

- **PHYSICALLY PRINT OUT** this PDF and **HANDWRITE** (with a black or blue pen) your answers directly on this PDF. Typed or digitally-written work is not accepted. Do not answer questions on separate paper.
- **Importantly, study guides are NOT GROUP PROJECTS!!!** You, and you alone, are to answer the questions as you **read** your assigned textbook. You are not to share answers with other students. You are not to copy any answers from any other source, including the internet.
- **Get in the habit of writing LEGIBLY, neatly, and in a medium-sized font.** AP essay readers and I will skip grading anything that cannot be easily read so start perfecting your handwriting, and don't write so large you can't add all the relevant details and key elaborations in the space provided.
- **SCAN** physical documents in color and with good resolution. Then, upload your final work as **PDFs** to Archie. Avoid uploading dark, shaded, washed-out, sideways, or upside-down scans of homework. Keep completed physical study guides organized in your biology binder to use as future study and review tools.
- **READ FOR UNDERSTANDING** and not merely to complete an assignment. *First*, read a section quickly to get an overview of the topic covered. Then, read it a second time slowly, paraphrasing each paragraph out loud and analyzing every figure. Finally, read it a third time as you answer the study guide questions if assigned and start building your memory. Try to write answers out in your own words, when possible, and try to purposefully and accurately use all new terminology introduced.

1. Throughout the various species that occupy our planet, an enormous amount of variation can be seen in their appearances, all as a consequence of **natural selection and resulting adaptations**. What kind of variation does natural selection favor?
2. **The body plans of animals are programmed by their genomes, the genes in their DNA.** (Recall that **genes** contain the instructions on how to build polypeptides - and, therefore, **proteins** - and various **RNA molecules**). Though body plans vary due to variations in genome composition and patterns of gene expression, certain aspects of animal body plans are still bound to certain ranges of variations based on physical laws. What **four aspects of animal body plans are governed by physical laws**, for example?
 - i.
 - ii.
 - iii.
 - iv.
3. Animals that evolve in similar environments often evolve to have similar adaptations, a process called **convergent evolution**. Recall that an **adaptation** is a characteristic (**behavior, physiological function, or anatomical structure**) that helps that species **1. survive and**, therefore, more likely **2. reproduce**.
 - Of course, small variations in these adaptations still do exist among the organisms within a species, leading to individual organisms often having differing **relative biological fitnesses**, which is a term that refers to an individual organism's success in surviving to reproductive age, finding a mate, and producing offspring.

Your text details how certain animals evolved streamlined body plans as a result of natural selection. Explain why you think that **the fusiform body plans of various marine organisms that move through water, which is much more dense and thick than air, might be an adaptation** in terms of helping the organisms **1. survive and**, as a **consequence**, **2. reproduce**. (Always answer ALL part of such questions)

1. How does fusiform body shape help certain marine organisms like dolphins, fish, seals, or penguins **survive**? (Think: What activities that are essential to life might they do better with this body shape?)
2. How surviving help them be more successful at **reproducing** in their lifetime?

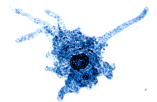
4. a. As you've seen already, just for cellular respiration, let alone so many other processes, animals need to exchange materials with their environment. What are the **three categories of materials that all animal cells must exchange with their outside environment?**
- 1.
 - 2.
 - 3.

5. a. **The process of exchanging materials with the environment occurs as substances dissolved in an aqueous medium move across the plasma membrane of each cell.**

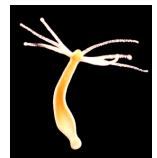
Fill in the blanks: Recalling from your studies on the importance of Surface-Area-to-Volume-Ratios of cells (*revisit the Ch.6 Slides to review this topic for a moment*), the _____ of exchange is proportional to the _____ involved in exchange, whereas the _____ of material that must be exchanged is proportional to the total body (or cell) volume.

- b. For certain animals with simpler body plans, their cellular arrangement (body plans) enable their cells to all engage in the **direct exchange of material between their cells and the external environment**. Explain how the following organisms' body plans allow for a large number of their cells to be in direct contact with (or very close to) the external environment.

