

**STUDY GUIDE - Ch. 6.2 - Eukaryotic Cells have Internal Membranes that Compartmentalize their Functions**

NAME: \_\_\_\_\_

- **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. Which **two domains of life** consist of prokaryotic cells?

2. a. **All cells on Earth today share a common ancestor and have certain characteristics in common.** What four cellular components do all domains of life have in common? Be sure to include a brief description of each.

1.

2.

3.

4.

b. A major **difference between prokaryotic and eukaryotic cells is the location of their DNA.** Describe this difference.

3. a. On the illustration of a prokaryotic cell, identify the highlighted prokaryotic cell components.

1. (the outermost coating present on some prokaryotes - sometimes called a **capsule**)

2. (the middle coating)

3. (the innermost coating)

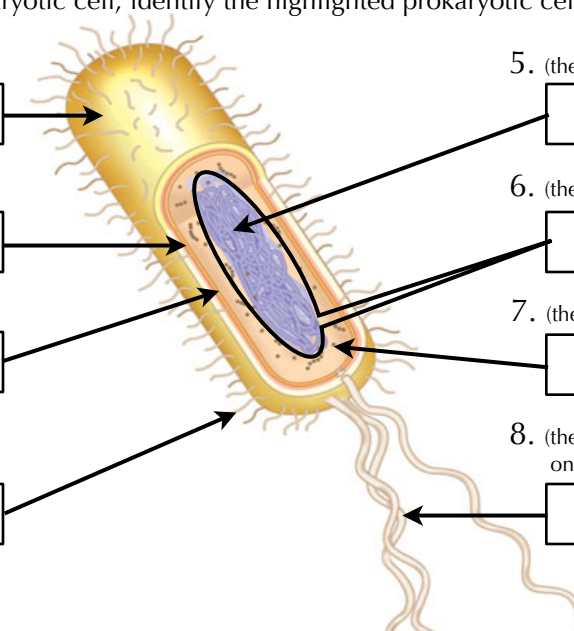
4. (the cellular projections present on the surface of some bacteria)

5. (the string-like material drawn in purple)

6. (the region with the purple substance)

7. (the small dots floating in the cytosol)

8. (the long cellular projections present on some bacteria)



b. Explain the function of each of the **prokaryotic cell parts** identified above

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

4. What is the definition and difference between the cell's **cytosol vs cytoplasm**?

5. **Eukaryotic cells are usually anywhere from 2 times to 20 times the size of prokaryotic cells.** Why is there a **limit to how small a cell can be** (how small the volume of a cell can get)?

6. a. What is the function of every cell's **plasma membrane**?

b. Study Figure 6.6 and the figure legend. Describe the **composition and organization** of a typical plasma membrane, noting as well the **spacial orientation of hydrophobic and hydrophilic components** of membranes.

7. a. Cells also have limits of just how big they get (*how large of a volume they can contain relative to the amount of plasma membrane they have*). In order to be able to function, the cell needs to maintain a large enough surface area to volume ratio. Explain why there is an upper limit to cell size in terms of its plasma membrane *and* specifically its surface area to volume RATIO. *This is an extremely important concept to understand very well!*

- b. Study Figure 6.7 very well. **Know how to calculate a cell's surface area to volume ratio (SA:V ratio or SA/V ratio).**

This is an important statement to remember: **A \_\_\_\_\_ surface-to-volume ratio facilitates the \_\_\_\_\_ of \_\_\_\_\_ between a cell and its environment (or between an organelle and the eukaryotic cells cytoplasm)**

- c. Though all cells need a certain surface-area-to-volume ratio to be viable (to survive), which cells might you expect to have even higher surface-area-to-volume ratios than average?

Why?

- d. What are ways cells can increase their SA/V ratios?

8. **Here is some important details to understand & study for the AP Biology exam.**

- When a cell grows, its volume increases at a greater rate than its surface area, thus its SA: V ratio decreases.
- Cells with adaptations for engaging in a greater rate of exchange or diffusion of materials across their membranes have larger SA:V ratios.
- Plant cells are much larger than animal cells in general, but they have a large central vacuole organelle, which pushes the other organelles to the edge of the cell where, due to proximity, they get regular access to resources diffusing or being transported into the cell across the plasma membrane.

As you hopefully mentioned above, **cells (or organelles) may increase their SA:V ratio by having:**

- ★ **Long thin** or elongated shapes (e.g. nerve cells - build a lot of plasma membrane with little extra volume)
- ★ Having extra foldings of or outward projections on the surface of their plasma membrane. (e.g. villi and microvilli of the lining in the small intestines and inner mitochondrial membrane)

9. Let's do a refresher on some simple geometry calculations and apply what we have learned about SA/V ratios. Complete Scientific skills Exercise: Using a Scale Bar to Calculate Volume and Surface Area of a Cell. Report your answers below, showing your calculation work when relevant. (As a general rule, always show your work for the class, but also on the AP exam.)

1.

