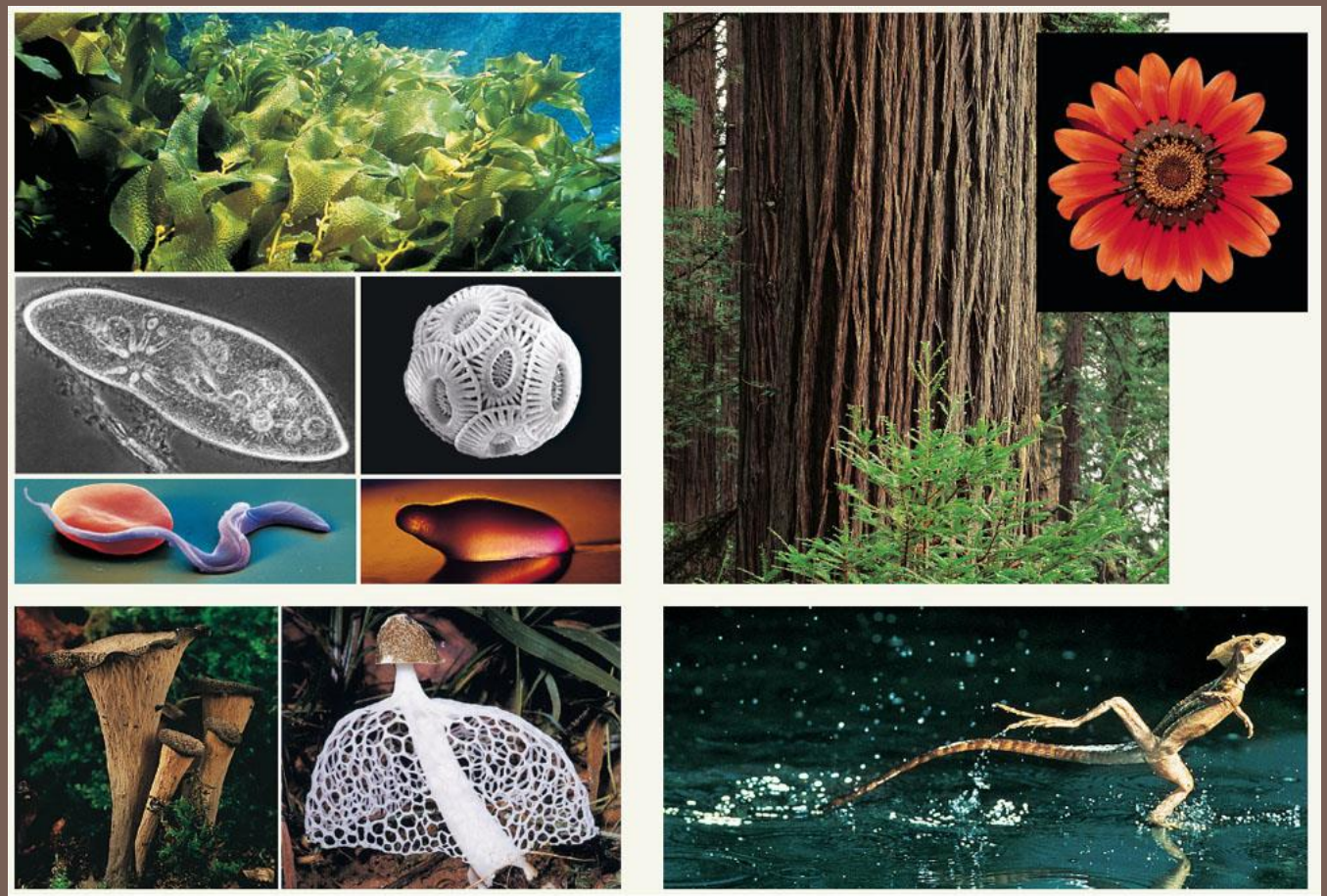
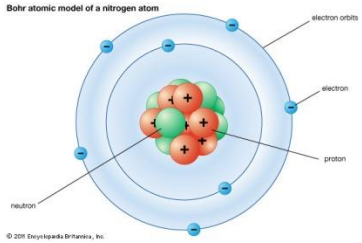


