

## General Biology 101/ Fall 2009/ Dr. Morrison

### Learning Objectives for Lecture Exam I

Required Reading in *Biology: Concepts and Connections* (SIXTH edition) by Campbell et al.

#### Animal Form and Function (Parts of Chapters 20, 21 and 25)

1. Give examples of how structure fits function in the animal body, especially **how form fits function** in chemical exchanges between animals and their environments (20.13).
2. Compare and contrast the specialized **structures used for food processing** (ingestion, digestion, absorption and elimination) in hydra, worms, grasshoppers, birds and mammals (21.2 and 21.3, Lab Guide Minicourse 1)
3. Contrast the three **forms of nitrogenous waste** excreted by animals -- ammonia, urea, and uric acid -- in terms of their toxicity, solubility and chemical composition. Cite the advantages and disadvantages of excreting each (25.5).
4. **Trace the processing of filtrate through the nephron** of a human kidney, including the glomerulus, Bowman's capsule, proximal convoluted tubule, descending and ascending portions of the loop of Henle, distal convoluted tubule, and the collecting duct (25.6). Describe each structure's role in filtration, reabsorption, secretion or excretion (25.7 and 25.8).
5. Explain the effects on **urine production** of antidiuretic hormone (ADH), ethyl alcohol and caffeine (Lecture).
6. Compare a kidney dialysis machine with a normal kidney (25.9)
7. What kinds of information about the body are provided by CT scans, magnetic resonance imaging (MRI), and positron emission tomography (PET) scans (20.11)?

#### Respiratory Systems (Chapter 22)

1. **List four things necessary for gas exchange** to occur in multicellular animals and explain why each is required (Lab Guide, Minicourse 2, p. 2).
2. Compare and contrast the systems used for gas exchange by various animals (22.2), including insects (22.4). **Describe how the efficiency of gas exchange and transport has been improved** by respiratory pigments, red blood cells, branched gas exchange surfaces, and internal transport systems (22.10 and 22.11).
3. **Compare and contrast the structural organization and gas exchange efficiency of gills and lungs**. Include the availability of oxygen in water and air, countercurrent flow in gill filaments, and the structure of the alveolar sacs in lungs (22.3 and 22.6).
4. In terms of structural changes in the lungs, **describe the steps by which smoking leads to emphysema and lung cancer** (22.7).

#### Circulatory Systems (Chapter 23)

1. **Explain how the efficiency of animal circulatory systems has been improved** by the evolution of internal body cavities, open circulatory systems, closed circulatory systems, respiratory pigments, atria and ventricles (23.1, 23.2 and 23.3)
2. Given a diagram of the human heart, label its structures (including chambers, valves and major blood vessels) and **trace the flow of blood through the heart** (23.4)

3. **Explain how the pumping efficiency of the vertebrate heart has been improved** by the evolution of: atria, the AV node, the SA node, the bundle of His, the separation of right and left ventricles, atrioventricular valves and semilunar valves (23.6 and 23.7).

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#### **Circulatory Systems** (continued)

4. **Correlate the features of a normal, human electrocardiogram (ECG) with the events associated with one heartbeat:** heart sounds and the status of the chambers and valves (Figure 23.7).
5. Define systolic and diastolic pressure and describe how a sphygmomanometer is used to measure **blood pressure**. Describe some of the causes and consequences of high blood pressure (23.9 and 23.10).
6. Describe some of the causes and treatments of **heart attack**, including the meaning of atherosclerosis, angina, scar tissue, coronary artery bypass, and angioplasty (23.8)

