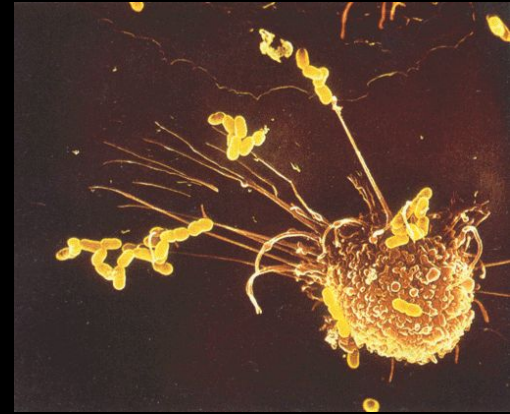
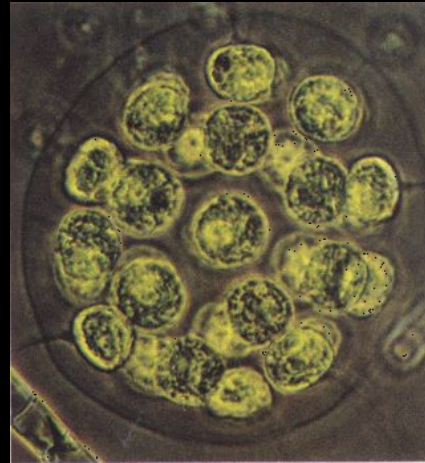
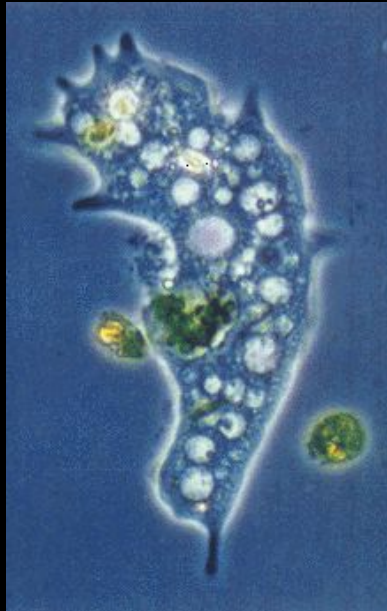


# Warm Up

- What are some examples of living things?
- Describe the characteristics of living things



# Objectives

- **Identify the levels of biological organization and explain their relationships**
- Describe cell structure and its significance in biotechnology research and product development
- Discuss the types of organisms researched and the types of cells grown and studied in biotechnology facilities plus the products with which they are associated
- Distinguish between the cellular organization of prokaryotic and eukaryotic cells

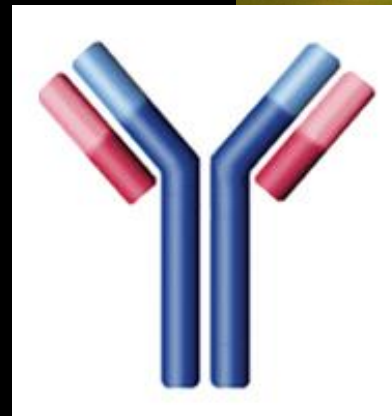
# Organisms and Their Components

- To manufacture biotechnology products, scientists must work with organisms and their components.
- These are the “**raw materials**” of biotechnology.



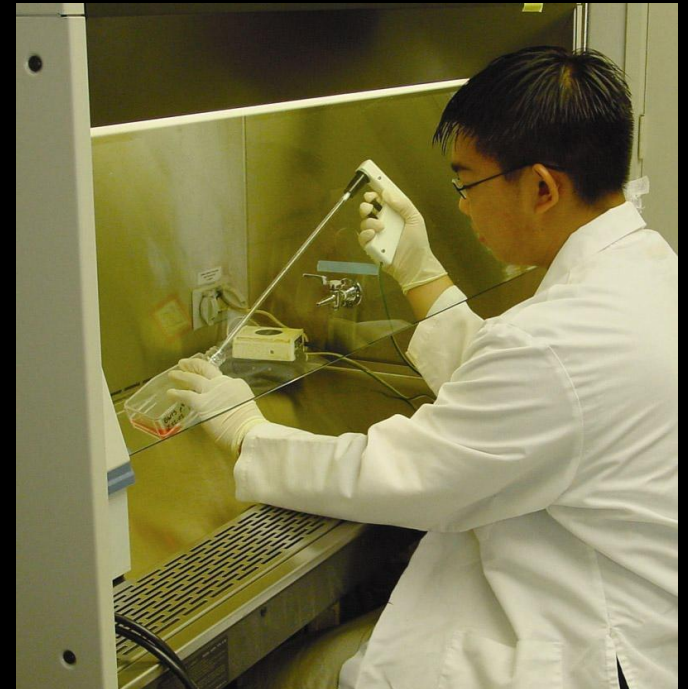
# Examples of “Raw Materials”

