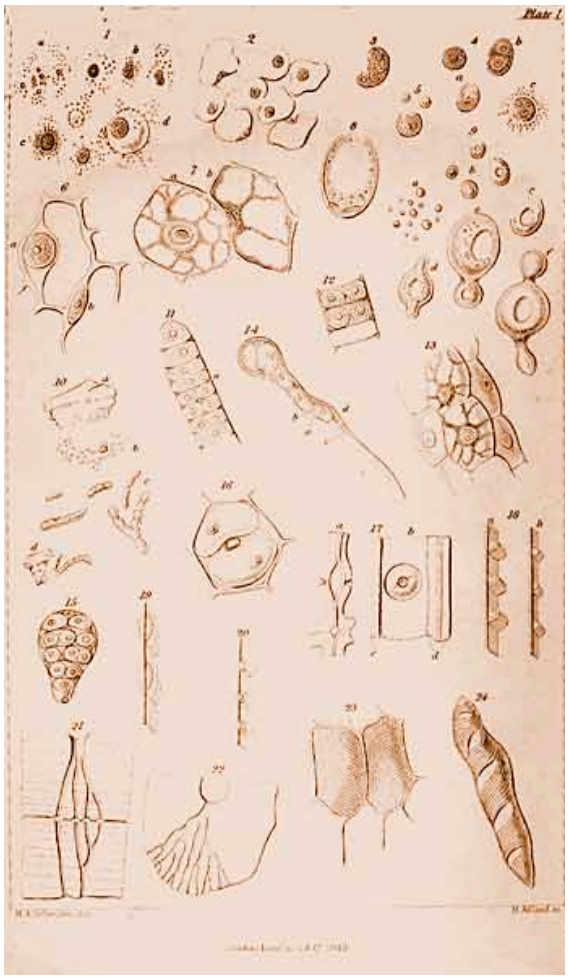
The Unity of Life

All living things are made up of small individual units called cells.



- **Robert Hooke** (1600's) - examined slices of cork with a magnifying glass and observed box-like structures which he called cells.

- **Robert Brown** (1831) - discovered the structure of the nucleus.

The German barrister, doctor of philosophy, doctor of medicine, and professor of botany Matthias Jacob Schleiden (1804–81) was the first to recognize the importance of cells. His work inspired the German biologist Theodor Schwann (1810–82) to take the matter further.

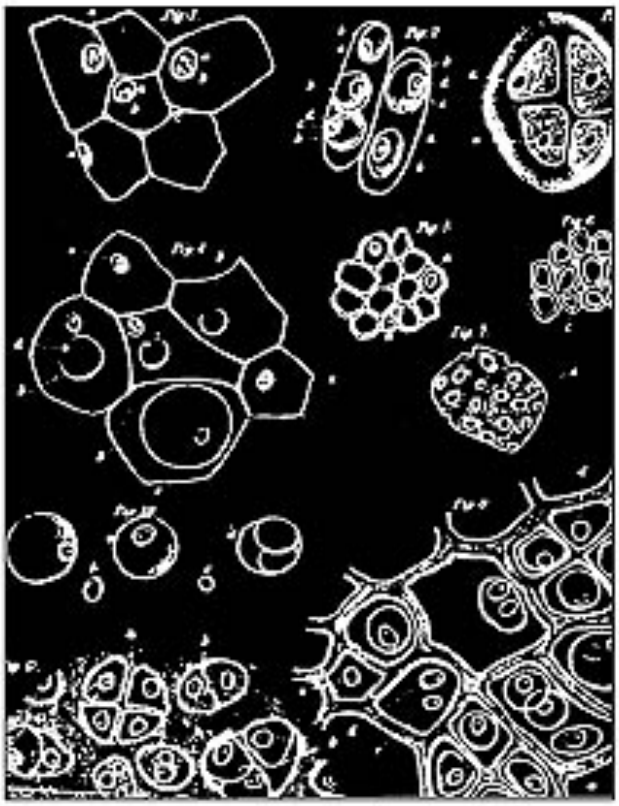
THE CELL THEORY

Through the work of these two men, the cell theory of biology was established. It states that cells are of universal occurrence and are the basic units of living organisms. This is one of the most central concepts in all biology.

