

How Are Cell Classified?

Chapter 2 Lesson 2

ByDesign Science, Level 6

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How are Cells Classified?

- ◆ One-way scientist categorize living organisms is by whether they are made of one cell or many cells.
- ◆ Another way scientist divide cells is into groups that have a nucleus or not.
 - ◆ Nucleus controls all the activities of the cell
 - ◆ Much like your brain
- ◆ Because of this the nucleus is sometimes referred to as the brain or control tower of the cell.



Prokaryotes

- ♦ **Prokaryotic Cell:** a cell that does not have a nucleus.
 - ♦ AKA prokaryote
- ♦ Even though they do not have a nucleus they still live a function because they have DNA.



- ♦ Examples: Bacteria and Blue-green Algae

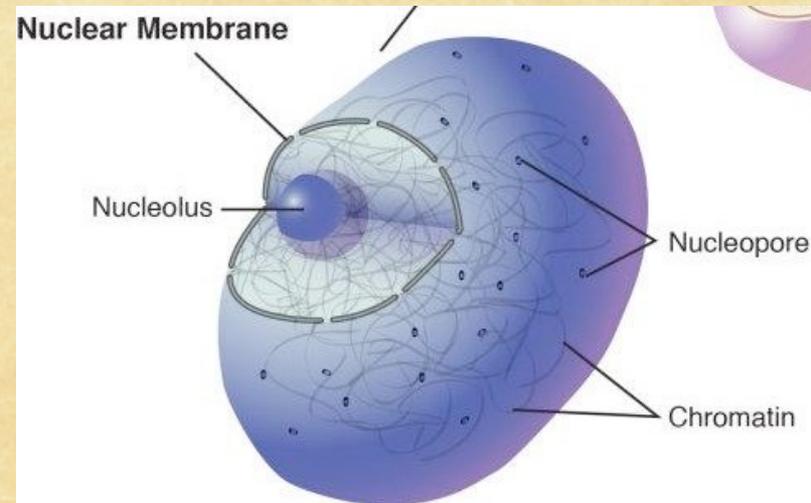
Eukaryotes

- ◆ **Eukaryotic Cell**: a cell that does have a nucleus
 - ◆ AKA eukaryote
- ◆ Examples: Plants, Animals, Fungi, and Protists



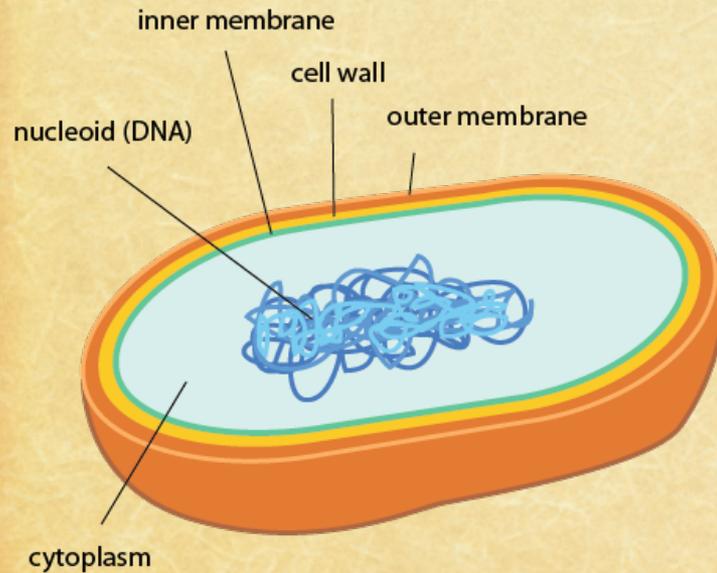
Eukaryotes

- ◆ The nucleus of a eukaryote is surrounded by a double membrane called the nuclear membrane.
- ◆ Tiny holes in this membrane, called pores, allow molecules to pass back and forth between the nucleus and the cytoplasm.



Prokaryotes and Eukaryotes

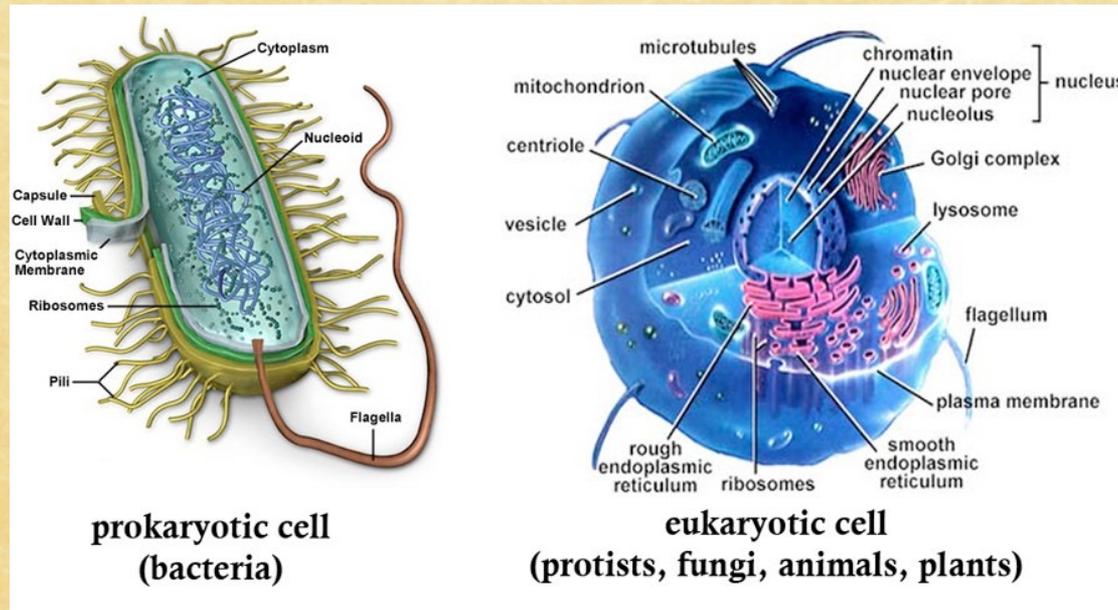
- ◆ Prokaryotic cells do not have all the small, specialized, organ-like structures, or organelles, that eukaryotic cells have.