#### **Nervous Systems** (Chapter 28)

1. **Diagram a typical motor neuron** and describe the electrical conduction properties of the dendrites, cell body, axon, and synaptic end bulbs (28.1 and 28.2).
2. **Describe the basic mechanisms that help generate the “resting potential” of a neuron:** the axon’s selectively permeable membrane, the sodium-potassium pump, and the unequal distribution of positive and negative ions inside and outside the axon (28.3).
3. **Describe how an “action potential”** (“all-or-nothing” nerve impulse) **propagates along an axon without fading out.** Include the role of the stimulus, the depolarization threshold, the opening and closing of sodium gates, and the movement of sodium and potassium ions. Explain how the AP spreads along the axon without fading out (28.4 and 28.5).
4. Applying your knowledge of action potentials: (a) How do poisons like cyanide and puffer fish tetrodotoxin paralyze? (b) **If all action potentials look the same, how do they carry information** about different intensities and qualities (light, sound, touch) of sensory stimuli? (c) What causes “seeing stars?” (Lecture)
5. **Given a diagram of a synapse, label all major structures and describe the sequence of events involved in the transmission of a nerve impulse from a neuron to a post-synaptic cell** (28.6 and 28.7).
6. Describe several synaptic *mechanisms* by which drugs (stimulants and depressants) alter behavior (28.8 and 28.9).
7. Given a diagram of a **human brain**, identify and briefly describe the function of the hindbrain (medulla, cerebellum, pons), midbrain (tectum), forebrain (thalamus, hypothalamus, cerebral cortex and corpus callosum), and reticular activating system. Label the major sensory and motor areas of the cerebral cortex (28.15 and 28.16).
8. What kinds of information about the brain are provided by functional MRI (fMRI) scans (28.8)?
9. **Why do amputees still feel pain in their “phantom” limbs?** What insights into the brain have been gained from studies of phantom limb phenomena? (Lecture)
10. **Citing experiments with "split-brain" patients, discuss what they reveal about the specialization of the right and left cerebral hemispheres** with respect to (a) connections from the retina, (b) processing of sensory input, (c) types of information remembered, and (d) the control of motor output like hands and speech (28.17).

11. Describe the role of **emotion** and the amygdala in the formation of long-term **memory** (28.20)

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#### **The Senses (Chapter 29)**

1. **Given a diagram of the human eye, label and describe the interrelationships of the structures** involved in focusing an image on the retina, including the cornea (sclera), aqueous humor, pupil, lens, iris, ciliary body, vitreous humor, retina, rods, cones, fovea, and choroid layer. (29.7 and 29.8)
2. **Describe how the retina and visual cortex of humans process visual input.** (29.10).
3. Given a diagram of the **human ear**, label and give the major function of the structures responsible for hearing, including the tympanic membrane, middle ear bones (hammer, anvil and stirrup), oval window, cochlea, basilar membrane, organ of Corti, hair cells and Eustachian tube (29.4).

#### **Reproduction and Embryonic Development (Chapter 27)**

1. Given a model or diagram, identify all major parts of **the reproductive system of the human male and female and describe the primary function(s) of each structure.** Trace the pathway of human sperm and ova from site of origin to site of departure from body (27.3 and 27.4).
2. Describe the role of **human reproductive hormones** in the formation of gametes and the implantation of zygotes. Include testosterone, FSH and LH in males, and FSH, LH, estrogen, progesterone, and HCG in females. Consider the sources, targets, and feedback interactions of the hormones involved (27.5 and 27.6).
3. **Describe the sequence of events during and immediately following a sperm's penetration of a human ovum** (27.9).
4. Compare and contrast the overall **pattern of cleavage** in the sea urchin, frog, chicken and human, relating each to the amount and distribution of yolk in the egg (27.10).
5. **Compare the overall pattern of gastrulation in the sea urchin, chicken and human.** Explain the importance of gastrulation for subsequent development, including the organs derived from the 3 primary germ layers (27.11 and 27.12).
6. **Describe the cellular processes involved in organ formation – induction, cell migration, and programmed cell death --** citing examples such as the induction of the neural tube and the lens of the eye (27.13 and 27.14).
7. **Compare the structure and functions of the four extraembryonic membranes in chickens and humans** (27.15 and Lab Guide Minicourse 3).
8. **Contrast the major anatomical and physiological changes that occur during *embryonic period* with those that occur during the *fetal period of human development*** (27.16).
9. Describe the major events associated with each of the three **stages of labor** (27.17).