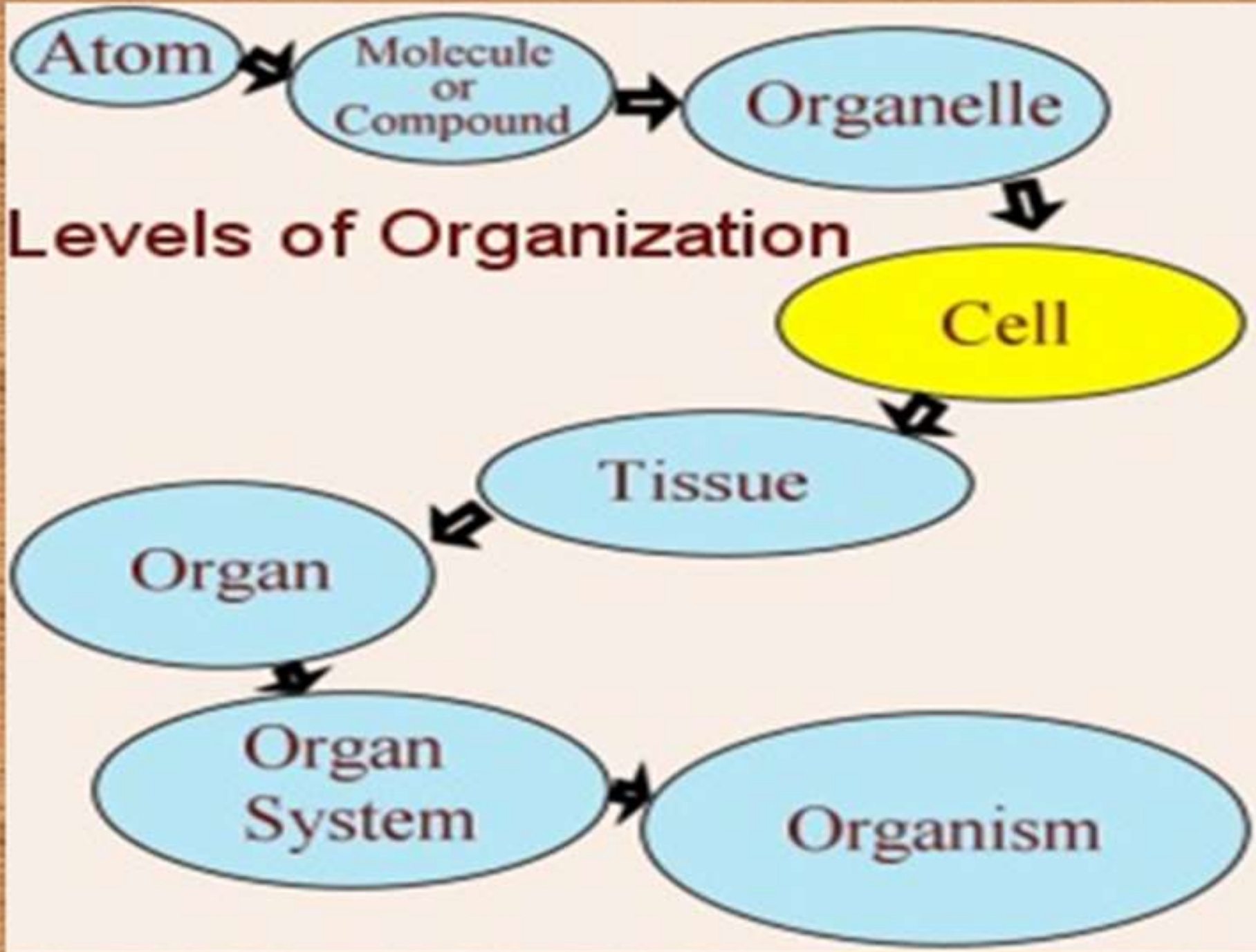
BIOLOGY AND ITS BRANCHES

BIOLOGY

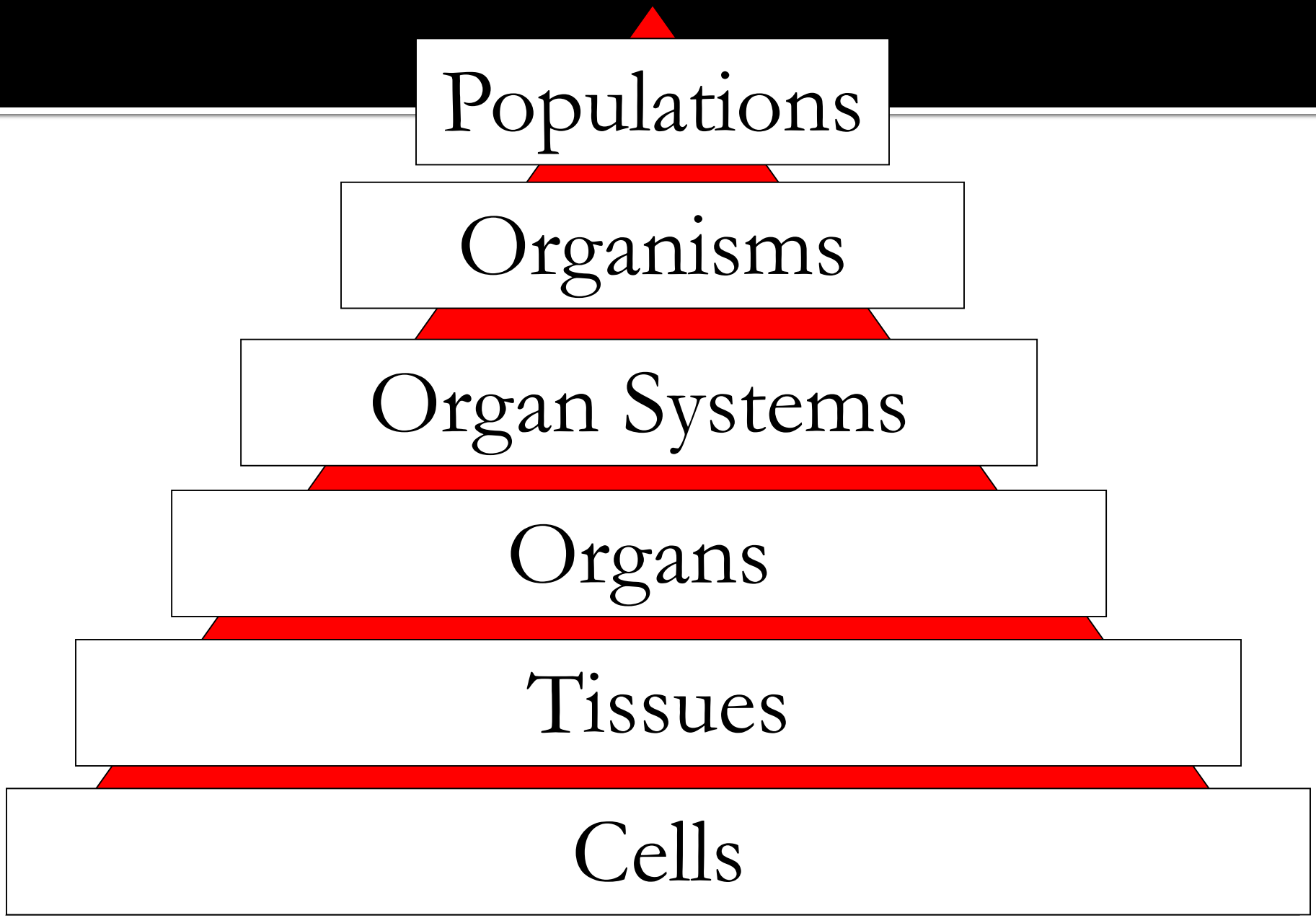
- Biology is a natural science concerned with the study of life and living organisms, including their structure, function, growth, evolution, distribution, and taxonomy.
- Biology generally recognizes the cell as the basic unit of life, genes as the basic unit of