- ◆ Prokaryotic cell's DNA is not contained in a nucleus like in the eukaryotes.
- ◆ Instead, the DNA of a prokaryotic cell is clumped up and free-floating inside the cell.

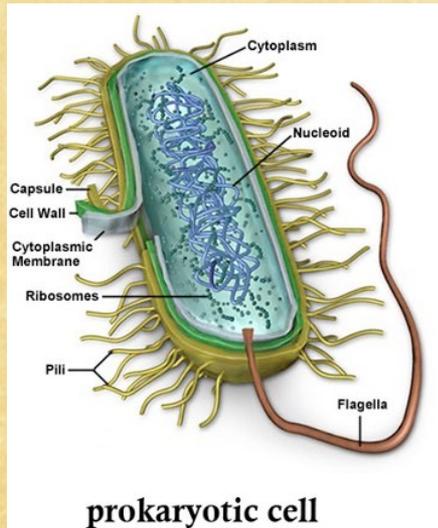
Prokaryotes and Eukaryotes

- ◆ Prokaryotes are often called “simple” while eukaryotes are often called “complex”.
- ◆ Prokaryotes are structurally different in a way that could be considered simpler.



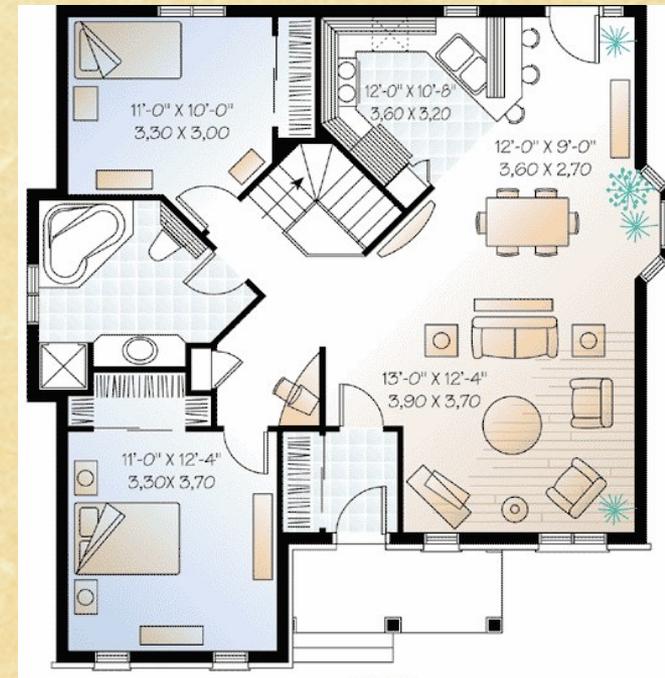
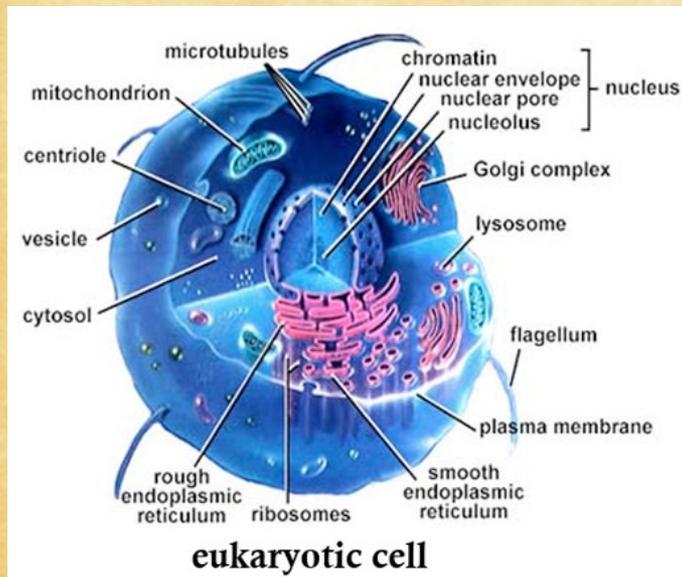
Prokaryotes and Eukaryotes

- ◆ Think of prokaryotes as a studio apartment compared to a house.
- ◆ A studio apartment consists of a single room that is set up with specific sections to eat and sleep.



