About the study question on pedomorphism: Why is pedomorphism necessary? Why is it advantageous to make the brain more like the brain of a child?

According to Allman, one consequence of the truncated development of mammals is that they become smaller in body size (as compared with the more primitive cynodonts). Truncation of the developmental process is an easy way for this to happen in evolution. Smaller mammals can survive by preying on smaller creatures like insects, thereby avoiding competition with larger animals and depending on larger prey animals for food. The smaller body size results in an increase in relative brain size of mammals (as compared with cynodonts).

There may be some more subtle reason behind the selective advantage(s) of pedomorphism. Stephen Jay Gould's "Ontogeny and Phylogeny" should be a good book to consult if you are interested.

*Is the wulst *genetically* related to the neocortex of mammals, or just in function?*

The Wulst in birds and neocortex in mammals are genetically related, meaning that both regions are the results of similar gene expression patterns during development. Ref: p.113 of Allman. The functions of the Wulst in birds are similar to the functions of the visual cortex of mammals.

What sensory and other structures should we contrast in Question 21? Where can i find this information?

Question 21 is about contrasting the differing fates of neural crest cells and sensory placodes. First you should know what is meant by neural crest and sensory placodes. For what neural crest cells give rise to, see p. 123 of Butler and Hodos. For placodes, consult bpp. 126-130.

In the questions for lectures 7 and 8, and there was one about why the wall of the neural tube can be called "pseudostratified". I looked throughout the reading and couldn't find it, i mean i could make conjectures, but i want to make sure that i'm right. Are you sure it's in the reading and if not then where should I look for the answer?

In histology, the term "pseudostratified epithelium" has been used to described epithelial tissues which are (1) only one-cell thick (i.e., one layer of cells between the lumen and the basement membrane to which the epithelium is attached), and (2) assumes an appearance of a tissue with multiple layers of cells (under light microscopes) owing to differing locations of cell nuclei across cells. Usually, a pseudostratified epithelium is composed of ciliated cells. A classic example is tissues from tracheal linings.

For the wall of the neural tube, if you look at Fig. 12 of Purves and Lichtman (p. 19), you can see that at least initially, the neural epithelium is composed of one layer of cells. However, cells migrate back and forth between the basal and apical surfaces of the epithelium, and this shuttling of cells results in a multi-layer appearance of the epithelium owing to differing locations of the cell bodies. Thus, we say that initially, the neural epithlium is pseudo-stratified.

As a side note, we now know that while the cells divide mitotically when they are near the ventricular surface, they actually synthesize DNA when they are nearer to the marginal zone. The tenth chapter of Nauta has a very good description of this.

Question 2 of the Class 5-6 reading notes asks why salamanders are fascinating to scientists. However, page 59 of the Striedter readings implies that it is actually the axolotl which scientists are fascinated by, because of its ability to regenerate brain regions which were removed. Which one should I write?

You are indeed right. It is true that the axolotl should be the animal in question, although both axolotl and tiger salamander are urodeles of the genus Ambystoma (Ambystoma mexicanum and Ambystoma tigrinum) and probably have very similar properties. Both species have been used extensively for studies of limb regeneration. There are fewer studies of brain regeneration, and perhaps most of them have been on the axolotl and some newts.

About the question, "Contrast the location of primary sensory neurons of the body region in earthworms and mammals", do you mean the location of the cell body of the neurons (rather than body regions)?

I mean body region in contrast to head region. I want to know about positions of the cell body of the primary sensory neurons.

What does it mean for a cell to "ramify"? (Nauta, p. 46)

"To ramify" just means to separate into branches.

Are neuromeres the same things described in the Allman readings, the segments which are activated with a retinoic acid concentration gradient?

Yes. According to Allman, though, the morphogenic gradient of retinoic acid is responsible for turning on different patterns of Homeobox genes in the rhombomeres -- that is, the neuromeres of the hindbrain -- and the spinal cord. The more rostral neuromeres may be controlled by other morphogens.

About Class 5-6 lecture question #12: When did we learn about "multipurpose actions"? I can't find anything about them in my notes.

What are the differences between the spinoreticular tract and the corticospinal tract? Where can I find good pictures of these tracts?

The spinorecticular tract is an ascending, sensory pathway going from the spinal cord to the recticular formation of the midbrain and hindbrain. It is mostly ipsilaterally projected, though with ramifications to the contralateral side as well. Because of its widespread bilateral projection pattern, it is believed to be more primitive than the corticospinal tract. Also, it has fewer axons than the corticospinal tract.

The corticospinal tract is not an ascending sensory pathway. It is a descending, motor pathway going from the neocortex to the spinal interneurons (and a lower percentage to motoneurons). Although ~10% of the corticospinal axons project ipsilaterally, most of them decussate at the caudal end of the hindbrain. It is, phylogenetically, less primitive, and contains more axons than the spinoreticular tract.

For pictures:
Spinorecticular: look at slides in the beginning of Class 9.
Corticospinal: look at the second half of Class 6.

How does silver staining of axons work?

The silver stain of Cajal works by first immersing a block of neural tissues in silver nitrate, then in some strong reducing agents. This particular method, however, is not specific for degenerating axons. To stain those more specifically, an intermediate step with an oxidizing agent is required.

What is an adaptive advantage that a nervous sytem would confer?

A nervous system would confer adaptive advantage to a multicellular organism by coordinating the different body parts of the animal in responding to any local external stimulus. As the organism becomes more complex in structure, any behavior might require activation of various body parts in a specific, coordinated pattern. Such coordination would become impossible without the nervous system orchestrating the activation of the different body parts. Also, a nervous system would make possible an association between specific sensory stimuli and a motor response pattern, and it would allow learning to be possible, e.g., by increasing sensitivity to any potentially harmful stimuli, and by shortening the time of response to those stimuli.

Contrast the dorsal horn, lateral horn, and the ventral horn.

- Dorsal horn: axonal endings of primary sensory neurons; cell bodies of secondary sensory neurons
- Lateral horn (present in thoracic and upper lumbar segments): visceral motor neurons (i.e., preganglionic neurons of the sympathetic nervous system)
- Ventral horn: somatic motor neurons (i.e., motor neurons innervating the striated muscles)

Note that a similar organization of sensory and motor neurons is present in the brainstem, though the dorsal-ventral arrangement of the sensory-motor neurons in the spinal cord becomes, in the brainstem, lateral-medial. This distortion can be attributed to the formation of the pontine flexure and widening of the roof plate during the development of neural tube.

What is denervation supersensitivity? It's a mechanism of recovery from diaschisis, right?

Denervation supersensitivity refers to the increased sensitivity of postsynaptic neurons as a result of loss of input from presynaptic neurons. "Increased sensitivity" means relatively less input is required to trigger the same level of response. One possible mechanism can be that following denervation (causing reduction of inputs to the postsynaptic neuron), more receptors of neurotransmitters are expressed in the postsynpatic neuron, which now can be more responsive to the remaining inputs to the cell.

It is indeed a mechanism of recovery from diaschisis.