heredity, and evolution as the engine that propels the synthesis and creation of new species.
- The term biology is derived from the Greek word bios, "life" and the suffix -logia, "study of."

Biological Organization

Does this apply to humans too?

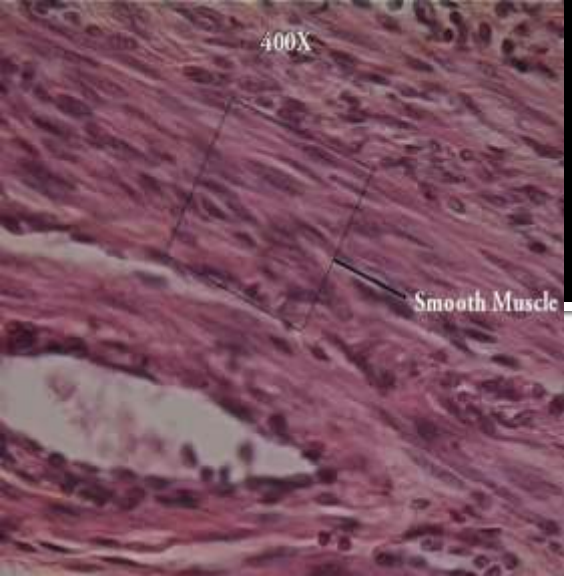

Atom
Molecule or Compound
Organelle
Levels of Organization
Cell
Tissue
Organ
Organ System
Organism