- **Molecule:** Antibody used to treat patients with diseases
- **Cell:** *Escherichia coli* (*E. coli*)
- **Multicellular organisms:**
  - Frost resistant strawberry plants
  - Increase genetic diversity of endangered animals



# Working in any area of biotechnology requires...

- Understanding of the characteristics of life
- Structures that compose organisms



## ■ Example:

- Developing pesticide resistant soybean plant
  - Understand normal soybean growth and factors that influence it
  - Recognize normal stem, root, and flower development in soybeans
  - Understand chemical structure of pesticide molecules and how these will interact with the cells and tissues
- Development of antibiotics (Medical application)
  - Understand the behavior of the microorganism
  - Recognize the chemical structure of antibiotic
  - Interaction of antibiotic with receptors on microorganism

# Content Knowledge

Minimum requirement:

- Basic biochemistry
  - Chemistry of living things
- Cytology
  - Cell biology
- Anatomy
  - Structure
- Physiology
  - Function

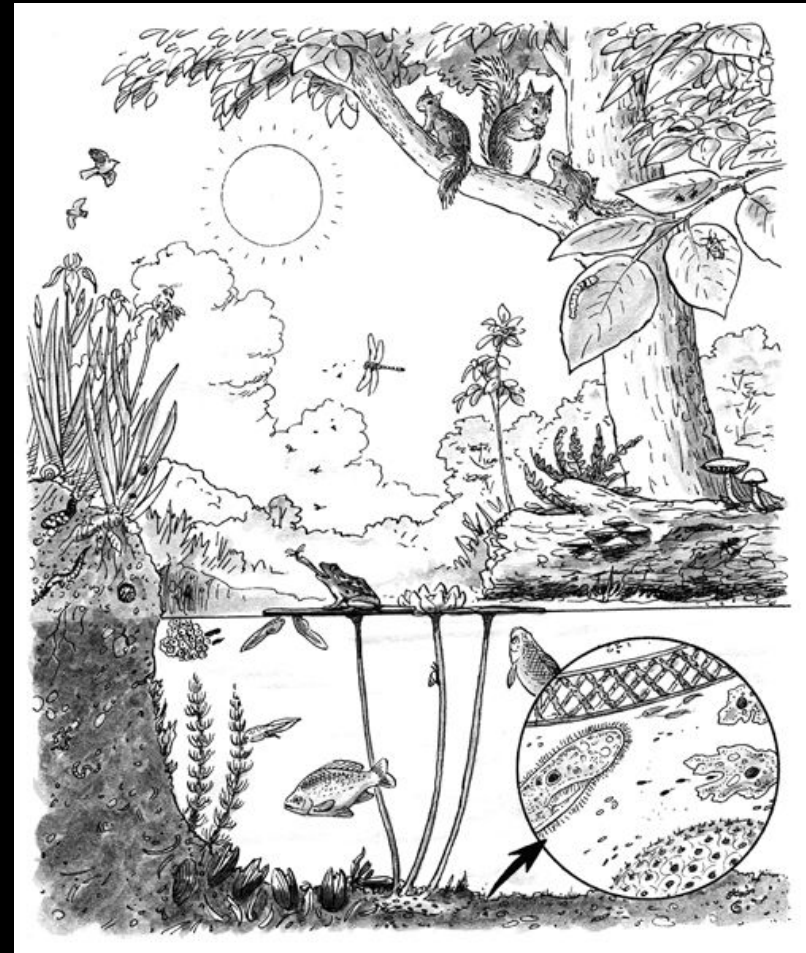
# The Living Condition

- Living things include:
  - Plants
  - Animals
  - Bacteria
  - Fungi
  - Protozoans
- Popular research organisms used in Biotech:
  - Soy beans, cotton, fruit flies, worms, cows, chicks, zebrafish, mice, rats, yeast and bacteria