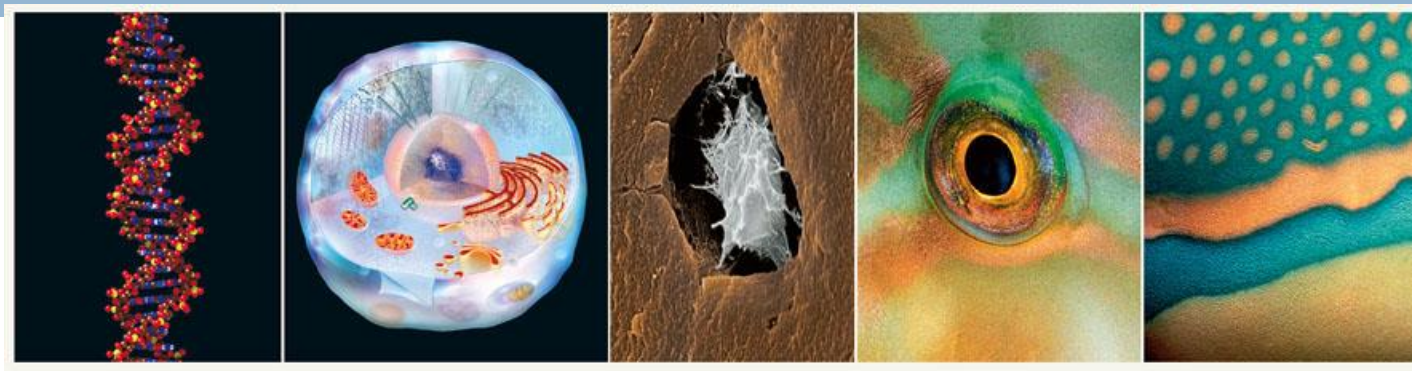
CHAPTER 1

Invitation To Biology

Levels of organization

- A) Atom





- B) Molecule
- C) Cell
- D) Tissue
- E) Organ
- F) Organ System

ATOMS – ORGAN SYSTEMS

B molecule

Two or more atoms joined in chemical bonds. In nature, only living cells make the molecules of life: complex carbohydrates and lipids, proteins, and nucleic acids.

C cell

Smallest unit that can live and reproduce on its own or as part of a multicelled organism. A cell has DNA, an outermost membrane, and other components.

D tissue

Organized array of cells and substances that are interacting in some task. Bone tissue consists of secretions (*brown*) from cells such as this (*white*).

E organ

Structural unit of two or more tissues that interact in one or more tasks. This parrotfish eye is a sensory organ used in vision.

F organ system

Organs that interact in one or more tasks. The skin of this parrotfish is an organ system that consists of tissue layers, organs such as glands, and other parts.

single-celled organisms can form populations

A atom

Atoms are fundamental units of all substances. This image shows a model of a single hydrogen atom.

Organization - continued

G multicelled organism

Individual composed of different types of cells. Cells of most multicelled organisms, such as this parrotfish, form tissues, organs, and organ systems.

H population

Group of single-celled or multicelled individuals of a species in a given area. This is a population of one fish species in the Red Sea.

I community

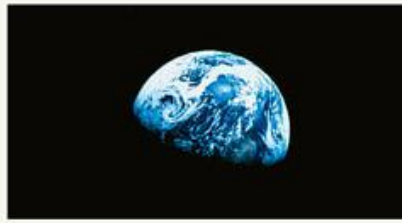
All populations of all species in a specified area. These populations belong to a coral reef community in a gulf of the Red Sea.

J ecosystem

A community that is interacting with its physical environment through inputs and outputs of energy and materials. Reef ecosystems flourish in warm, clear seawater throughout the Middle East.

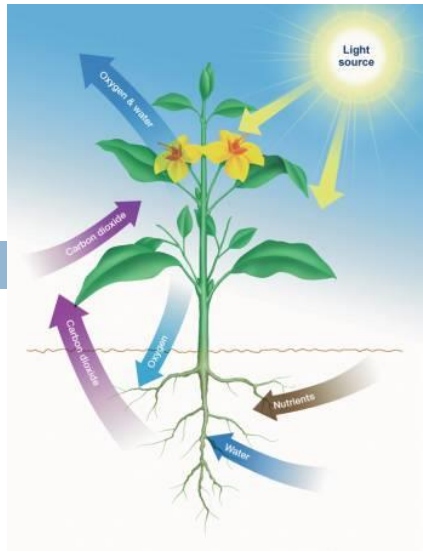
K biosphere

All regions of Earth's waters, crust, and atmosphere that hold organisms. Earth is a rare planet. Life as we know it would be impossible without Earth's abundance of free-flowing water.

