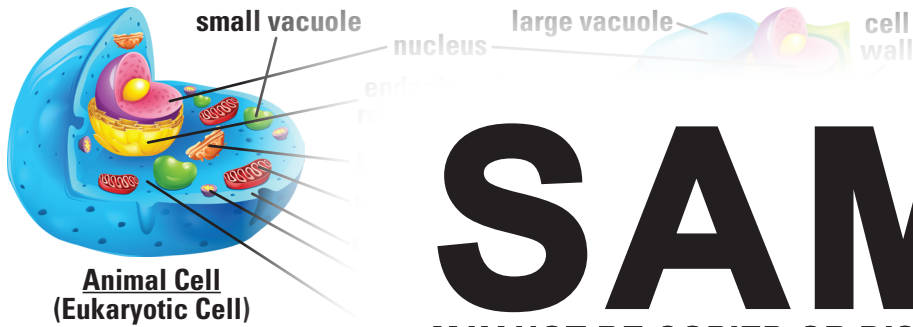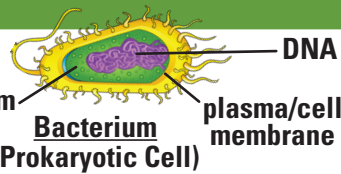## Category 1 – Cell Structure and Function

B-4:A CELLS AND CELLULAR COMPLEXITY

Scientists classify all cells into one of two categories based on their complexity:

- **prokaryotic:** simple cell; no nucleus; no membrane-bound organelles
- **eukaryotic:** complex cell; has nucleus; has membrane-bound organelles

Bacterium (Prokaryotic Cell) — DNA, cytoplasm, plasma/cell membrane

Animal Cell (Eukaryotic Cell) — small vacuole, large vacuole, nucleus, cell wall

Cell Part or Organelle

Cell Part or Organelle	
cell membrane	semi-permeab... enters/leaves...
cytoplasm	suspends and...
nucleus	holds DNA (ge...
mitochondrion	powers cell by...
endoplasmic reticulum (ER)	pipe-like struct... lipids: ribosome...
golgi complex	changes/packages cell products, moved in vesicles out of cell
lysosome	breaks down waste with acid and enzymes to speed digestion
vacuole	holds materials/water; larger in plant cell than in animal cell
cell wall	surrounds cell membrane in a plant cell to support/protect
chloroplast	holds chlorophyll for photosynthesis; makes sugars and oxygen from sunlight, carbon dioxide, and water (in plant cells, algae)

Evidence supports that eukaryotic cells evolved from primitive prokaryotes.

Examples: A prokaryote has no mitochondria. Cellular respiration takes place in its cytoplasm. If one primitive bacterium absorbed another, and the absorbed cell continued to respire, then it could function like a weak mitochondrion. In fact, a modern mitochondrion has its own DNA, structured like bacterial DNA and separate from the cell's DNA. And mitochondria are not made by cells, but are produced only from pre-existing mitochondria in a splitting process (similar to how bacteria reproduce). Similar evidence supports that primitive cells once engulfed photosynthetic bacteria. What organelle is believed to have evolved over time from this? *chloroplast*
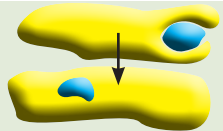
B-4:B CELLULAR PROCESSES CR

energy conversion: during cellular respiration, cells make energy in usable form: ATP (adenosine triphosphate); it is used to power cellular processes

molecular synthesis: cells make biomolecules, such as proteins and lipids

transport: movement of molecules within cell or across the cell membrane

Examples: Cell membrane's lipid bilayer has polar surfaces (+/– ends) and a nonpolar center (repels polar molecules and ions); it is selectively permeable.

extracellular fluid (ECF) *outside cell* — transport protein — ATP — [1] [2] [3] [4]

...oving a molecule from ...ow to high concentration ...equires **active transport** ...hrough a protein pump: ...ses a transport protein ...nd energy (ATP or from ...energy-releasing transport ...f a different molecule) ...e purple molecules. ...oncentration ...e orange cations (+ ions). ...o low concentration ...he orange cations. ...o high concentration

Describe the different energy sources for active transport in #3 and #4.
#3 uses energy from ATP; #4 uses energy released from allowing the white cations to move from high to low concentration

homeostasis: regulation of specific internal conditions that keep cell healthy, such as "normal" (stable/balanced/equilibrium) pH, volume, and ion levels

Example: Cells maintain a membrane potential (voltage) by controlling the number of positive and negative ions in them. The diagram below shows a feedback loop to maintain a cell at a target membrane potential of –60 mV. What cellular process does the cell use to adjust its membrane potential up or down? *transport*
What happens when the cell's membrane potential is –45 mV?
–45 mV is greater than –60 mV, so cations would be transported out of the cell.

ICF — ECF
cation(s) transport out of cell — cation(s) transport into cell
–60 mV
>–60 mV — <–60 mV