- In 1838, Schleiden announced that all the various parts of plants were either made of cells or comprised the products of cells.
- He surmised that each cell of every tissue could be looked on as an independent unit, but it must also contribute to the life of the whole organism to which it belonged.
- In 1839, Schwann published a paper in which he extended Schleiden's idea to animals.
- Schwann also recognized that some organisms were unicellular, others multicellular.

Schleiden went on to research further.

- He recognized the importance of the cell nucleus (control center).
- He was mistaken, however, in believing that new cells budded off the surface of the nucleus.
- He also observed the active movement of the substances within the cell and called this "protoplasmic streaming." This made it clear that cells contain living material.



Schwann's drawings of plant and animal cells.

OTHER SIGNIFICANT DISCOVERIES

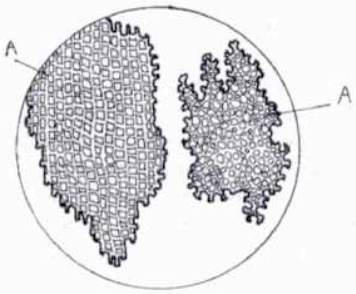
Schwann made many other important contributions to biology:

- He recognized that an ovum (egg) is a single cell that, after fertilization, divides repeatedly and develops into a complex organism.
- He isolated a digestive enzyme (biological catalyst) from the stomach lining and named it pepsin. He recognized that pepsin was responsible for protein digestion.
- He proved that fermentation of sugar was the result of living yeast cells.
- He provided strong evidence to counter the theory of spontaneous generation of life in putrefying organic material.
- He coined the term "metabolism" for the chemical changes occurring in living tissues.
- He discovered the cells that make up the myelin sheath of nerve cell axons. These are known to this day as Schwann cells.

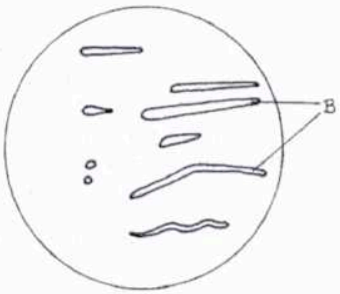
CELL THEORY.

FIRST OBSERVED CELLS★

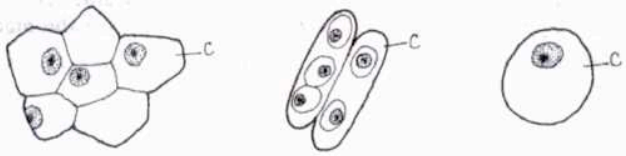
CORK CELLS[A]



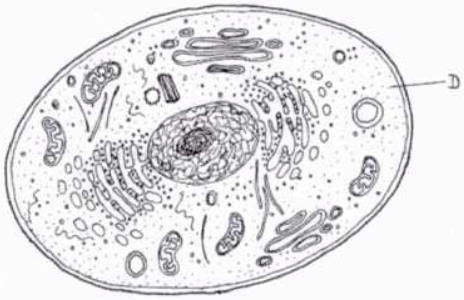
MICROSCOPIC ANIMALS[B]



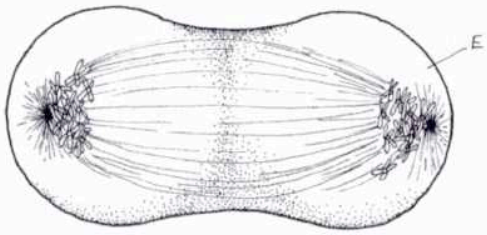
ALL LIVING THINGS ARE MADE OF ONE OR MORE CELLS[C]



THE CELL IS THE BASIC UNIT OF LIFE[D]



ALL CELLS COME FROM PREEXISTING CELLS[E]



Historical Background

- Improvement in microscopes in the last four centuries has allowed scientists to better develop the cell theory.

Cell Theory

- Cells are the structural units of living things.
- Cells are the functional units of living things.
- All cells arise from preexisting cells.