1. a single-celled amoeba (*a protist, not an animal*)



2. a hydra (*an animal*)



3. a tapeworm (*an animal*)



- c. Most animals have more complex body plans and so are not single-celled, two-cells thin, or flat in shape. For animal organisms with more complex body plans, humans included, our bodies are composed of **compact and thicker masses of cells**. What types of **adaptations are seen in these organisms' body plans to allow for sufficient rates of exchange of matter with the environment?**

6. a. In organisms with thicker and more compact masses of cells, all the body cells do **not** exchange material (nutrients, waste products, and gases) directly with the external environment then since they are not in contact with that external environment. What is **interstitial fluid**?

- b. Complex bodies also contain internal circulatory fluids, like human's vertebrate blood. What is the **relationship between interstitial fluid and circulatory fluid**?

7. Study Figure 40.4, including the figure legend. In animals with complex, thicker masses of cells making up their body plan, **most cells exchange material with the interstitial fluid immediately surrounding the cell instead of the external environment directly**. Nutrients and gases reach this interstitial fluid (and thus the cell) with the help of the **surfaces specialized for exchange**, which you discussed in question 5.c. Waste products and waste gases leave cells and enter this interstitial fluid too, being later removed from the entire body also by these **specialized exchange surfaces** alluded to in question 5.c..

These surfaces specialized for exchange of matter between the body and the external environment or the interstitial and circulatory fluids include the **alveoli of the lungs** where oxygen and carbon dioxide gases are exchanged between circulatory fluid and the external air, the multicellular organ surface projection and individual cell plasma membrane projections knowns as the **villi and microvilli of the small intestines** where nutrients from food are absorbed into the circulatory fluid, the **nephrons of the kidney** where blood is filtered and urine with waste products is produced in order to remove them from the body, and the extensive **capillary system of our cardiovascular system** where matter is exchanged between the blood and the fluid that bathes our body tissues.

It takes more steps to get nutrients and gases to the body cells and waste products and waste gases out of the body cells in organisms with complex body plans. So, why would natural selection have sometimes favored such complex body plans? What are the **advantages of having complex body plans over having simpler body plans**?

- 1.
- 2.
- 3.
- 4.

8. What the difference between a **tissue** and an **organ**?

9. a. What is an **organ system**? (*Note that one organ may be a part of multiple organ systems*)

- b. Study Table 40.1. Then, as a self-quiz, list the **11 mammalian organ systems** and their **main functions**.

1. _____ =

2. _____ =

3. _____ =

4. _____ =

5. _____ =

6. _____ =

7. _____ =

8. _____ =

9. _____ =

10. _____ =

11. _____ =

10. There are **four types of animal tissues** (See Figure 40.5). For each, first provide a general overview of the tissue. Then, provide some specifics related to cells within this category of tissue.

1. a. Where is **epithelial tissue** usually found (location) within an animal body?

b. What are the general **functions of epithelial tissue**?

c. Epithelial cells are said to be **polarized** (have polarity) **with an apical and basal surface**. Explain.

Apical Surface of an epithelial cell =

Basal Surface of an epithelial cell=

d. Let's look at some specific types of cells that fall under the category of epithelial tissue. Provide a description of the cell, its general function, and an example of the location you may expect to find these cells at in the body.

Cuboidal Epithelial Cells

Tissue Description:

General Function(s):

Locations:

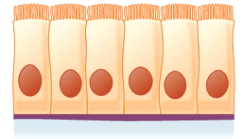


Simple Columnar Epithelial Cells

Tissue Description:

General Function(s):

Locations:



Simple Squamous Epithelial Cells

Tissue Description:

General Function(s):

Locations:

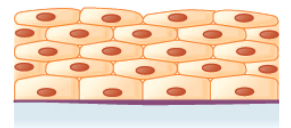


Stratified Squamous Epithelial Cells

Tissue Description:

General Function(s):

Locations:

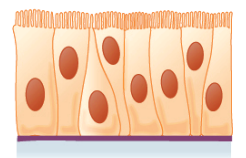


Pseudostratified Columnar Epithelial Cells

Tissue Description:

General Function(s):

Locations:

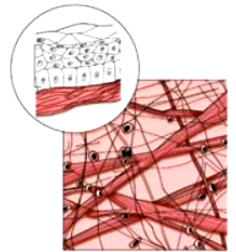


2. a. What does the general organization of **Connective Tissue** look like?
- b. What is the general **function of Connective Tissue**?
- c. What are the **three types of fibers found in Connective Tissue** (in varying ratios) and what do they do?
- i.
- ii.
- iii.
- d. Let's look at some specific subtypes of tissues that fall under the category of connective tissue. Provide a description of the tissue and describe its function(s).