# The Living Condition

- Characteristics of life:
  - Growth
  - Reproduction
  - Response to stimuli
  - Breakdown of food molecules (respiration)
  - Production of waste products



# Levels of Biological Organization

- Unicellular Organism
  - Organism composed of only ONE cell
    - Example: Bacteria, algae, protozoans
  - Use a microscope to view unicellular organism
  - Biotech application: *E.coli* used in genetic-engineering experiments

# Levels of Biological Organization

- Multicellular Organisms
  - Cells of multicellular organisms are grouped into functional units:
    - Tissues are group of cells that function together (e.g. Muscular or nervous tissue)
    - Organs are tissues that act together to form a specific function in an organism (e.g. liver and stomach)

# Levels of Biological Organization

organisms



frog



corn plant

organs

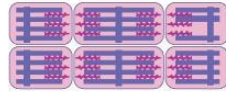


stomach

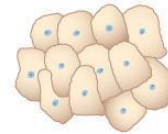


ovary

tissues

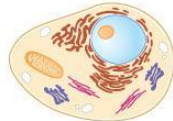


muscle tissue  
with muscle cells

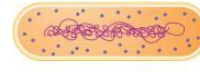


epithelial tissue

cells



animal cell



bacteria cell

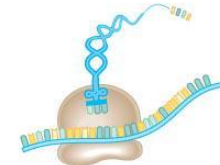
organelles



mitochondrion



chloroplast



ribosome

molecules



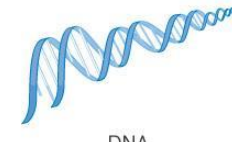
carbon dioxide



water



protein



DNA  
deoxyribonucleic acid

atoms



hydrogen



carbon



oxygen



nitrogen



phosphorus



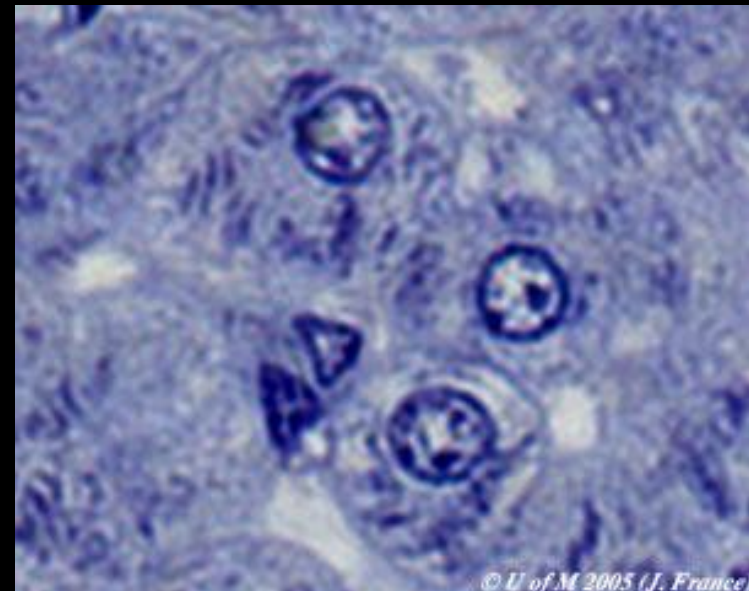
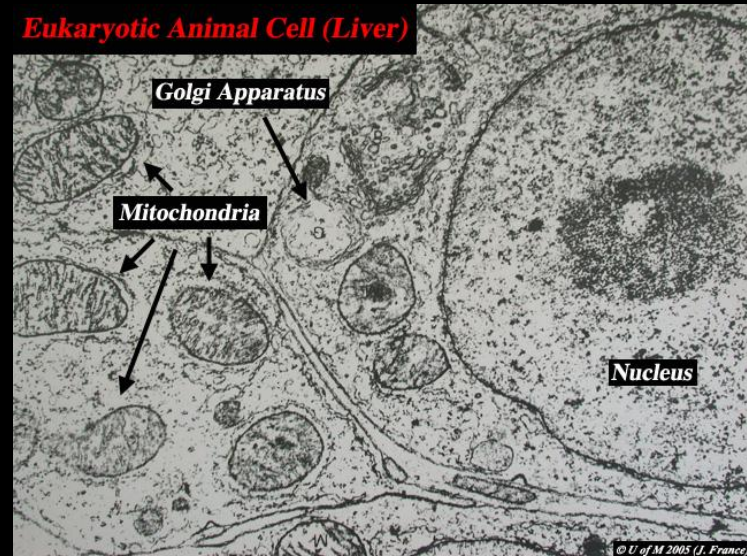
magnesium