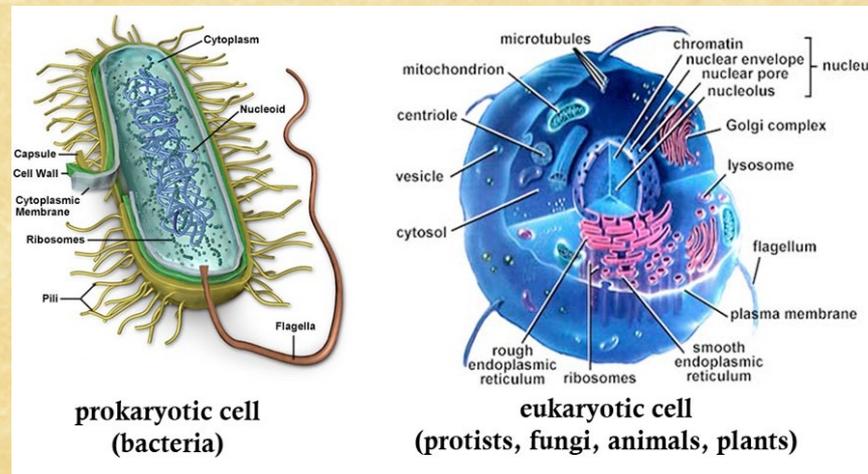
Prokaryotes and Eukaryotes

- ◆ Eukaryotes are more like a house will separate rooms for different activities.



Prokaryotes and Eukaryotes

- ◆ All functions of daily life, like eating and sleeping, take place in both the studio apartment and the house.
- ◆ Most of the same complex processes occur in both prokaryotic and eukaryotic cells.



Prokaryotes and Eukaryotes

- ◆ Even though the structure of the prokaryote might be considered simpler, the processes happening there are complex.
- ◆ Compare a computer and a mobile device.