Loose Connective Tissue

Tissue Description(s):

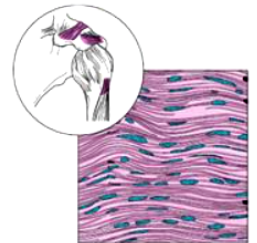
General Function(s):



Fibrous Connective Tissue

Tissue Description(s):

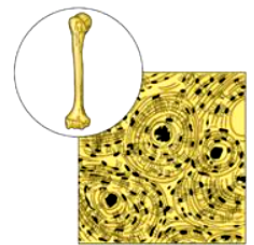
General Function(s):



Bone (Connective Tissue)

Tissue Description(s):

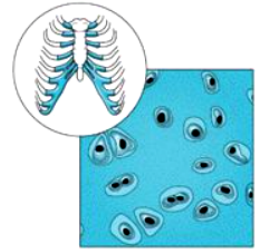
General Function(s):



Cartilage (Connective Tissue)

Tissue Description(s):

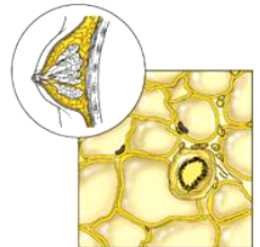
General Function(s):



Adipose (Connective) Tissue

Tissue Description(s):

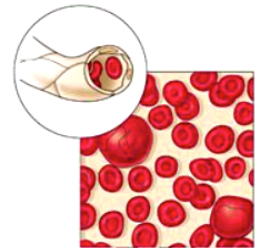
General Function(s):



Blood (Connective Tissue)

Tissue Description(s):

General Function(s):



3. a. What is the general **function of Muscle Tissue?**
- b. What are the **two proteins that interact that allow all types of muscle cells to contract?**
- c. Let's look at some specific subtypes of tissues that fall under the category of muscle tissue. Describe the location of the tissue and describe its function(s).

Skeletal Muscle *(also known as Striated Muscle)*

Tissue Location(s):

General Function(s):



Smooth Muscle

Tissue Location(s):

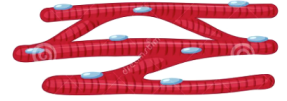
General Function(s):



Cardiac Muscle

Tissue Location(s):

General Function(s):

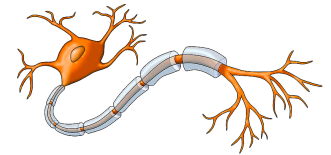


4. a. What is the general **function of Nervous Tissue?**

c. Let's look at the two categories of cells that make up nervous tissue. Describe what they do.

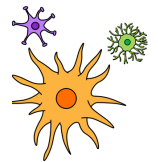
Neurons

General Function(s):



Glia

General Function(s):



Brain = an animal organ made up of a high concentration of nervous tissue.

General Function(s):



11. a. Since animals are multicellular, they need systems that allow them to coordinate between and control their cells and, thus, bodies' responses to the stimuli they receive. **Two major systems for coordinating and controlling responses** have evolved. Name and describe these two systems:

1. Name: _____

Description:

2. Name: _____

Description:

- b. Study Figure 40.6. What are the **signaling molecules called which are released by endocrine cells?**
- c. Study Figure 40.6. Which **cells are able to respond to endocrine signals?**
- d. What are the **three types of cells that nerve cells are able to communicate with?**
1. _____
 2. _____
 3. _____
- e. How are **signals transmitted through the nervous system?** (*Hint: There are two ways a signal is transmitted, first through the length of the neural cell and then onto the next cell*)
1. _____
 2. _____
- f. How **long does the effects of the signal from the endocrine cells last?**
- g. How **long does the effects of the signal from the neurons last?**
- h. Though both the endocrine and nervous systems communicate and coordinate activities and responses in the body, they are each adapted to different functions. What **types of function is each system best suited for?**

Endocrine System

Nervous System