# Levels of Biological Organization

- Atoms are the smallest unit of matter
- Atoms make up molecules
  - Carbohydrates, proteins and nucleic acids
- Molecules are the building block of cells
- Cells function in groups called tissues
- Tissues function together in organs
- Organs make up the organ systems
- Organ systems work together in multicellular organism

# Cells

- Smallest units of life
- Contain smaller, nonliving units known as **organelles**
  - Cannot exist outside the cell
  - Specialized microscopic factories with specific jobs
    - Example: Mitochondrion create energy for the cell
  - Composed of molecules and atoms (building blocks)
  - Too small to be seen with a conventional microscope

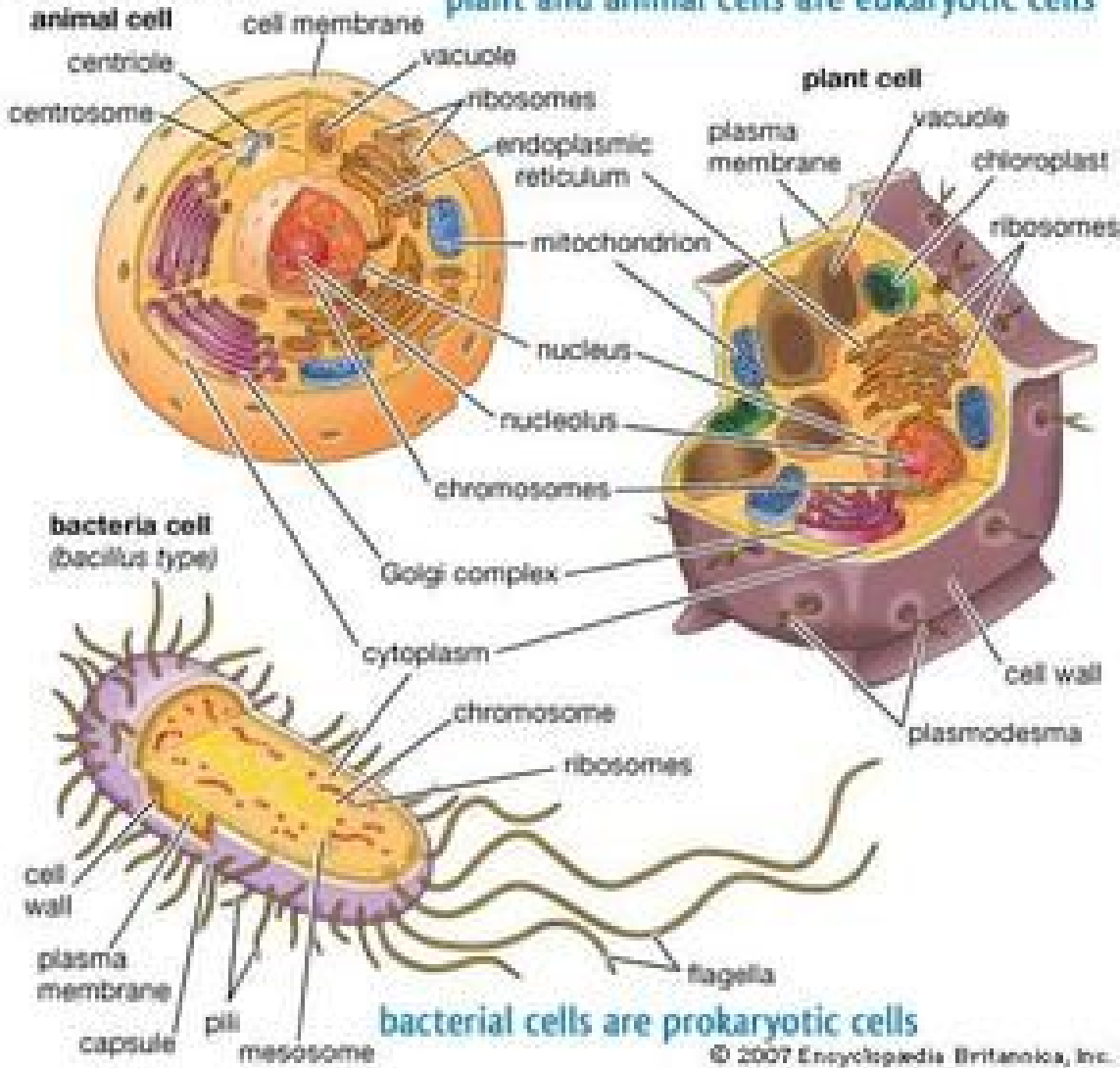


# In a cell...

- Different kinds of molecules are produced
  - Sugars
  - Starches
  - Proteins
  - Nucleic acids
  - Lipids
- Function of these molecules include:
  - Regulation of cell activity
  - Storage
  - Transportation
- Many of these are part of the structure of organelles.
  - Proteins are the most common molecules of cells.
    - Example: Insulin from pancreas cells, growth hormone from pituitary cells

**Some typical cells**

plant and animal cells are eukaryotic cells



bacterial cells are prokaryotic cells



## EUKARYOTE

10-100  $\mu\text{m}$  in diameter Bigger

Membrane Bound Nucleus  
& Nucleolus

Complex Appendages

Linear DNA With Histones

Membrane Bound Organelles

Membrane Receptors

Mitosis

Cell Wall Simple When Present

Cytoskeleton Big Ribosomes

## PROKARYOTE

.2-2.0  $\mu\text{m}$  in diameter Smaller

Unbound Nucleoid

Simple Appendages

Circular DNA

No Membrane Bound Organelles