- ◆ Mobile device is smaller but can do most of the complex processes of the computer.
- ◆ Calling a prokaryote simple is like calling a mobile device simple.



Prokaryotes and Eukaryotes

Characteristic	Prokaryotes	Eukaryotes
Nucleus	No	Yes
Cell Membrane		
Nuclear Membrane		
Cell Wall		
Perform Life Processes		
Organelles		

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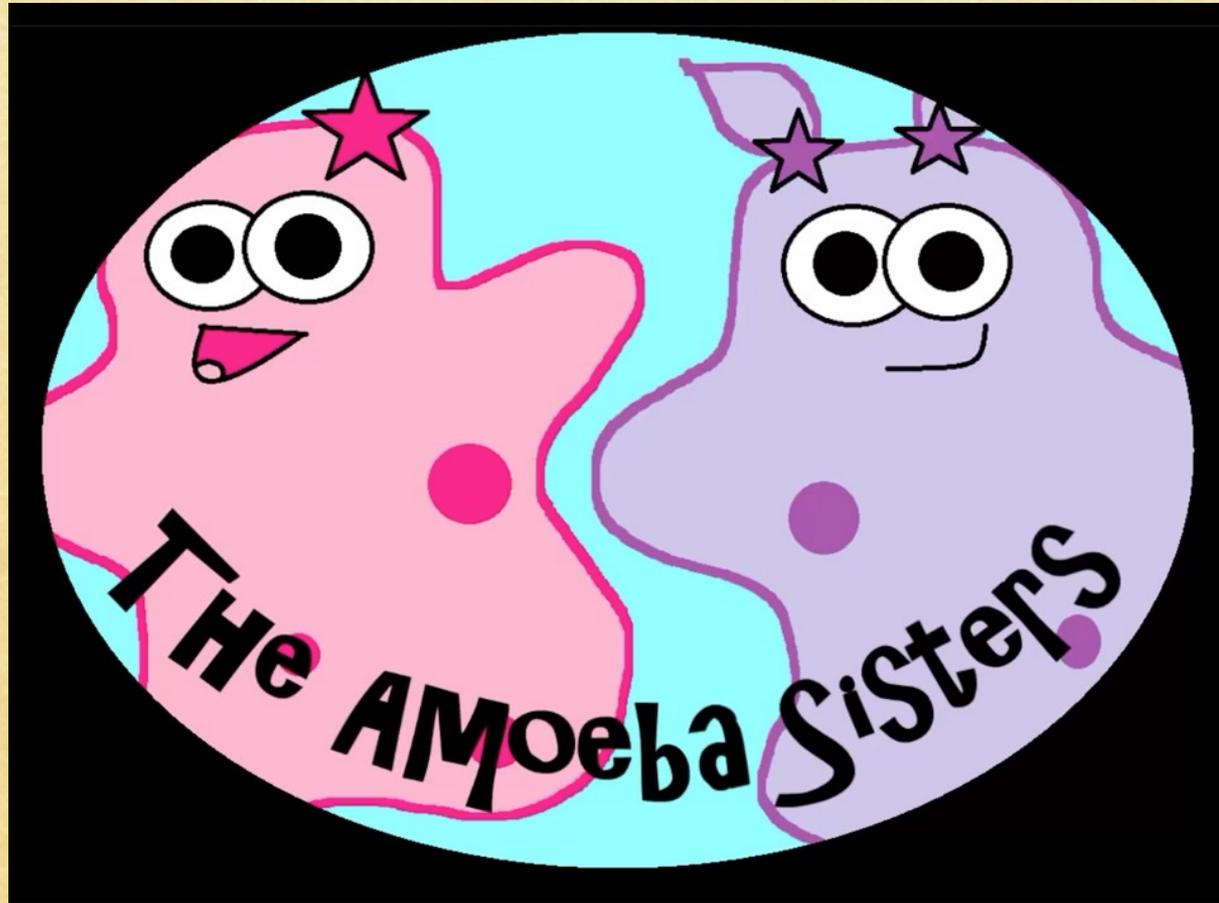
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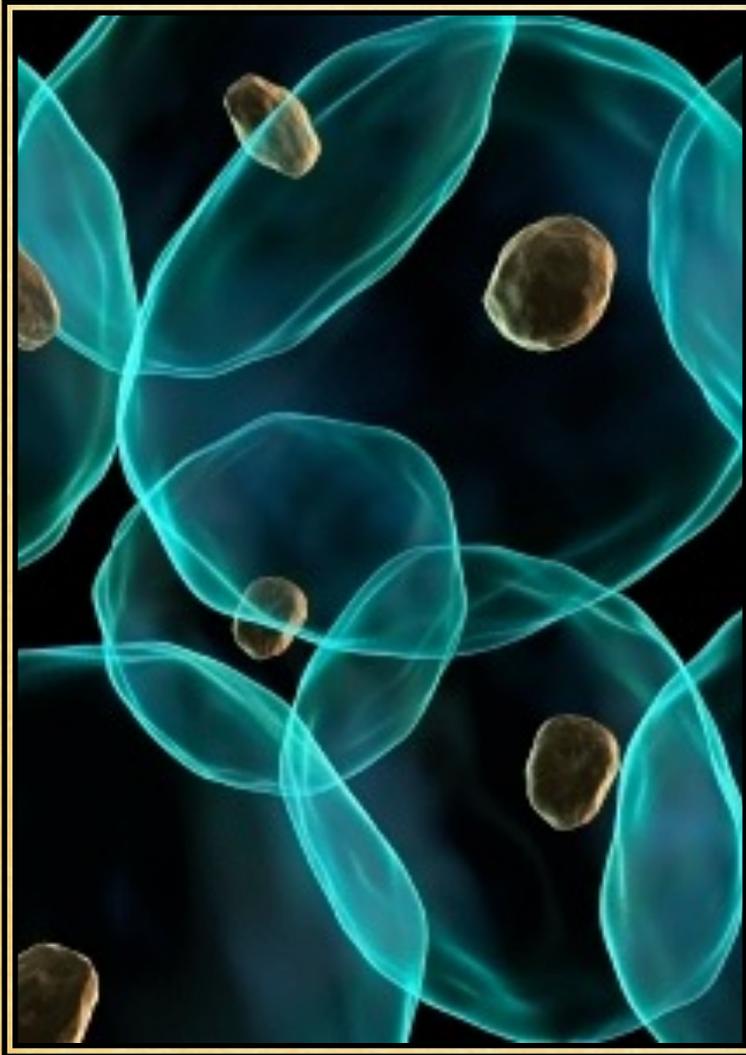
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Prokaryotes and Eukaryotes



