

Neurobiology and Human/Animal Behaviour
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problem set #2

Relevant reading: Kandel, Schwartz, Jessell, *Principles of Neural Science* 3/e, chapters 24 - 27.

1. Where are the cell bodies of primary afferent fibres located?
2. Given a structure within the central nervous system, what anatomical and physiological methods can be used to identify the structures that project to it, and what methods can be used to identify the structures to which it projects?
3. Briefly describe the locations (deep vs. superficial), the mechanical properties of surrounding tissue (bare nerve endings vs. thick lamellae), and the frequency selectivities (high-frequency vibration vs. constant pressure) of the following mechanoreceptors: Merkel's receptor, Meissner's corpuscle, Pacinian corpuscle.
4. Which fibres convey sharp pain and burning pain, respectively? In what fibre tracts do these separate sensations ascend? Where does each of these tracts decussate, and where within the thalamus and cerebral cortex does it eventually project?

What are Brown-Sequard syndrome and syringomyelia, and what do they tell us about how spinal afferents are organised?

5. Somatosensory cortex, like most of the cerebral cortex, has a six-layer structure. In what layer(s) is thalamic input received? In what layer(s) do cortico-cortical projections originate? What layer(s) produce the output of the cerebral cortex?
6. What's the difference between labelled-line coding and population coding? In what way and on what scale is each of these coding methods applied in somatosensory cortex?
7. If you hit your head, rubbing the painful area makes you feel better. What would the gate control model of nociceptive and tactile representations say about this phenomenon?

8. In what sense can cingulotomy (that is, ablation of cingulate cortex) be said to alleviate chronic pain?
9. What opiate-sensitive brain regions actively inhibit spinal cord neurons involved in signalling pain?
10. What happens to the cortical somatotopic map after an amputation? What perceptual changes may accompany these microanatomical and physiological alterations?
11. Shown below are a coronal section in T1-weighted and echo-planar T2-weighted magnetic resonance images, and also a T1-weighted parasagittal section. Identify the general region of the ventral posterior thalamus in each. Just for kicks, also identify any other structures that you can.



