MULTIPLE CHOICE.—For the following multiple choice questions circle the letter in front of the response that best answers the question or completes the sentence. (20%, 2% each)

1. Which of the following is a sphincter between the small intestine and the large intestine?
   a. Cardiac sphincter
   b. Pyloric sphincter
   c. Esophageal sphincter
   d. Ileocecal sphincter
   e. None of the above

2. Which of the following is usually caused by a reduced ability of target cells in the liver to respond to the hormone insulin?
   a. Hypoglycemia
   b. Insulin shock
   c. Type I Diabetes Mellitus
   d. Type II Diabetes Mellitus
   e. None of the above

3. Which of the following is a mobile blood clot?
   a. aneurysm
   b. embolus
   c. infarction
   d. thrombus
   e. None of the above

4. Which of the following is where cells are broken apart, bacteria are killed, and protein digestion begins?
   a. jejuno-ileum
   b. stomach
   c. duodenum
   d. colon
   e. None of the above

5. Which of the following has the thickest wall?
   a. arteriole
   b. artery
   c. capillary
   d. vein
   e. venule

6. In a mammal, blood from the superior vena cava, then flows to the…
   a. aorta.
   b. inferior vena cava.
   c. left atrium.
   d. left ventricle.
   e. None of the above

7. Which of the following is where urine is collected in the kidney?
   a. renal cortex
   b. renal medula
   c. renal pelvis
   d. urinary bladder
   e. None of the above

8. Which of the following organs can convert excess glucose to glycogen?
   a. kidney
   b. liver
   c. pancreas
   d. stomach
   e. None of the above

9. Which of the following brings neural signals to the involuntary muscles of the body?
   a. autonomic nervous system
   b. central nervous system
   c. sensory nervous system
   d. somatic nervous system
   e. None of the above

10. Which of the following are the spaces inside the vertebrate brain?
    a. atria
    b. central canals
    c. lateral canals
    d. ventricles
    e. None of the above
**MATCHING.**—For the following exercise match the substances in the right column with the cells or organs that secrete them in the left column. Each letter may be used more than once or not at all. (5%, 1% each)

1. liver                  ______   A. amylase
2. neuron                ______   B. bile
3. pancreas              ______   C. glucagon
4. salivary glands       ______   D. neurotransmitter
5. stomach              ______   E. pepsinogen

**FILL-IN-THE-BLANK.**—For the following exercises write the appropriate word or words in the available space. (25%)

1. Fill in the appropriate labels for the following drawing. (10%)

![Diagram 1]

- a. ___________________  
- b. ___________________  
- c. ___________________  
- d. ___________________  
- e. ___________________

2. The ___________________ is a gland functioning in both the digestive and the endocrine systems. (1%)

3. Fill in the appropriate labels for the following drawing. (8%)

![Diagram 2]

- a. ___________________  
- b. ___________________  
- c. ___________________  
- d. ___________________  
- e. ___________________  
- f. ___________________  
- g. ___________________  
- h. ___________________

4. List four diseases, disorders, or groups of diseases that occur at an increased frequency in someone who smokes. (4%)

   - ___________________  
   - ___________________  
   - ___________________  
   - ___________________  

5. __________ cells secrete insulin.

6. __________ cells secrete glucagon.
DEFINITIONS.—For the following words or phrases define them as accurately and concisely as possible. (20%, 4% each)

1. Action potential:

2. Lymph:

3. Peristalsis:

4. Strep throat:

5. Stroke (the medical disorder):

SHORT ANSWER.—For the following answers, address each question in as concise and lucid a manner as possible. Do NOT exceed the space provided. (10%)

1. Explain why the human stomach normally does NOT digest itself. What is it called when the stomach does digest a region of its lining. (6%)

2. What is a nephron and how does it function? (4%)
SHORT ESSAYS.—For the following essays, address each question in as concise and lucid a manner as possible. Do NOT exceed the space provided. (20 points)

1. Describe the blood flow through the mammalian heart. Be certain to identify all major chambers, blood vessels, and the destination of the blood once it leaves the heart. Also indicate which blood is high in oxygen and which blood is low in oxygen. (Feel free to use text and/or drawings for your answer.) (10 points)

2. Explain what happens to “food” in the digestive system as it travels from the pyloric sphincter to the anus. Be certain to identify all regions through which the “food” passes and what happens in each region. (Feel free to use text and/or drawings for your answer.) (10 points)
MULTIPLE CHOICE.—For the following multiple choice questions circle the letter in front of the response that best answers the question or completes the sentence. (20%, 2%)