Exceptions to the Cell Theory:

1. **Viruses**

a) Are living.

b) Are not made up of cells.

c) Contain genetic material.

d) They can reproduce only within a living cell.

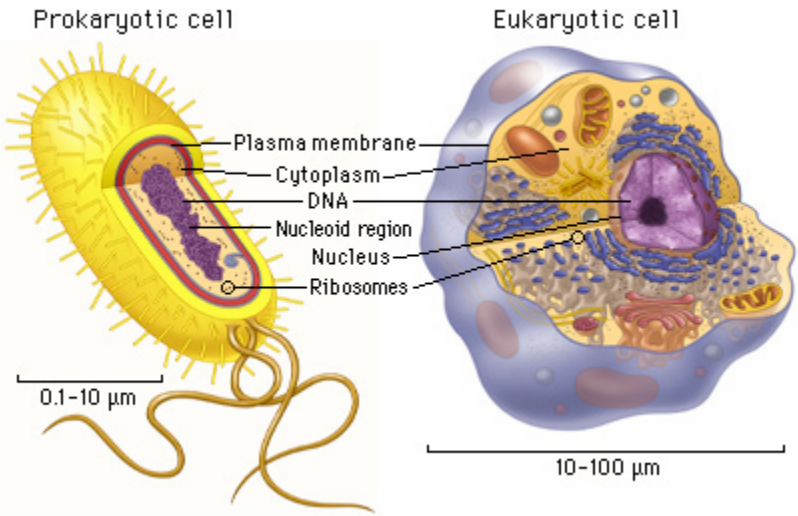
2. **Where did the first cell come from?**

3. **Mitochondria and chloroplast**

a) Contain their own genetic information different than that in the nucleus.

b) Can self replicate

PROKARYOTIC CELLS	EUKARYOTIC CELLS



• Lack membrane bound organelles	• Membrane bound organelles
• lack a nuclear envelope	• DNA is within the nuclear membrane
• unicellular	• unicellular or multicellular
• have a cell wall	Plant cells have a cell wall, animal cells do not

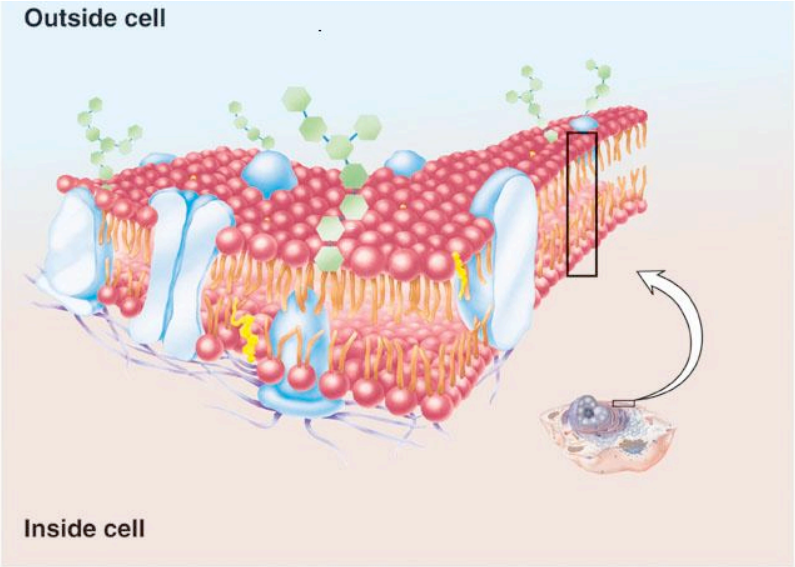
Prokaryotic_Cells.asf
Eukaryotic_Cells.asf

Levels of Organization:

Organelles→cells→tissues→organs→organ systems→organism

Cardiac→heart→circulatory sys→ human

Cell structure

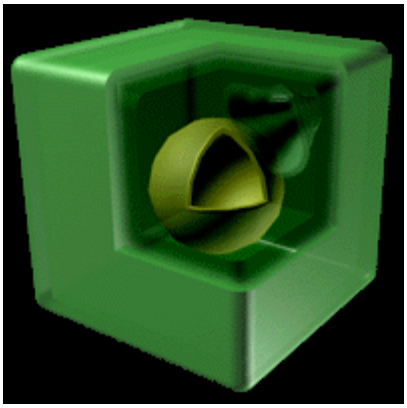


- Cells vary in size, shape, structure, and function; however, most eukaryotic cells possess the following parts or organelles:

1. **Cell membrane**

- Also known as the plasma membrane, it surrounds the cell and controls what goes into and out of the cell.
- It is a double-layered, semi permeable membrane composed of lipids and proteins. The cell membrane is alive (organic- proteins and lipids)

2. Cell Wall (found only in plant cells)

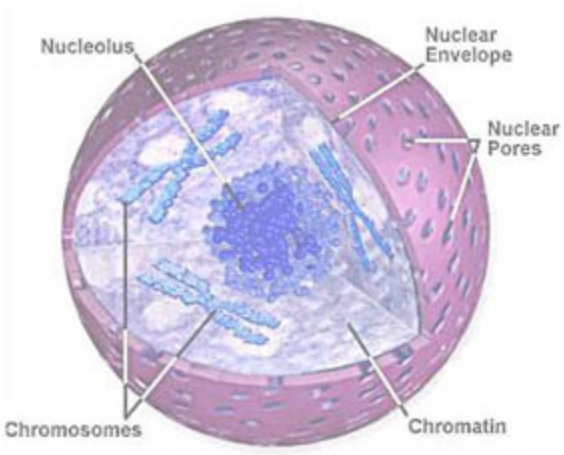


- It is a nonliving supportive structure found outside the cell membrane.
- Composed of cellulose.
- Primary function is to support and protect the cell.

3. Cytoplasm

- Fluid-like material that fills the space between the cell membrane and the nucleus of the cell.
- Contains the organelles.
- Many biochemical processes occur in the cytoplasm.

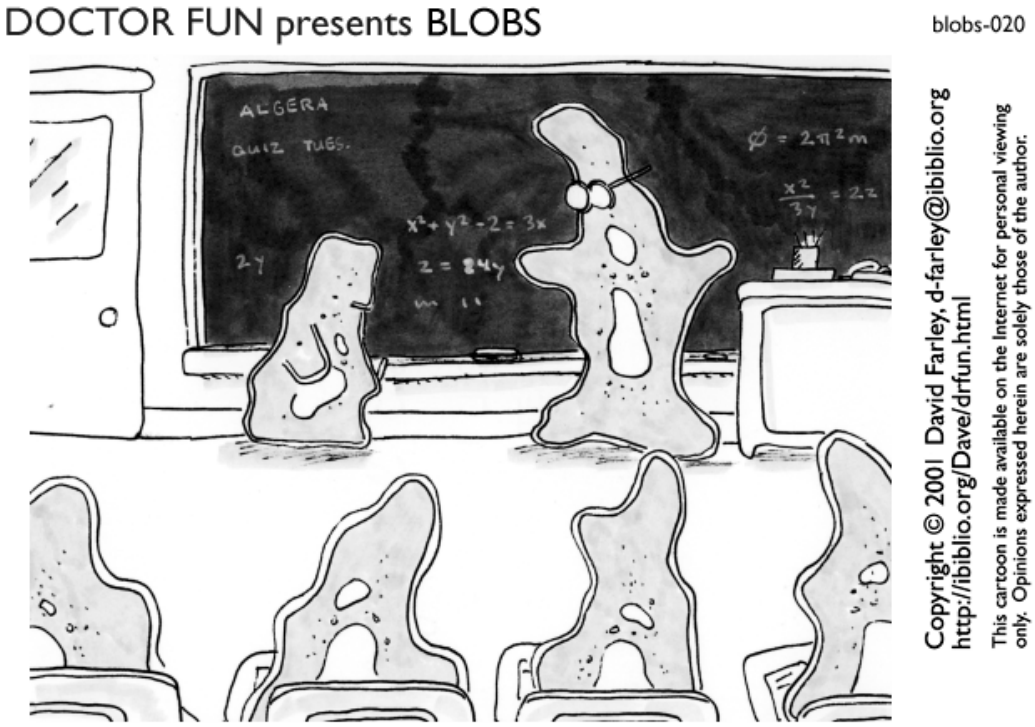
4. Nucleus



- Control center of the cell
  - Controls cellular metabolism (chemical activities) and reproduction.
  - Contains DNA and hereditary material
  - Surrounded by a nuclear membrane.