Levels of Biological Organization

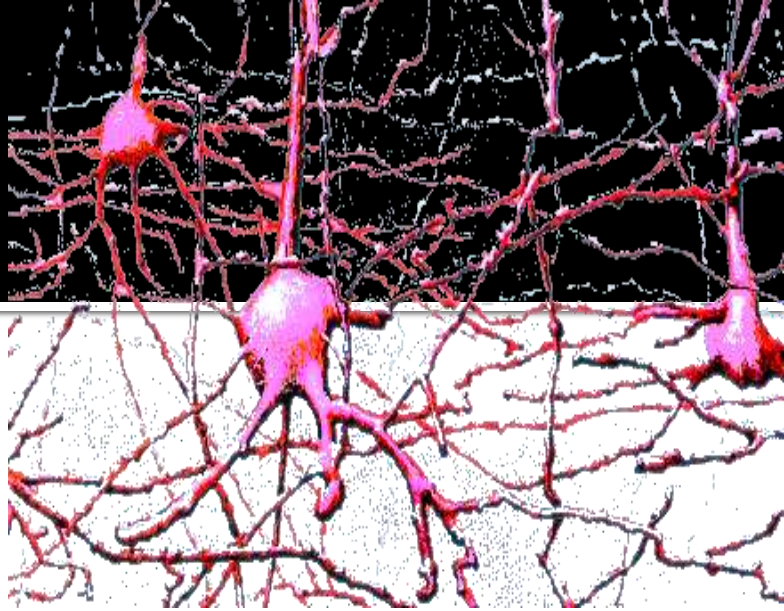


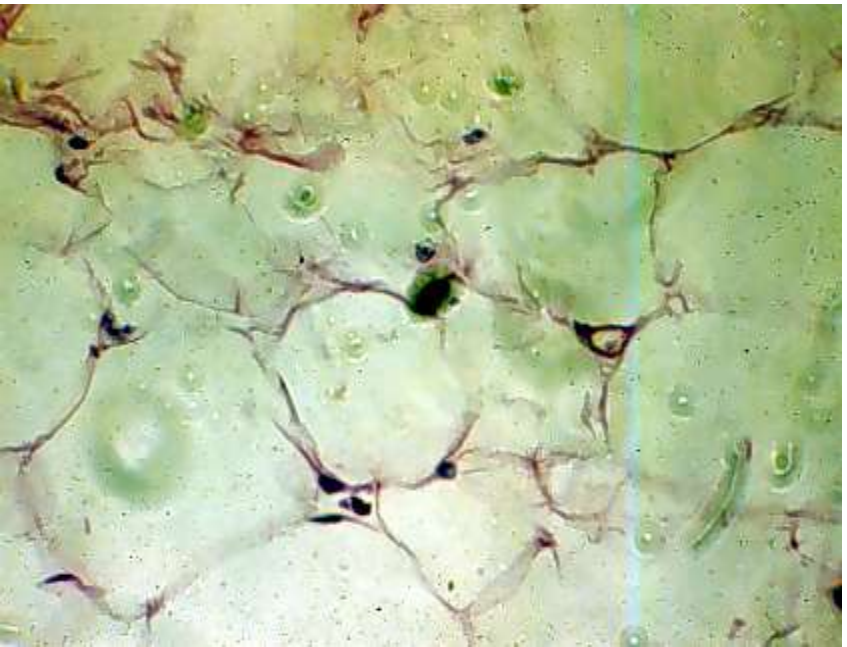
Cells

- A **cell** is the most basic unit of structure

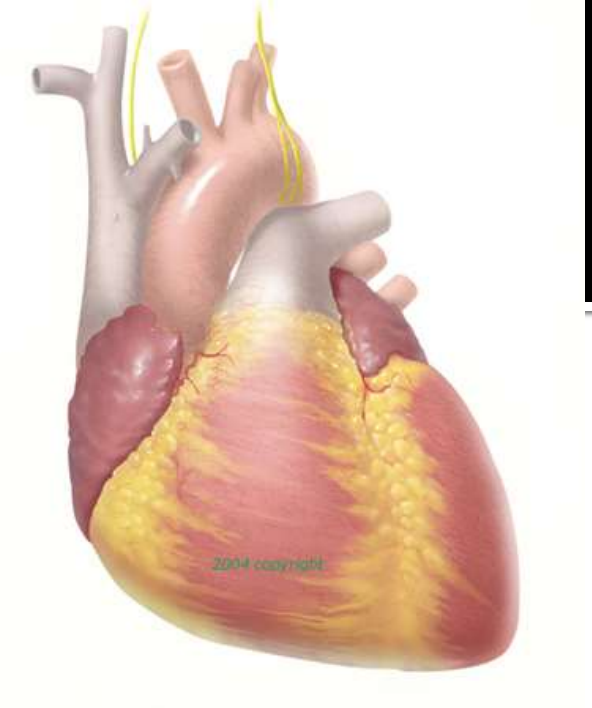


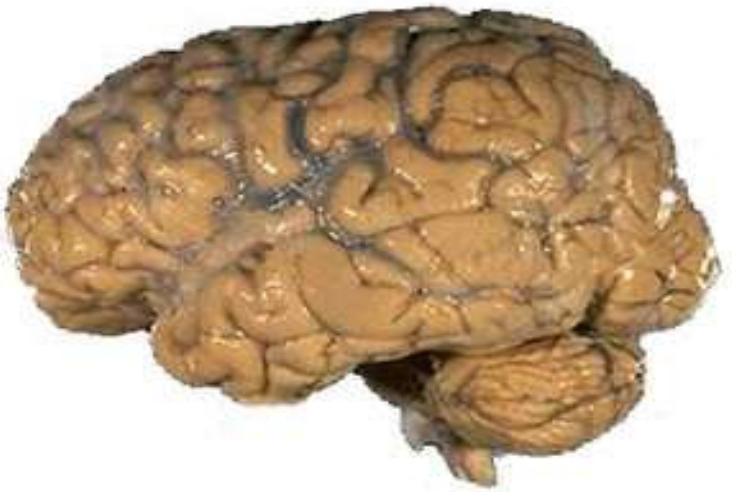
Tissues

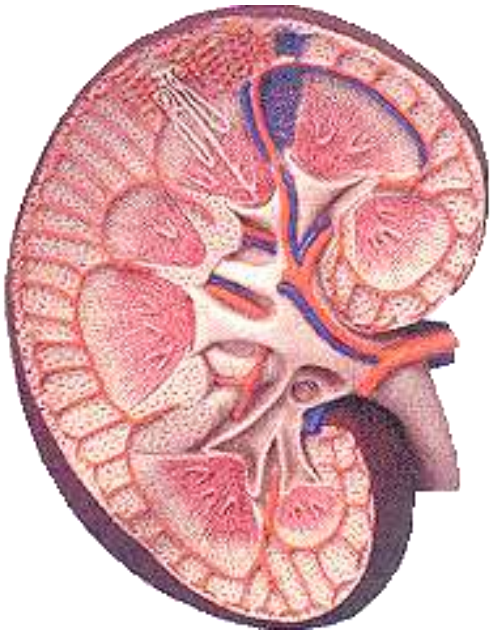


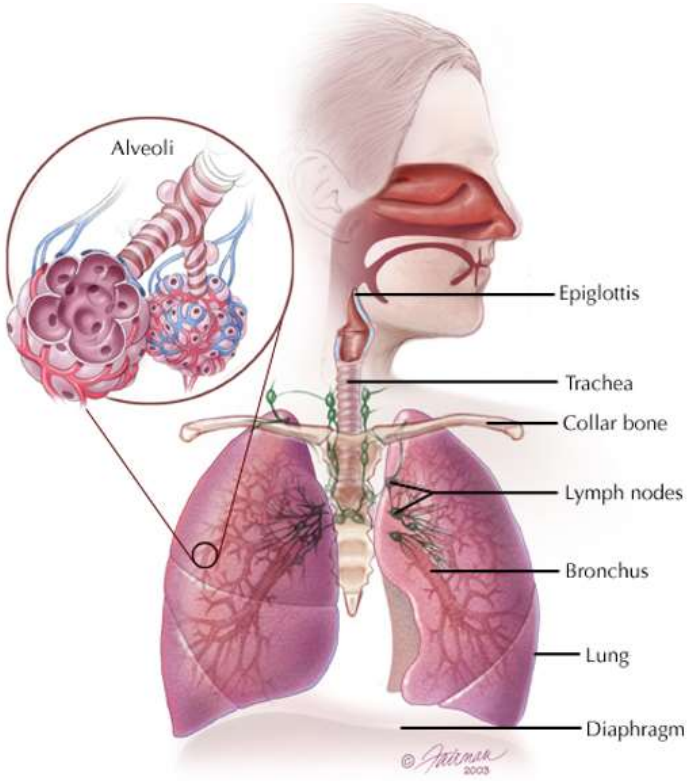


Organs

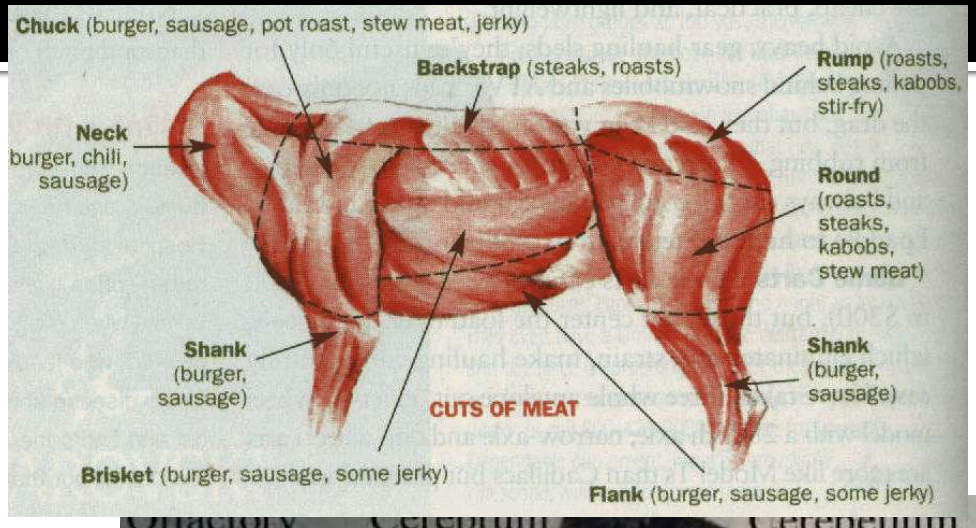

2004 copyright

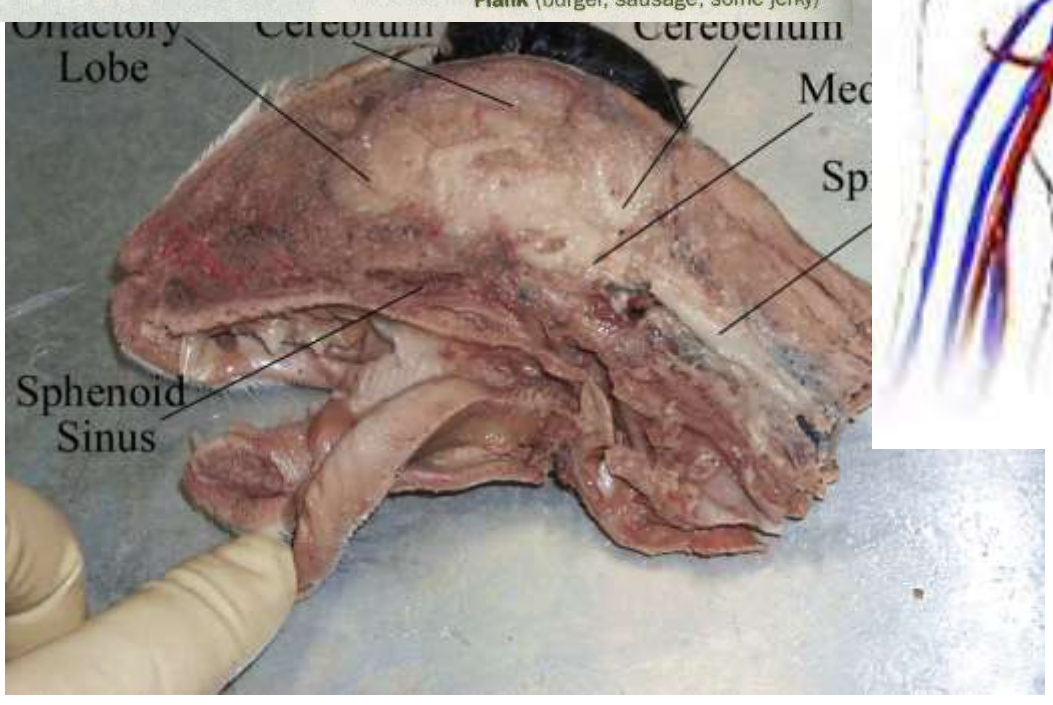


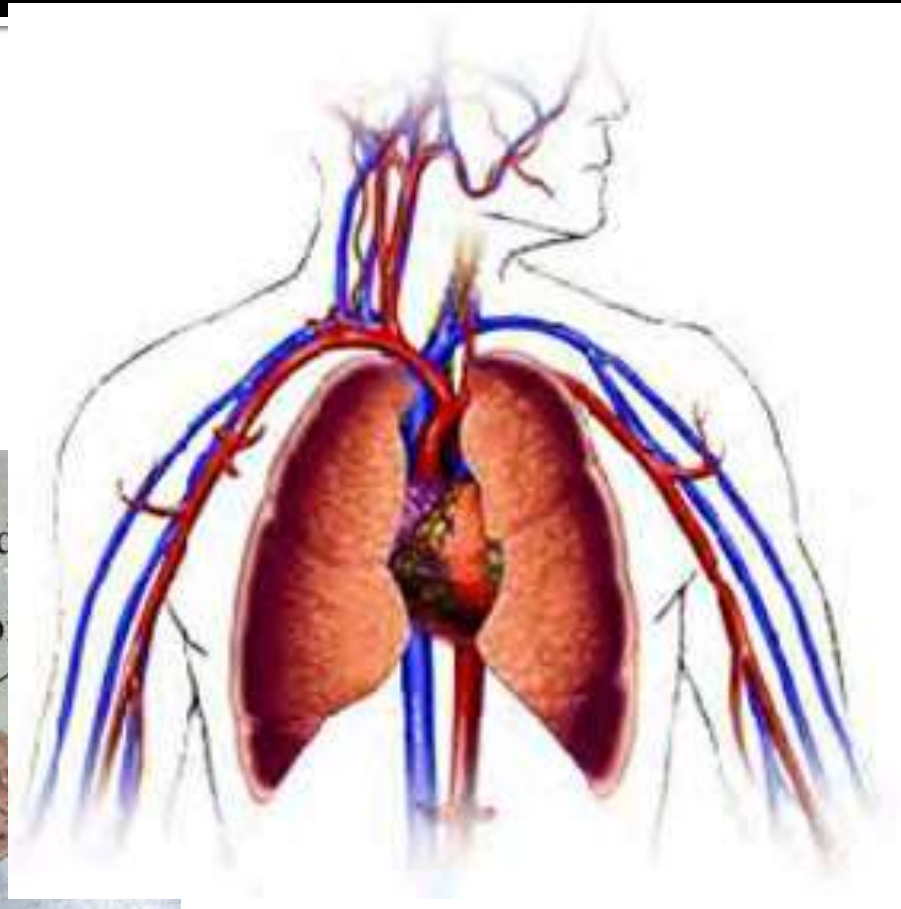



Alveoli
Epiglottis
Trachea
Collar bone
Lymph nodes
Bronchus
Lung
Diaphragm

Organ Systems







Organisms

Populations