1. Which of the following biomes typically has the most frequent fires?
   a. Desert
   b. Temperate deciduous forest
   c. Temperate grassland
   d. Tropical rain forest
   e. Tundra

2. Which of the following lacks a sporophyte in its life cycle?
   a. Bryophyta
   b. Charophyta
   c. Coniferophyta
   d. Pterophyta
   e. None of the above (all lack sporophytes)

3. Which of the following typically has mesoderm tissue?
   a. Anemone
   b. Jelly"fish"
   c. Sponge
   d. Tapeworm
   e. None of the above (none have mesoderm)

4. To which of the following phyla does an earthworm belong?
   a. Annelida
   b. Arthropoda
   c. Nematoda
   d. Platyhelminthes
   e. None of the above

5. Which of the following describes a dung beetle relying on buffalo for their feces (used as food by the beetles)?
   a. Commensalism
   b. Mutualism
   c. Predator
   d. Primary production
   e. None of the above

6. Which of the following best describes pollen?
   a. A baby plant in a box with its lunch
   b. Airborne plant sperm
   c. Mobile microsporangium
   d. Small male gametophyte
   e. Sporophyte

7. Which of the following is the term for a bacterium living as clumps of rod-shaped cells?
   a. Staphylobacillum
   b. Staphylococcus
   c. Streptobacillum
   d. Streptococcus
   e. None of the above

8. Which of the following has populations that are usually entirely female and reproduce parthenogenetically?
   a. Butterflies
   b. Earthworms
   c. Rotifers
   d. Sponges
   e. None of the above

9. Which of the following is a fungal mutualism with vascular plant roots?
   a. Fairy rings
   b. Lichen
   c. Mycelium
   d. Mycorrhizae
   e. None of the above

10. You put a nail in a tree 1.5 meters above the ground. The tree grows 1 meter taller per year. How high above the ground is the nail after 5 years?
    a. 1.5 meters
    b. 5.5 meters
    c. 6.5 meters
    d. 50.5 meters
    e. None of the above
MATCHING.—Match the organism in the right column with the corresponding taxonomic group in the left column. Each letter may be used more than once or not at all.(10%, 1% each)

1. Anthophyta ______ ______
2. Arthropoda ______ ______
3. Molluska ______ ______
4. Nematoda ______ ______
5. Platyhelminthes ______ ______

A. barnacle
B. beetle
C. clam
D. daisy
E. fluke
F. Guinea worm
G. magnolia
H. pine
I. roundworm
J. tapeworm
K. squid

FILL-IN-THE-BLANK.—For the following exercises write the appropriate word or words in the available space.(20%)

1. Fill in the appropriate labels for the following drawing. (6%)

   a. __________________________
   b. __________________________
   c. __________________________

2. Fill in the blanks below. (3%)

   The three functions of the lymphatic system are…
   __________________________
   __________________________
   __________________________

3. The vertebrate class that includes the ray-finned fishes is __________________________.

4. Label synapomorphies for the indicated branches below (6%)

   Fungi Porifera Other Animals
   A B C
   a. __________________________
   b. __________________________
   c. __________________________

5. Sketch a typical terrestrial biomass pyramid in the space provided. Be certain to label each layer. (4%)

   __________________________
   __________________________
   __________________________
DEFINITIONS.—For the following words or phrases define them as accurately and concisely as possible. (20 points, 4 points each)

1. Science:

2. Aneurysm:

3. Genetic Drift:

4. Sink Population:

5. Tuberculosis:

SHORT ANSWER.—For the following answers, address each question in as concise and lucid a manner as possible. Do NOT exceed the space provided. (10%)

1. Is a population with the following allele and genotype frequencies at Hardy-Weinberg equilibrium? Show your work. Frequency of A = 0.6; Frequency of a = 0.4; Frequency of AA = 0.40; Frequency of Aa = 0.50; Frequency of aa = 0.10 (5%)

2. If a population of 200,000 individuals is growing exponentially and has an intrinsic rate of increase (r) of 0.1, then what is the size of the population after one year? Two years? Show your work. (5%)
SHORT ESSAYS.—For the following essays, address each question in as concise and lucid a manner as possible. Do NOT exceed the space provided. (20%)

1. Describe the life cycle of a fern. Include all life cycle stages and important structures. Also indicate all cellular processes that occur. (Feel free to use text and/or drawings for your answer.) (10%)

2. Define natural selection and explain how it can result in the evolution of antibiotic resistant strains of bacteria. (10%)