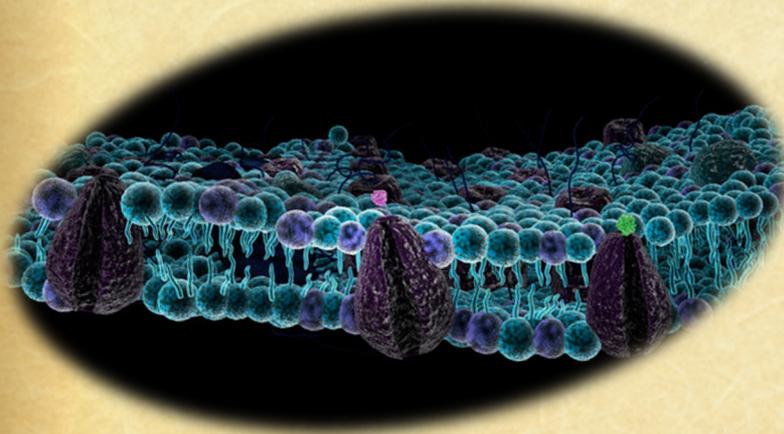


Why Surface Area Matters

Do you think a cell can carry out its life functions efficiently if it were larger?

Why or why not?

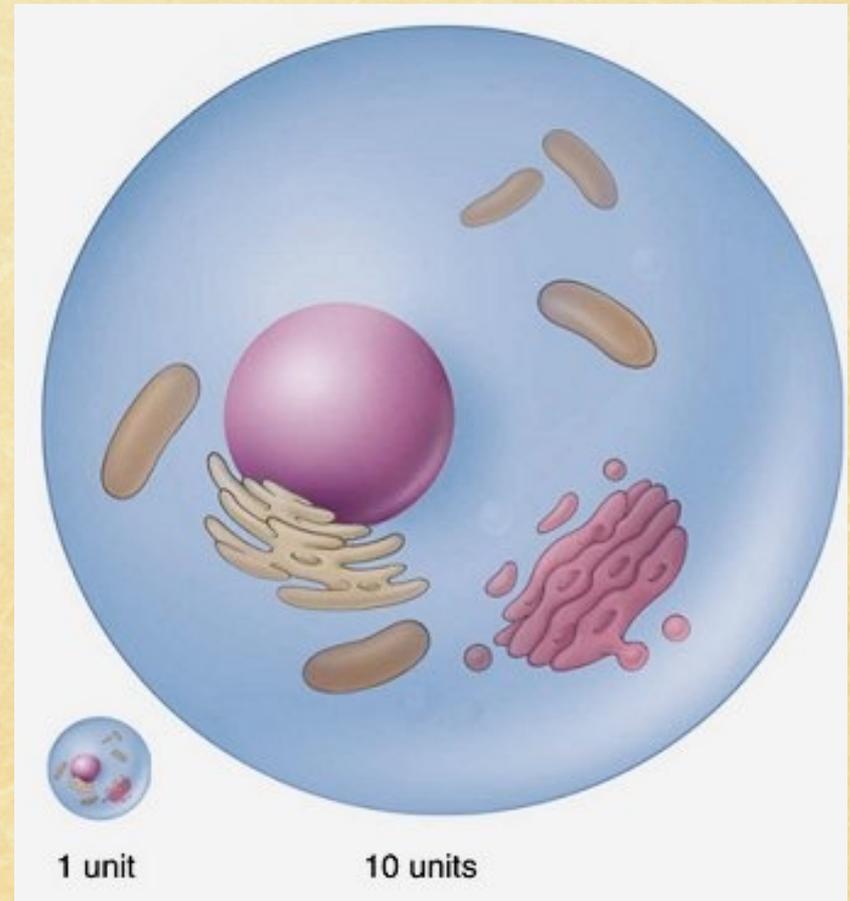
Why Surface Area Matters



- ◆ Individual cells grow.
- ◆ As cells grow, they get food and exchange gases by diffusion.
- ◆ Water enters and exits the cell by osmosis.
- ◆ Cell wastes are removed through the cell membrane.
- ◆ The larger the cell, the more nutrients it needs.

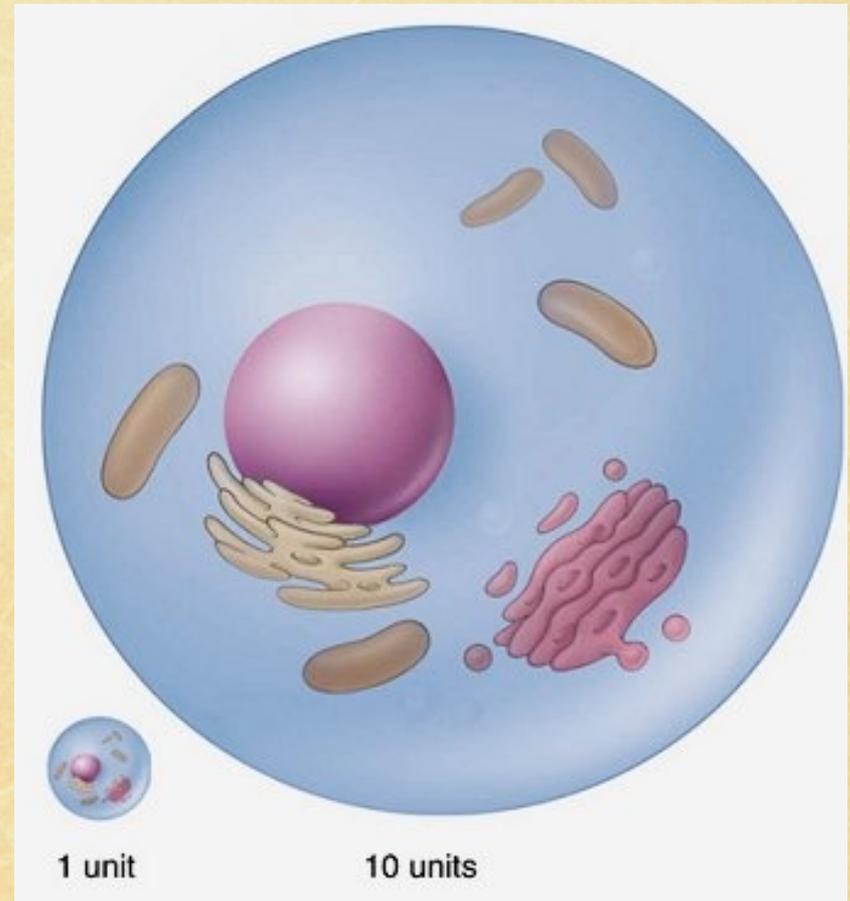
Why Surface Area Matters

- ◆ If volume of a cell increases faster than the surface area of its membrane, there can come a point when a cell is too big.
- ◆ Its need for materials increases faster than its ability to supply those materials.