5. Nucleolus (nucleoli)

• Structure that is the site of ribosome synthesis



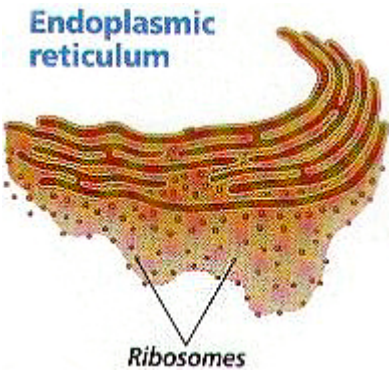
"Oh, come on, Alan - think. Use your nucleus!"

6. Ribosomes

•Site of Protein Synthesis

• May be found in the cytoplasm or attached to the membrane of the endoplasmic reticulum.

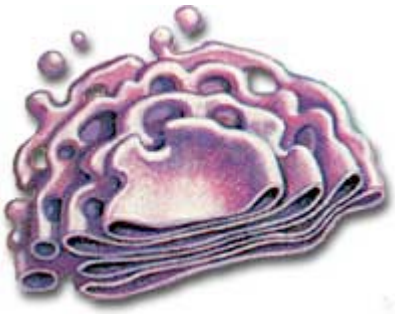
7. Endoplasmic reticulum



- System of fluid-filled canals
- Associated with synthesis, storage, and transport of materials within the cell.

8. Golgi Bodies

- Involved in the packaging and storing of cellular components.

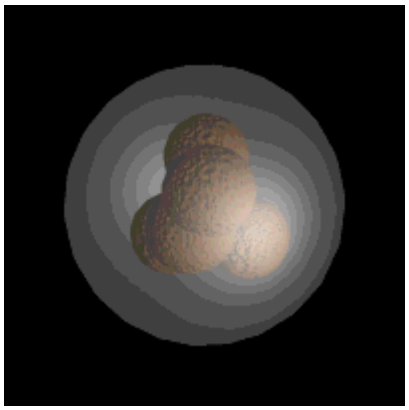


http://student.ccbcmd.edu/%7Egkaiser/biotutorials/eustruct/endomembanim.html

http://vcell.ndsu.nodak.edu/animations/proteintrafficking/movie.htm

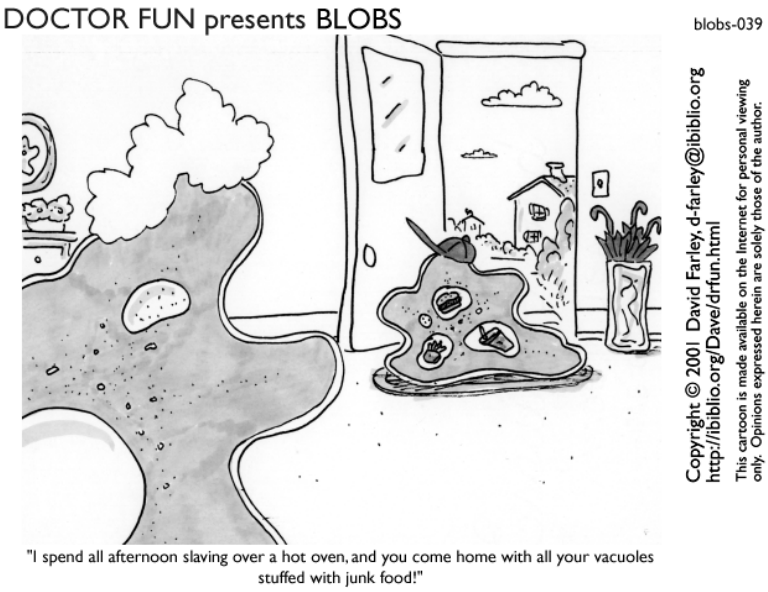
http://search.live.com/images/results.aspx?q=cheek+cells&mkt=en-us#focal=87b77df9e808e0f1c92439de4885b41b&furl=http%3A%2F%2Fwaynesword.palomar.edu%2Fimages%2Fcheek2.jpg (*cheek cell)