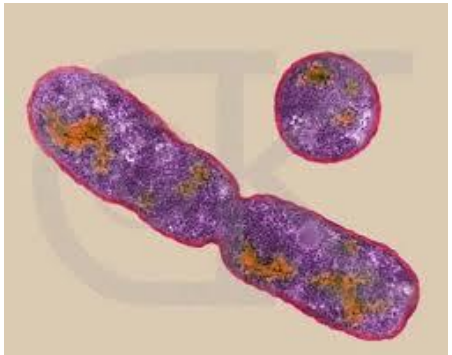


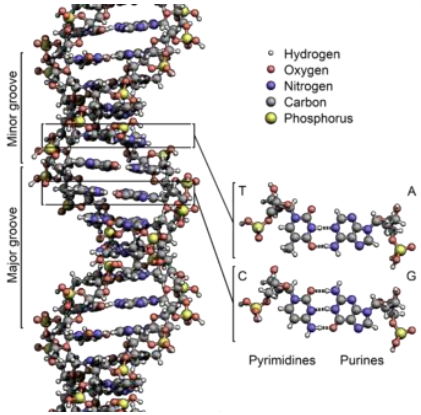
- G) Multicellular Organism
- H) Population
- I) Community
- J) Ecosystem
- K) Biosphere

1.2 What is life?

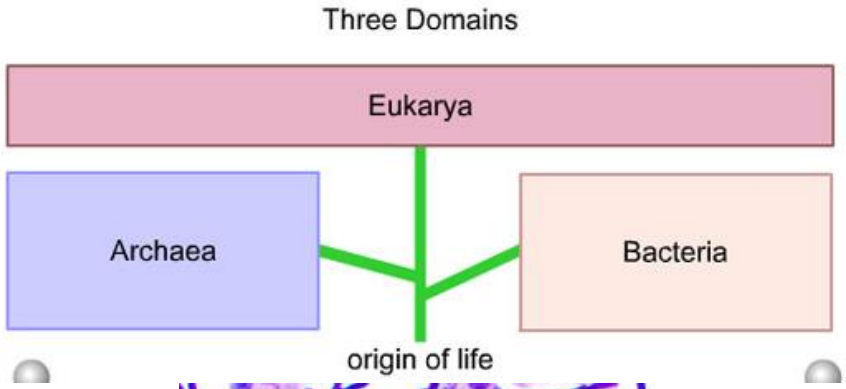


- Organisms –
  - Require input of energy and nutrients
  - Respond to change
    - maintain **homeostasis** – regulate their internal environment to favor cell survival
  - Grow
  - Reproduce
    - Transmit genetic material (DNA) to offspring

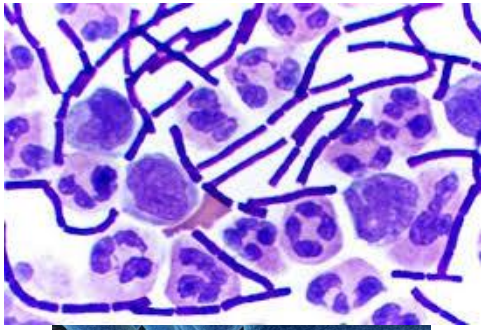


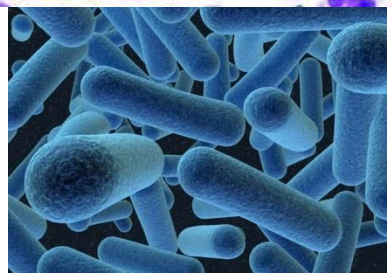


1.3 Life's Diversity



- 3 Domains
  - **Bacteria** – single celled organisms with no nucleus
  - **Archaea** –single celled organisms – evolutionarily closer to Eukarya
    - Found in extreme environments (hydrothermal vents, digestive systems, etc.)
  - **Eukarya** – Single or multicellular organisms with a nucleus
    - Fungi, protists, animals, plants