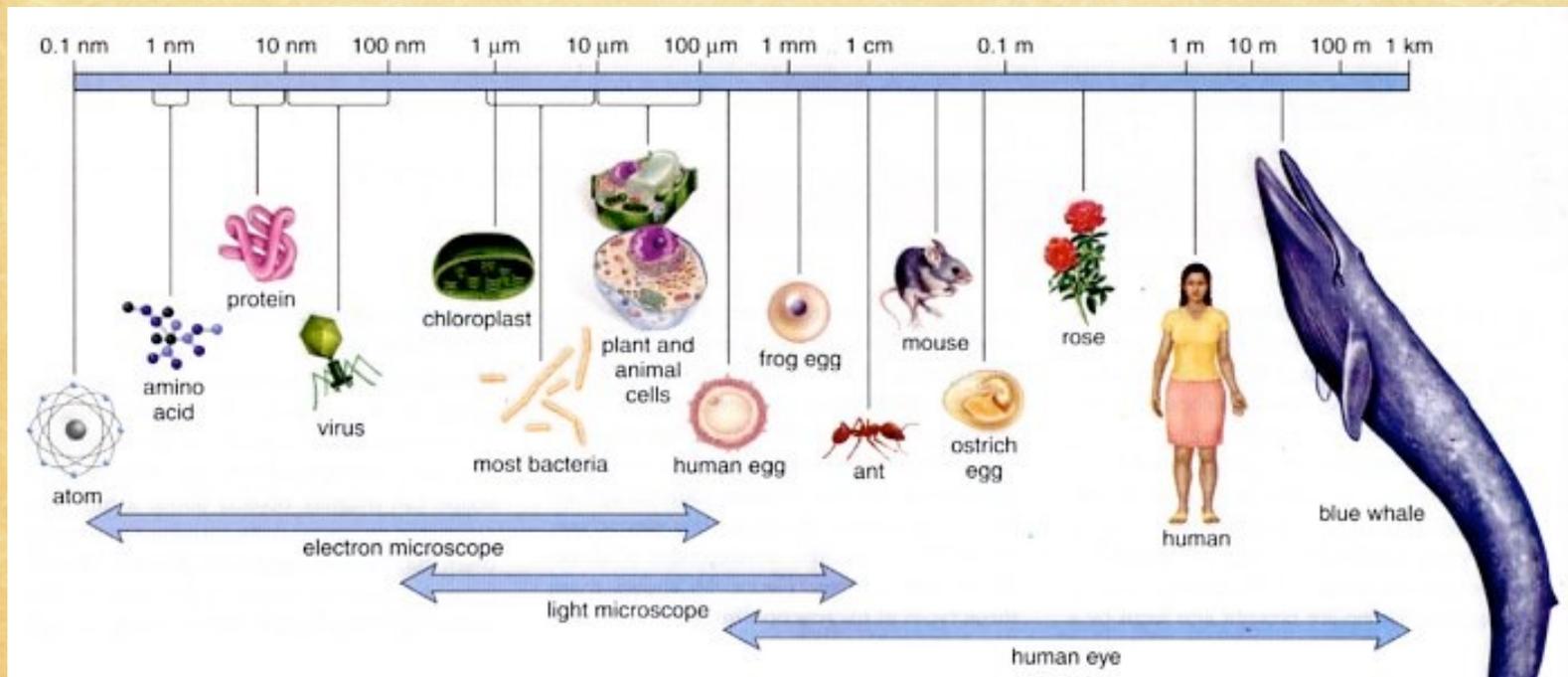
Why Surface Area Matters

- ◆ No longer space on the cell membrane for all the work to happen that is needed to support the cell.
- ◆ Not enough nutrients can get in, and not enough waste can get out.



Why Surface Area Matters

- ♦ God designed cells to be small because they are most efficient that way.



Why Surface Area Matters

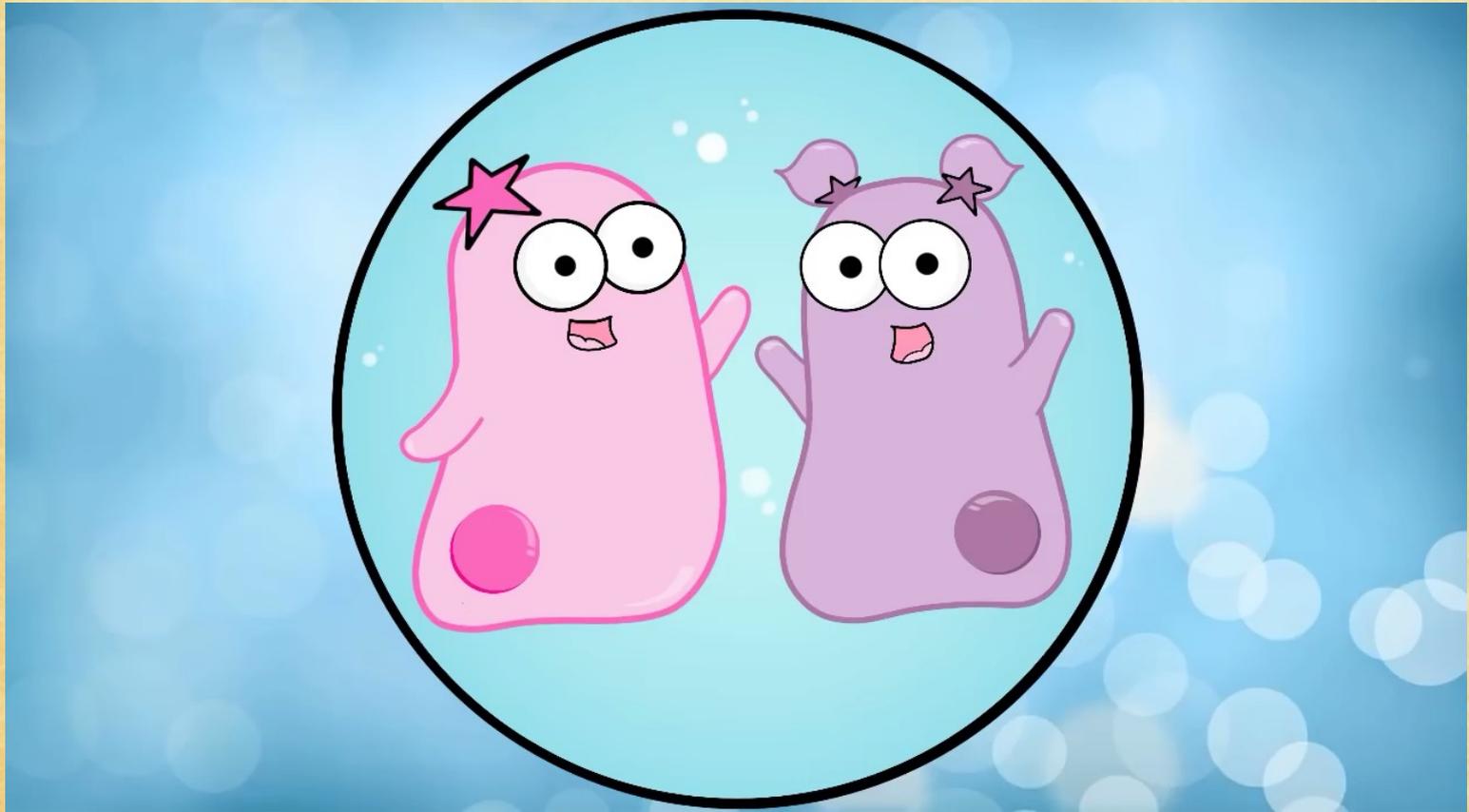
- ◆ *Question 1: What is surface area?*
 - ◆ Surface area is the total area of all the faces of a solid object
- ◆ *Question 2: As the surface area of a cell increases, what happens to the overall volume of the cell?*
 - ◆ Volume increases much more as the surface area increases
- ◆ *Question 3: What are some advantages several small cells have over one large cell?*
 - ◆ Small cell can take in nutrients and release wastes faster because it has a higher surface area to volume ratio