2. *Label clearly what is your work for the mature cell vs the budding cell*

a.

b.

3. *Label clearly what is your work for the mature cell vs the budding cell*

a.

b.

4.

FYI - If you are asked to report a cell's surface to volume ratio, report it as either as SA / V (a fraction) or as SA:A. *Simplify the ratio when it is easy to do so.* (For example, for a cell with a plasma membrane surface area of  $150\mu\text{m}^2$  and volume of  $15\mu\text{m}^3$ , the cells SA / V ratio would be 150 / 15 or 10 / 1, which could also be written as 150 : 15 or 10 : 1.)

10. a. What are the two benefits to Eukaryotic cells of having membrane-bound organelles?

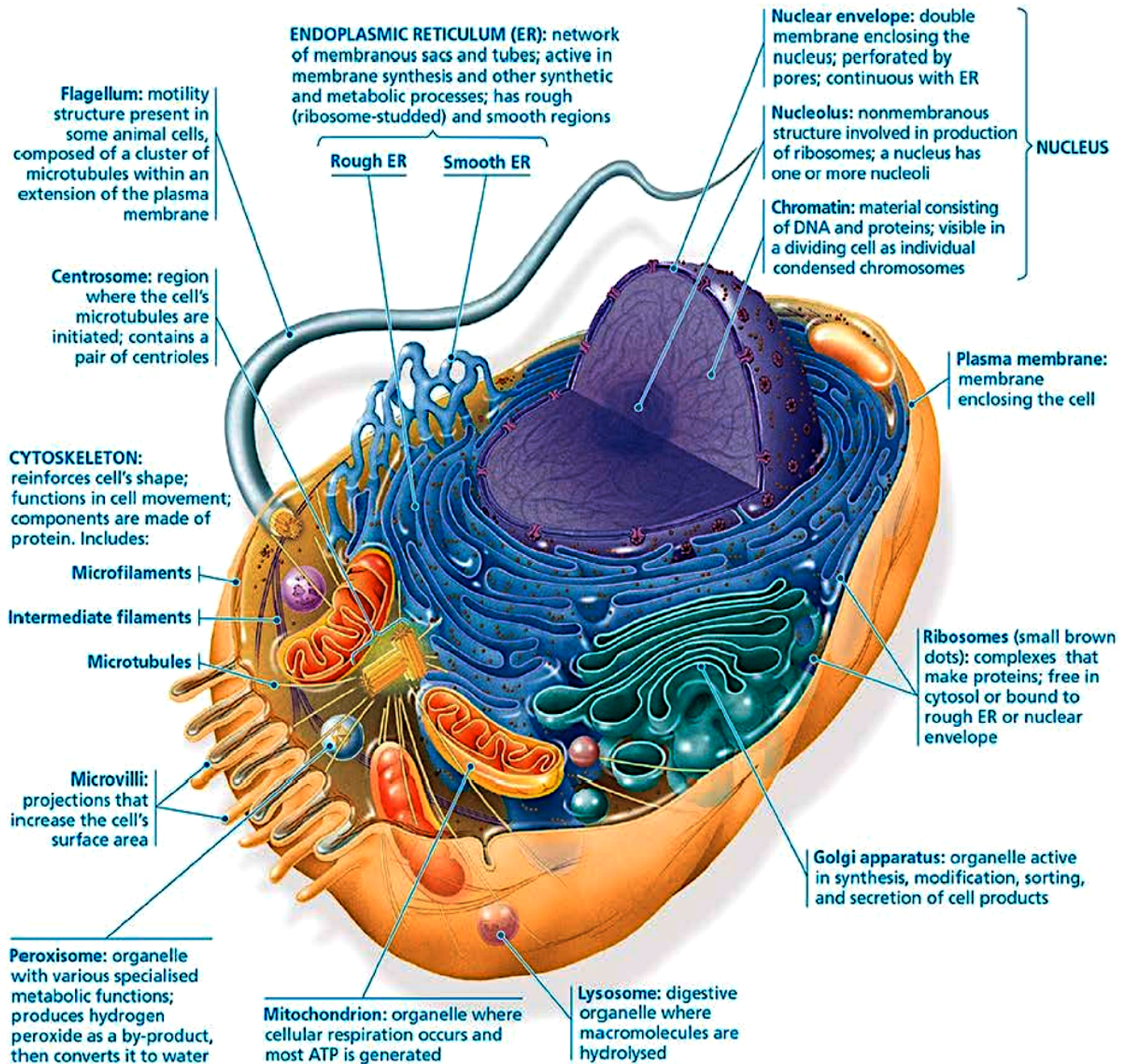
1.

2.

- b. How is a membrane from one organelle or cell able to engage in different functions or behaviors from the membrane of a different organelle or cell?

11. It is important that you know what the common **Eukaryotic cell components' functions** are and that you can [list the similarities and differences between animal versus plant cells](#). Memorize Figure 6.8.

## Animal Cell





## Plant Cell