Binary Fission

No Membrane Receptors

Complex Cell Wall

Small Ribosomes

No Cytoskeleton

Flagella

Plasma  
Membrane

Cell  
Division

Cytoplasm

Ribosomes  
Chromosomes

# What are model organisms?

Biology is similar in most organisms

- Fit for laboratory study
- Grow Quickly
- Short Life cycles
- Small
- Mammalian- cell division, organ systems, and immune response
- Non-Mammalian- genome resources
- The reason we can use these diverse organisms is because of their similarities with animals.

# Activity: Popular research organisms used in biotechnology/biomedical research

## ■ **Background:**

- Popular model organisms have strong advantages for experimental research, and become even more useful when other scientists have already worked on them, discovering techniques, genes and other useful information

# Activity: Popular research organism used in biotechnology/biomedical research

- Instruction:
  - Each individual will be required to research on a model organism
  - You will be required to present and teach the class about your selected model organism.

# Activity: Popular research organism used in Biotechnology/Biomedical Research

- List of model organism:
  - Fruit fly (*Drosopila*)
  - Escherichia coli (*E. coli*)
  - Mouse
  - Rat
  - Zebrafish
  - Chicken
  - Nematode (*Caenorhabditis elegans*)
  - Yeast

# Activity: Popular research organism used in Biotechnology/Biomedical Research

- Discuss:
  - Background information
  - Types of biotech/biomedical research performed using the organism
    - Provide one or more specific example
  - Reasons on why the model organism is chosen for that particular type of research