9. Lysosomes http://highered.mcgraw-hill.com/sites/0072437316/student_view0/chapter5/animations.html#



- Membrane-bounded sacs that contain digestive enzymes.
- Involved in the digestion of food in unicellular organisms.
- Destroy damaged or old cell parts in multicellular organisms.

10. Vacuoles



- Fluid-filled sacs found in the cytoplasm.
- Contain stored materials, such as food and wastes.
  - Example:

a) In unicellular organisms: food is digested within a vacuole.

b) In plants: water is stored (sap). Most plants have one large vacuole that takes up most of the interior of the cell.

- Contractile vacuole- used to pump excess water out of cell.

11. Mitochondria

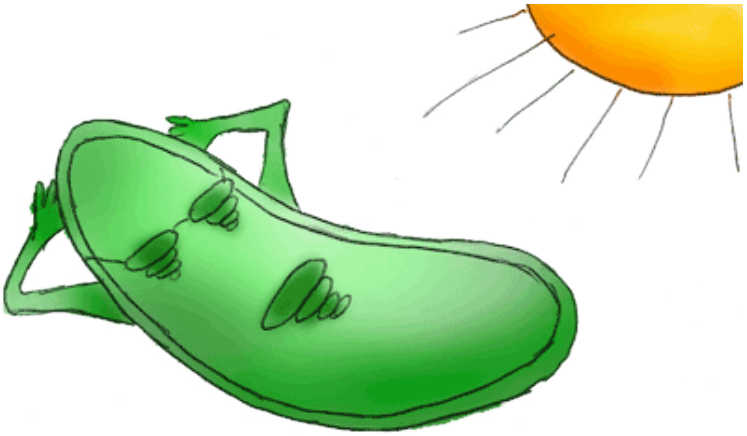
- Powerhouse of the cell.
- The site of respiration producing energy for the cell (ATP production).
- Contain their own DNA and therefore can duplicate themselves.

12. Centrioles (animal cells only)

- Found only in animal cells, not plant cells.
- Located near the nucleus.
- *May play a role in cell division*

13. Chloroplast (Plant Cell only)site of photosynthesis)

http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/artnov00/dwelodea.html



- Contain green chlorophyll pigment.
- Chloroplast, like mitochondria, has their own DNA and is capable of self-replication.

14. Cilia and Flagella

http://programs.northlandcollege.edu/biology/Biology1111/animations/flagellum.html

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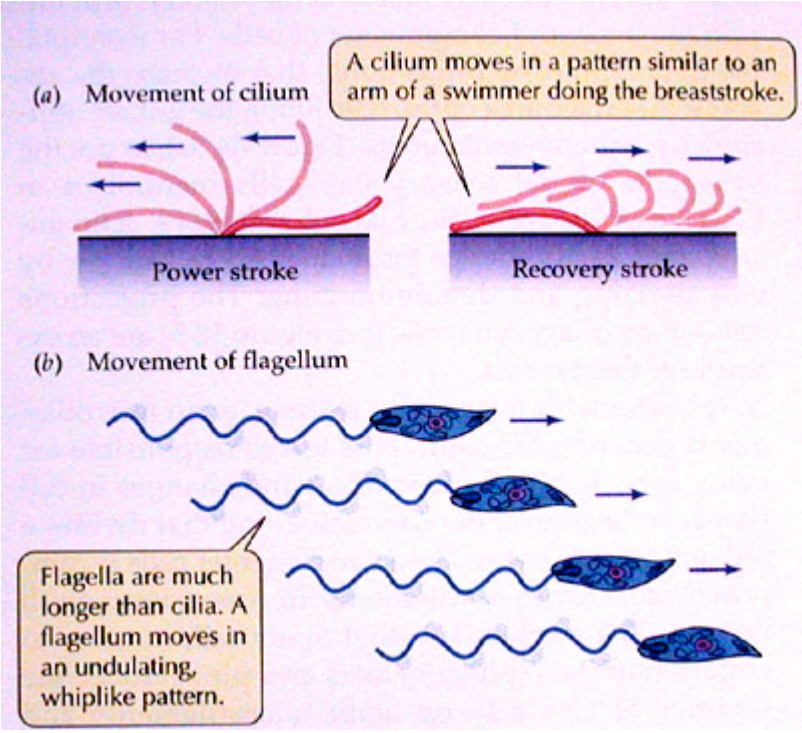

