal Behaviour
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problem set #6

Relevant reading:

Kandel & Schwartz, chapters 57-59.

LC Katz & CJ Shatz, 'Synaptic Activity and the Construction of Cortical Circuits', *Science* **274**(5290):1133-1138 (15 November 1996).

`http://www.sciencemag.org/cgi/content/full/274/5290/1133`

LM Boulanger, GS Huh, CJ Shatz, 'Neuronal Plasticity and Cellular Immunity: Shared Molecular Mechanisms', *Current Opinion in Neurobiology* **11**(5):568-578 (October 2001).

A Veraksa, M Del Campo, W McGinnis, 'Developmental patterning genes and their conserved functions: from model organisms to humans', Molecular Genetics and Metabolism **69**(2):85-100 (February 2000).

1. What is Wallerian degeneration?

2. What is a growth factor?

3. What is a growth cone?

4. Why do axons in the mammalian CNS not regrow?

5. What experiments with the goldfish eye established the selectivity of optic nerve axons for their tectal targets?

6. What physiological properties of the developing visual system lead to segregation of inputs from the two eyes? Can any such segregation occur in the absence of light? What experiments established these findings?

7. In the golden hamster, thalamocortical axons don't reach the cortex till a rather late stage of foetal development. This property makes the golden hamster an excellent model system for studying the activity-dependent differentiation

of cerebral cortex. Assuming that you have a skilled veterinary surgeon available, what experiment could you do?

8. Is the occipital cortex of any use in a person who is congenitally blind?

9. What is spina bifida and at what stage of neural development does it arise?

10. Define the following terms: subplate, ventricular zone, radial glial cell.

11. Cerebral cortex is generated inside-out. Explain the sense in which this statement holds.

12. What experiment showed that neural induction depends on a signal from the notochord?

13. What is a homeobox (Hox) gene?

14. What experiment showed that retinoic acid signals ectodermal patterning?

15. If you transplant a second notochord into a *Xenopus* oocyte, what happens?

16. If you remove the notochord at the time of neural tube closure, what happens?

17. Where is sonic hedgehog expressed and what does it do?

18. Where are BMP4 and BMP7 expressed, and what to they do?

19. Development of ommatidia in *Drosophila melanogaster* is a lot easier to study than development in vertebrates. Why?

20. In the video game 'Sonic the Hedgehog', Sonic fights to free cute, defenceless little animals from the robot monsters of what evil scientist?

21. Though the Finnish band 'Sonic Hedgehog' have borrowed from old-school punk, they've never completely abandoned their grunge roots. Agree or disagree.