Cell Specializations

- ◆ Remember that cells can be classified as either prokaryotes or eukaryotes?
- ◆ Another way to classify cells is by the function they perform.

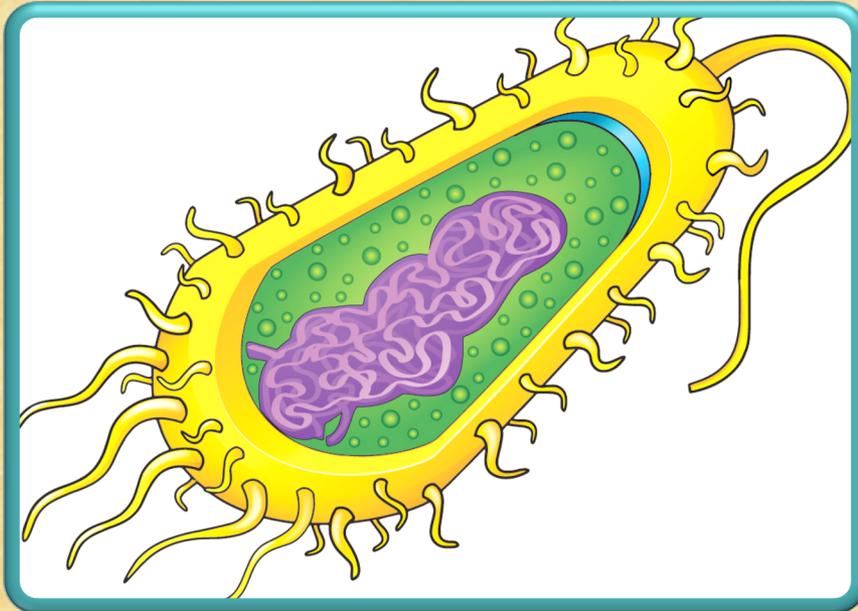


How Cells Become Specialized



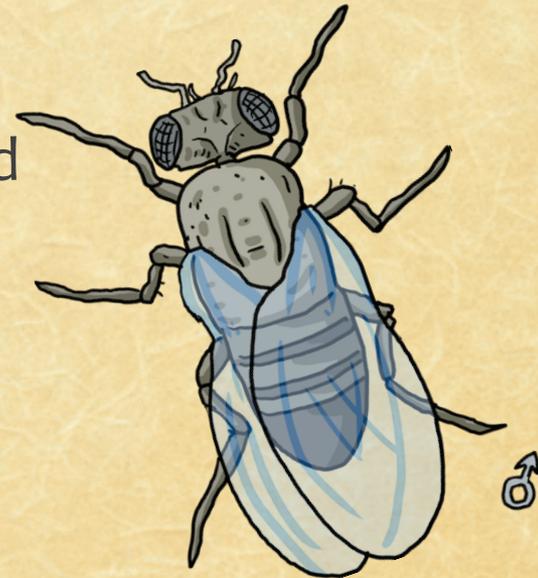
Cell Specialization

- ◆ Most prokaryotic cells are unicellular and do not perform specialized functions.
- ◆ All life processes must be performed in that one cell.