Naming of Organisms

- Each type of organism is given a two-part name that includes genus and species names
- **Genus**
  - A group of species that share unique features
- **Species**
  - Individuals that share one or more heritable traits and can interbreed (if sexually reproducing)
    - Ex. heavy-beaked parrotfish=*Scarus gibbus*

1.4 The diversity of life

- Organisms are have genetic variation
- When organisms compete, the “best fit” survives
- Over time populations change

1.5 Science

- Science = study of nature
  - Science does not address the things "beyond nature" or supernatural
- Explanations must be testable and be able to be repeated by others

1.6 How Science Works

- Scientific Method
  - Observation
  - Question
  - Hypothesis/Prediction
  - Experiment
  - Analyze Results
  - Conclusion

Example of a scientific approach.

Table 1.3 Example of a Scientific Approach

1.	Observation	People get cancer.
2.	Question	Why do people get cancer?
3.	Hypothesis	Smoking cigarettes may cause cancer.
4.	Prediction	If smoking causes cancer, then individuals who smoke will get cancer more often than those who do not.
5.	Gather information	Conduct a survey of individuals who smoke and individuals who do not smoke. Determine which group has the highest incidence of cancers.
	Laboratory experiment	Establish identical groups of laboratory rats (the model system). Expose one group to cigarette smoke. Compare the incidence of new cancers in each of the two groups.
6.	Assess results	Compile test results and draw conclusions from them.
7.	Report	Submit the results and the conclusions to the scientific community for review and publication.

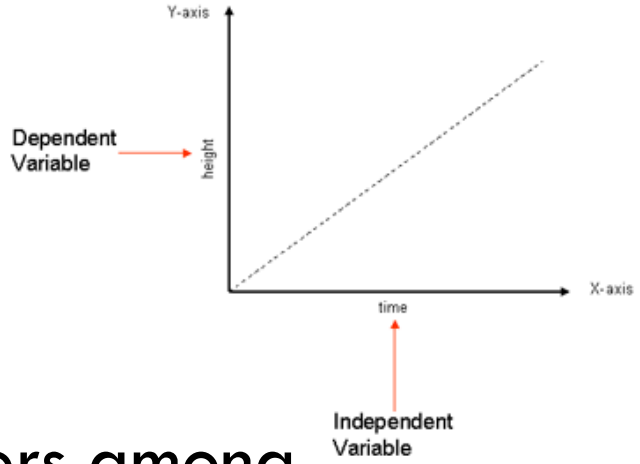
What is a Theory?

- Theory = a long-standing hypothesis that has been repeatedly tested and supported

Table 1.4 Examples of Scientific Theories

Atomic theory	All substances are composed of atoms.
Gravitation	Objects attract one another with a force that depends on their mass and how close together they are.
Cell theory	All organisms consist of one or more cells, the cell is the basic unit of life, and all cells arise from existing cells.
Germ theory	Microorganisms cause many diseases.
Plate tectonics	Earth's crust is cracked into pieces that move in relation to one another.
Evolution	Change occurs in lines of descent.
Natural selection	Variation in heritable traits influences differential survival and reproduction of individuals of a population.

EXPERIMENTS



- Variable – a characteristic that differs among individuals
  - Independent Variable – the variable the experimenter sets
    - Experiments are usually designed to test ONE variable
  - Dependent variable – the variable that changes as a result

EXAMPLE – Does shoe size determine a person's IQ score?

Independent variable = shoe size

Dependent variable = IQ score

EXPERIMENT

- Groups
  - **Experimental Group** = individuals who receive a certain treatment
  - **Control Group** = a group that is identical to the experimental group except for the variable being tested

Experiments

- Independent Variable
  - Amount of Olestra
- Dependent Variable
  - Intestinal cramps

A Hypothesis

Olestra® causes intestinal cramps.

B Prediction

People who eat potato chips made with Olestra will be more likely to get intestinal cramps than those who eat potato chips made without Olestra.

C Experiment

Control Group	Experimental Group
Eats regular potato chips	Eats Olestra potato chips

D Results

Control Group	Experimental Group
93 of 529 people get cramps later (17.6%)	89 of 563 people get cramps later (15.8%)

E Conclusion

Percentages are about equal. People who eat potato chips made with Olestra are just as likely to get intestinal cramps as those who eat potato chips made without Olestra. These results do not support the hypothesis.