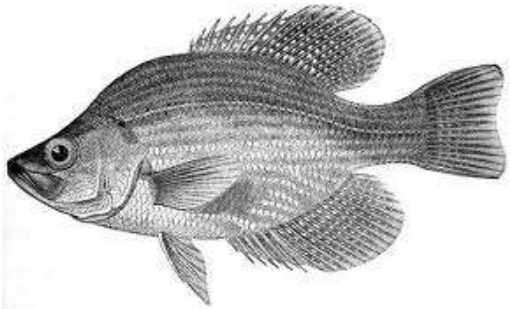
Classification of Living Things

What is classification?

- Classification is the grouping of living organisms according to similar structures and functions.

Early classification systems

- Aristotle grouped animals according to the way they moved



The modern classification system :

Developed by Carolus Linnaeus

Consists of 7 levels:

- **Kingdom**
- **Phylum**
- **Class**
- **Order**
- **Family**
- **Genus**
- **Species**

FIVE KINGDOMS

- **Monera** are single-celled organisms that don't have a nucleus. Bacteria make up the entire kingdom. There are more forms of bacteria than any other organism on Earth. Some bacteria are beneficial to us, such as the ones found in yogurt. Others can cause us to get sick.

- **Fungi** are usually motionless organisms that absorb nutrients for survival. They include mushrooms, molds, and yeasts.

- **Protists** are mostly single-celled organisms that have a nucleus. They usually live in water. Some protists move around, while others stay in one place. Examples of protists include some algae, paramecium, and amoeba.

- **Plants** contain chlorophyll, a green pigment necessary for photosynthesis, a process in which plants convert energy from sunlight into food. Their cell walls are made sturdy by a material called cellulose, and they are fixed in one place. Plants are divided into two groups: flower- and fruit-producing plants and those that don't produce flowers or fruits. They include garden flowers, agricultural crops, grasses, shrubs, ferns, mosses, and conifers.
-

- **Animals** are the most complex organisms on Earth. Animals are multi-celled organisms, eat food for survival, and have nervous systems. They are divided into vertebrates and invertebrates and include mammals, amphibians, reptiles, birds and fish. Actually, there are now six kingdoms. The five kingdom was during the 1969 and it included all the bacteria within one group.