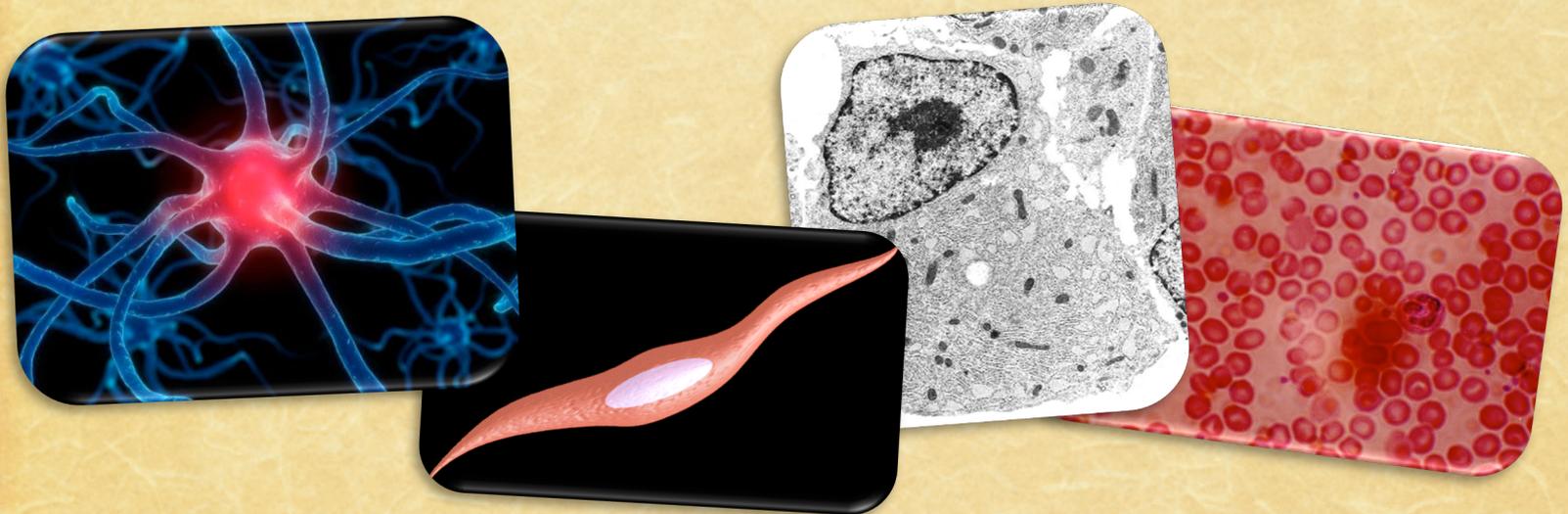
Cell Specialization

- ◆ Most eukaryotic organisms are multicellular.
- ◆ Each of these cells has the exact same instructions stored in its nucleus.
 - ◆ A complete set of instructions about how to maintain life.
- ◆ Some might think that this would mean all cells are identical but that is not true.



Cell Specialization

- ◆ There are hundreds of different cell types that are specialized to do different jobs.
- ◆ These specialized cells have different structures that are related to the task they perform.



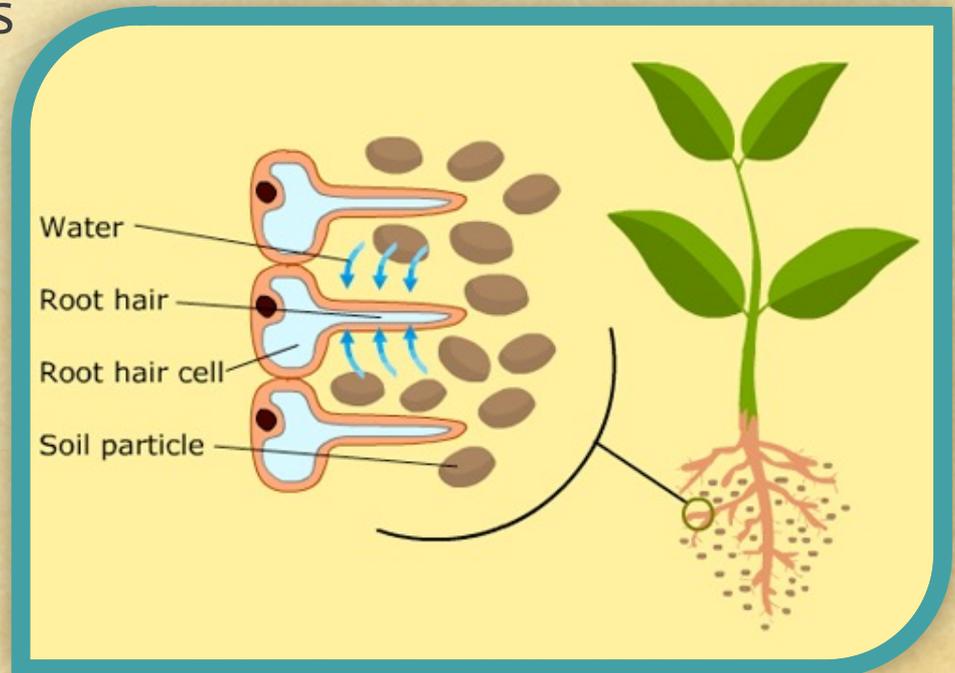
Cell Specialization: Red Blood Cell



- ♦ Red blood cells are flexible and disc-like.
- ♦ The flexibility allows the cell to squeeze through narrow places.
- ♦ Both sides of a red blood cell are concave.
- ♦ The concave shape results in greater surface area which allows greater exchange of oxygen and carbon dioxide.

Cell Specialization: Root Hair Cell

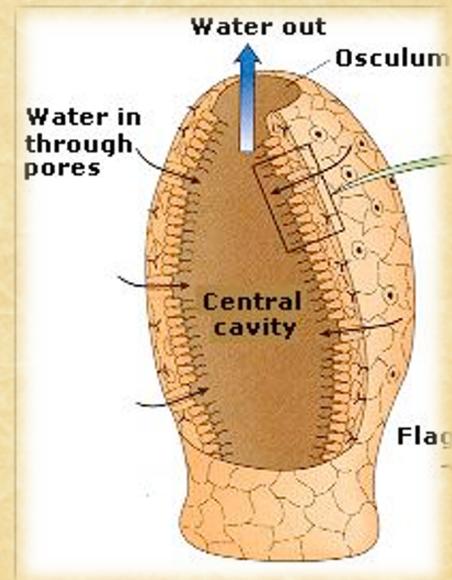
- ◆ Specialized cells on a plant's roots.
- ◆ Have long, narrow, hair-like structures that extend between soil particles to reach water and minerals.
- ◆ The shape provides more surface area for water and minerals to move in and out of the cell.



Cell Specialization: Collar Cell in Sea Sponge



- ◆ Cells line the open channels in the sponge.
- ◆ Whip-like structures that help push water through the channels.
- ◆ Cells are also sticky, which helps trap food particles moving with the water.



Importance of Specialized Cells

