Biology 358 — Neuroanatomy
First Exam

Please print your name clearly on the back of the last page of this exam. Please read the instructions preceding each section carefully.

Section 1: Diagram labeling. The following pages are unlabeled diagrams of either spinal cord or some portion of the brain. Utilizing the blue marker supplied to you, label the following structures on the diagram. **Outline the area in the diagram where the structure would be found, and then extend a line from the diagram out to the white margin. place the number of the question at the end of the line in the margin. (You need to do this on one side only).**

In the white margin label the outlined segment with the number found to the left of the structures listed below. **However, if the structure is not found on the segment put the number in the margin of the segment and mark the structure NFOS (not found on segment). If you take the exam apart you must put the pictures back in the order in which you found them, as it makes grading much, much easier and faster.** (2 points each)

**HBS-3: Transverse section of the lower medulla**

1. LMN of the descending pyramidal motor tract that only descends into the cervical and upper thoracic region of the cord.

2. Neuronal fibers of the S.O.N. of the tract that deals with information that is neurologically interpreted as telling the individual the “What, where and when” of a sensation.

3. S.O.N. of the tract dealing with pain, temperature and crude touch.

4. Reticular formation

5. Two nuclei contribute to the formation of this tract: the caudal magnocellular nucleus and the more rostral parvocellular nucleus. Once formed this tract decussates almost immediately, and travels in the cord ventral to the lateral corticospinal tract. This tract is somatotopically arranged.

6. Spinocerebellar tracts

**HBS-1: Transverse section through the cervical region of the spinal cord.**

7. This extrapyramidal tract extends only into the cervical region of the spinal cord. In addition it contains almost 100% contralateral fibers and synapses on LMNs that are classified as interneurons.

8. This tract, while containing fibers that deal with pain, temperature and crude touch, also carry sensory information to the reticular formation and the inferior olive.
9. Two nuclei contribute to the formation of this tract: the caudal magnocellular nucleus and the more rostral parvocellular nucleus. Once formed this tract decussates almost immediately, and travels in the cord ventral to the lateral corticospinal tract. This tract is somatotopically arranged.

10. This descending motor tract extends throughout the entire length of the spinal cord. The distribution of its UMN's is as follows: 60% of the UMN's originate in the primary motor cortex; 30% of the UMN's originate in the premotor cortex, and the remaining 10% of the UMN's originate in the somesthetic cortex of the parietal lobe.

**HBS-7: Transverse section through the mid-brain (inferior olivary) region of the medulla**

11. Small cell reticular nucleus

12. LMN of only lateral corticospinal tract.

13. Neuronal fibers of the S.O.N. of the tract that deals with information that is neurologically interpreted as telling the individual the “What, where and when” of a sensation.

14. Inferior olive

15. LMN of only the descending pyramidal motor tract that only descends into the cervical and upper thoracic region of the cord.

16. Neuronal somas of the F.O.N. of the tract that deals with information that is neurologically interpreted as telling the individual the “What, where and when” of a sensation.

Go to the next section of the exam, which will be found after the image of HBS-7.
Section 2: You are required to answer two of the following three questions. Please answer these questions on the accompanying blank sheets of paper. Place each of your answers to those questions (a) on a separate page and (b) in numerical order. You are limited to one side of one sheet of paper for each of your answers to the questions below. 20 points per question.

17. The long ascending motor tracts follow a general anatomical pattern. For this question you are to do the following:
   a. Discuss the general anatomy of the long ascending spinal tracts.
   b. Explain how the spinocerebellar tracts do not follow this general anatomical pattern.

18. Compare and contrast the anatomy and function of the pyramidal and extrapyramidal motor systems. Be sure to use an example of each system in your answer and explain how that motor tract exemplifies what you are talking about you your answer.

19. Pick one motor and one sensory tract and use each of those as an example to explain what an individual with a hemisection of the spinal cord at C₅ would experience and be aware of with respect to his/her motor and sensory deficits.

Go to the next section of the exam, which will be found after the second blank page of this exam.
Section 3: Clinical questions. Each of the next two questions present you with a clinical situation. You are to provide the following for each question:

a. Where the patient’s lesion is and what anatomical structures are affected by that lesion, as demonstrated by coloring in the area of the lesion with your blue pen on the spinal cord diagram on the attached page that precedes the blank piece of paper for each question.

b. A solid and anatomically logical rationale for your answer, which is to be written out on the blank piece of paper that follows the diagram of the spinal cord.

You will be graded on your answers based on the accuracy of your answer and the anatomical logic of your answer. Place each of your answers to those questions in numerical order, and please place each of the explanations of your anatomical logic on a separate piece of paper. You are limited to one side of one sheet of paper for each of your answers to the questions below.

(15 points per question)

20. A 20-year-old male celebrated the passing of his first neuroanatomy examination by drinking several beers at a party. On the way home he drove his car head-on into a bridge abutment. On examination in the ER he was found to have a fractured spine and symptoms of severe damage to the spinal cord. Upon examination he was found to have the following:

• Positive Babinski sign
• Paralysis of the left lower limb
• Loss of kinesthetic sense of the left lower limb
• Total loss of pain and temperature sensation inferior to the level of the umbilicus and involving the entire right lower limb.

State the anatomical structures involved and the level of the lesion.

21. A 60-year-old female walked into the neurology clinic and the physician paid particular attention to her gait. The patient raised her feet unnecessarily high and brought them to the ground in a stamping manner. While she was waiting for the physician, it was noticed that she stood with her feet wide apart. On questioning, the patient said that she was finding it increasingly difficult to walk and was starting to use a cane, especially when she went out for walks in the dark. The physician asked the patient to stand with her toes and heels together and to close her eyes. The patient immediately started to sway and the nurse had to steady her to prevent her from falling. On further examination, the patient was found to have a loss of proprioception and kinesthetic sense of both lower limbs and was unable to detect any feeling of vibration when a vibrating tuning fork was placed on the medial malleolus of either leg. No other sensory losses were noted.

State the spinal tract(s) that is/are involved in this patient’s neurological problems.