Kingdom Animalia

Phylum Chordata

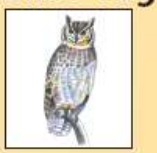
Class Aves

Order Strigiformes

Family Strigidae

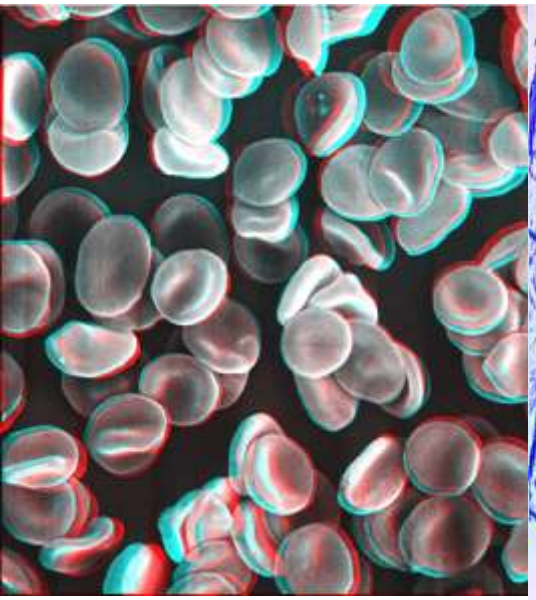
Genus *Bubo*

Species *Bubo virginianus*

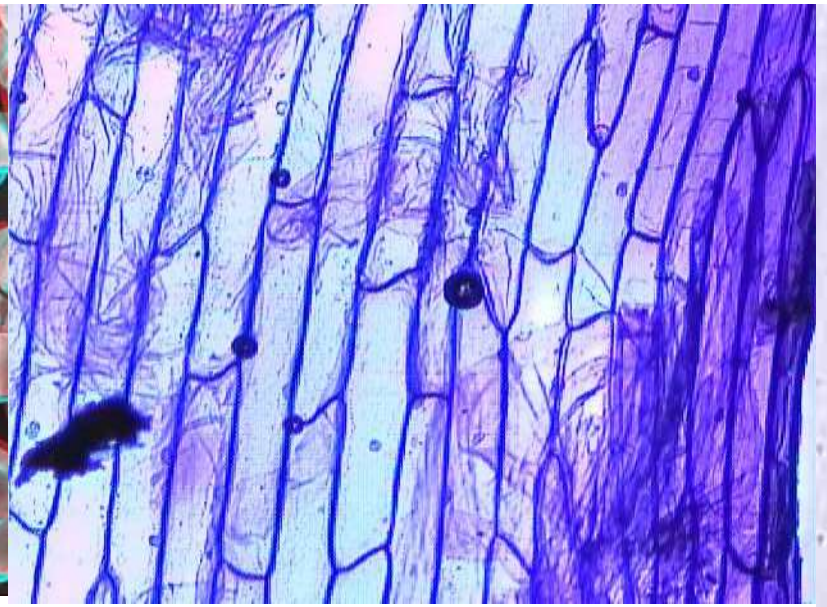


Characteristics of Living Things

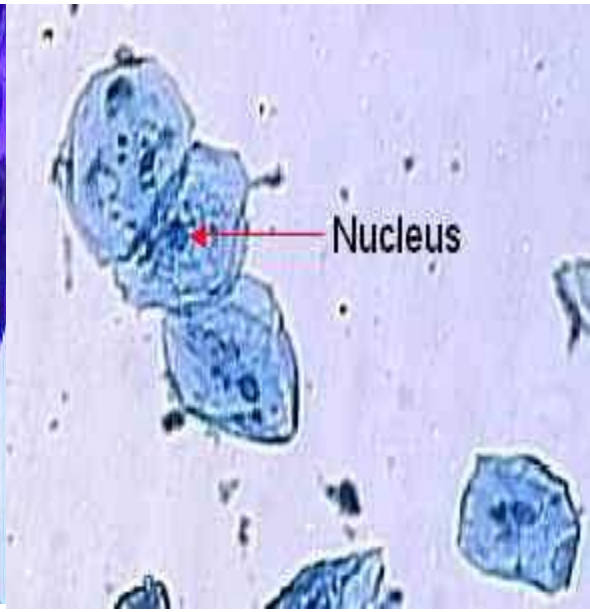
1. Made of Cells



Red Blood cells



Onion skin epidermal cells



Human cheek cells

Characteristics of Living Things

2. Grows and develops

- Increase in cell size and/or number
- Includes: development, aging, death
- Differentiation – cell specialization for a certain job

Characteristics of Living Things

3. Obtains & uses Energy

4. Reproduces

5. Responds to the Environment
    a. Movement – internal or external
    b. Irritability - ability to respond to a stimulus

BRANCHES OF BIOLOGY

Biology is simply the study of life.

- Biology is concerned with all living things.
- There are many branches of biology.
- Every one is study of a group of organism.

ZOOLOGY

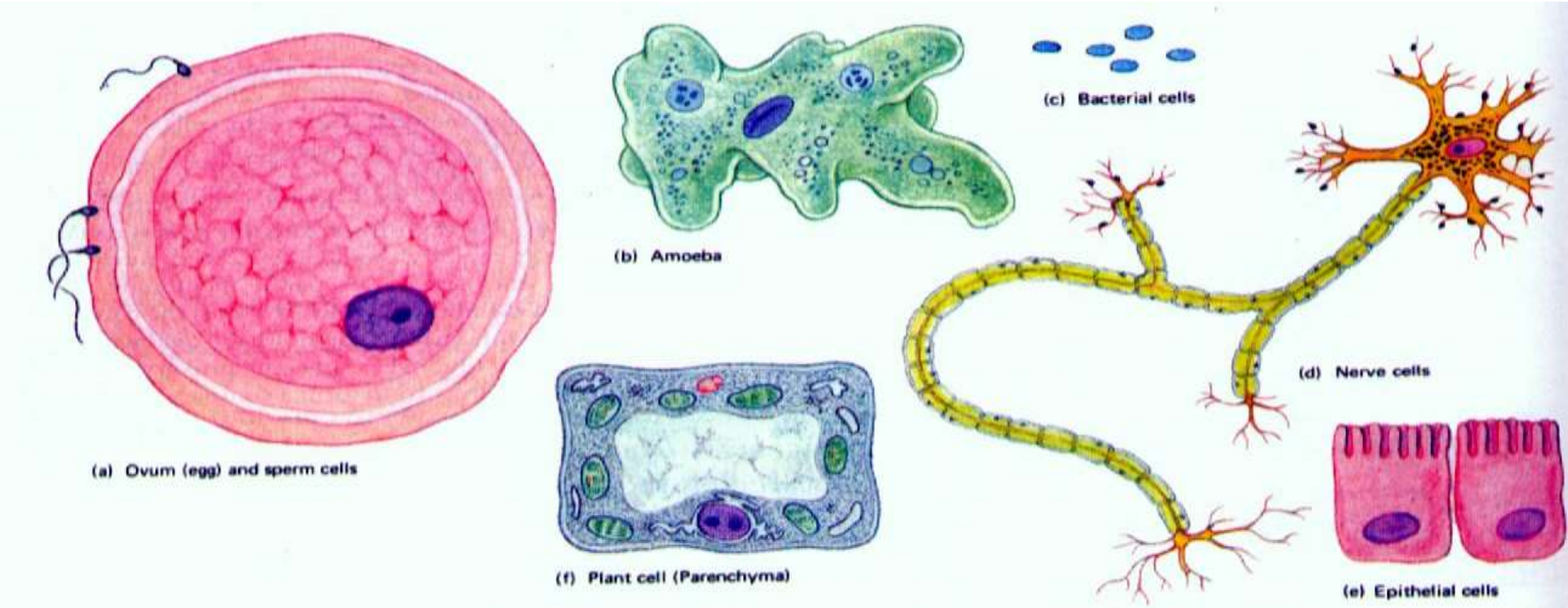
- Zoology is concerned with animals.
- Who does make the observation about zoology is called Zoologist.