- **Organelles responsible for cell movement**
  - **a) Cilia- usually many and smaller (Paramecium).**

b) Flagella- usually one or two and larger (Sperm).

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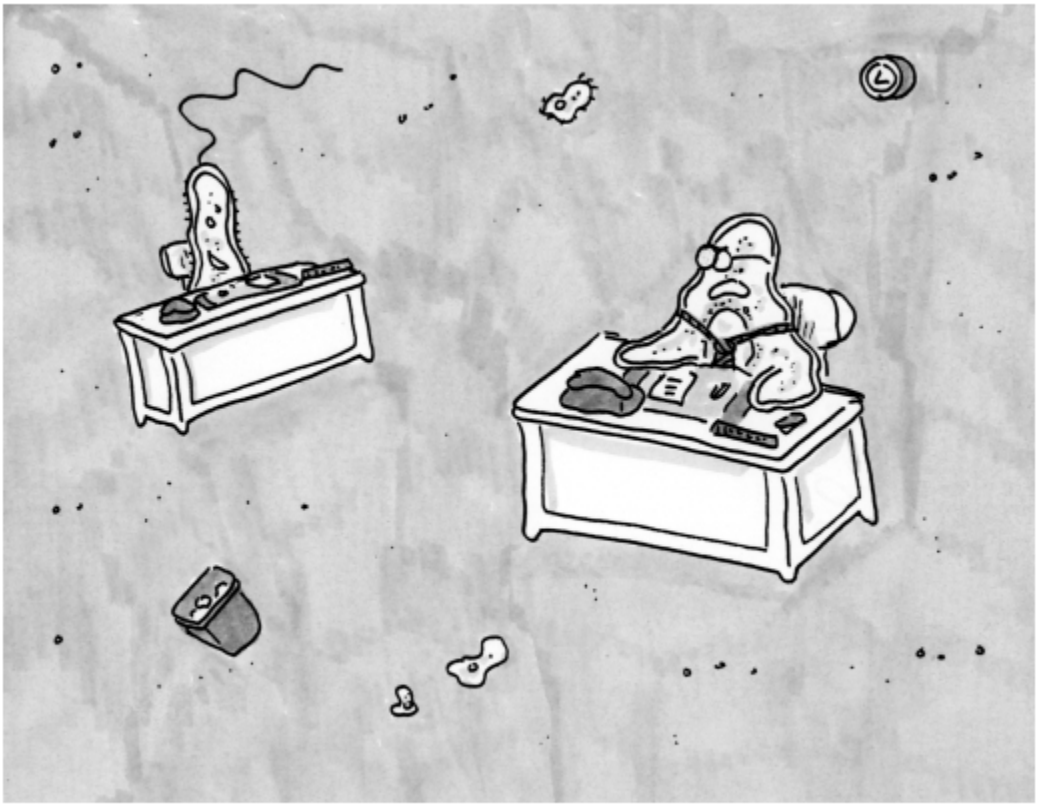
&width=640&height=520

Organelles.asf

Plant_and_Animal_Cells.asf

DOCTOR FUN presents BLOBS

blobs-027



"How am I supposed to get any work done with you waving the silly flagellum around all day?"

TRANSPORT ANIMATIONS

http://www.wiley.com/legacy/college/boyer/0470003790/animations/membrane_transport/membrane_transport.htm

Animal and Plant Cell