BOTANY

- Botany is concerned with plants
- Who does make the observation about the botany is called Botanist.

CYTOLOGY

- Cytology is the study of cells.



ECOLOGY

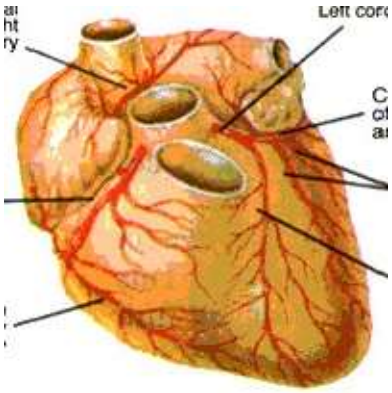
- Ecology is the science which studies the releationship of living things between each other and their environment.
- Also ecology is concerned with pollution. Such as air and water pollution

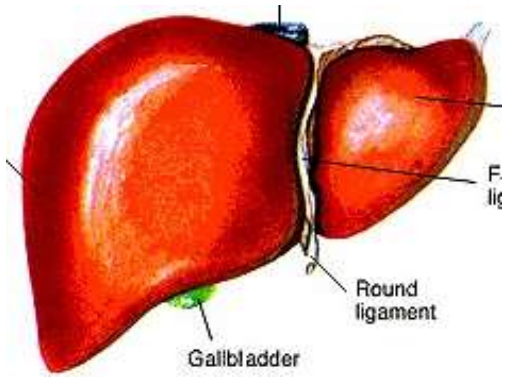
GENETICS

- Genetics is the study of how features is passed to offspring from their parents.

Anatomy

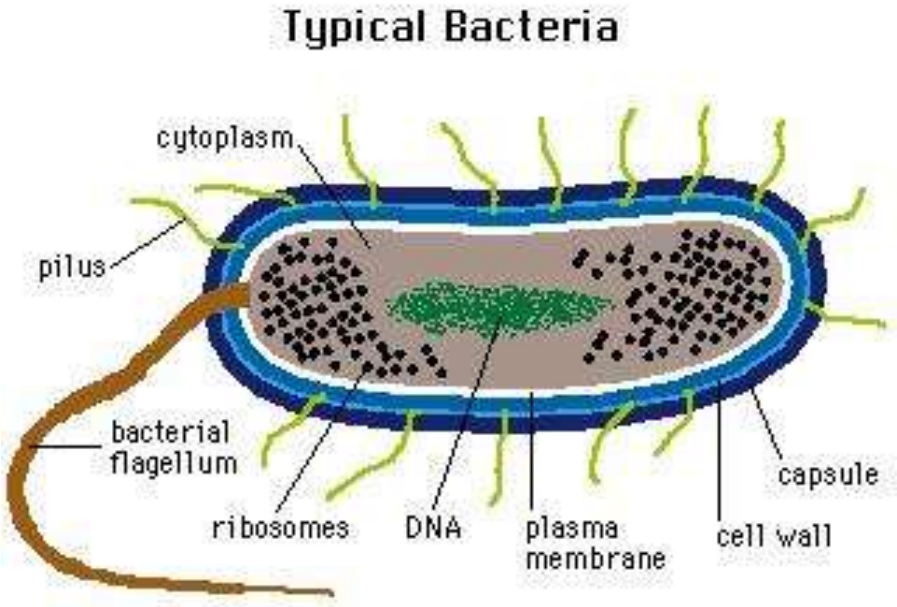
- Anatomy is the study of the inner organs of the body (kidney, hert, liver etc.)





MICROBIOLOGY

- Microbiology is the study of microscopic life.
- For ex. Bacteria.



taxonomy

- Taxonomy is the study of the classification of living organisms.
- Classification is made groups of organisms.



ORNITHOLOGY

- Ornithology is the study of birds.

ENTOMOLOGY

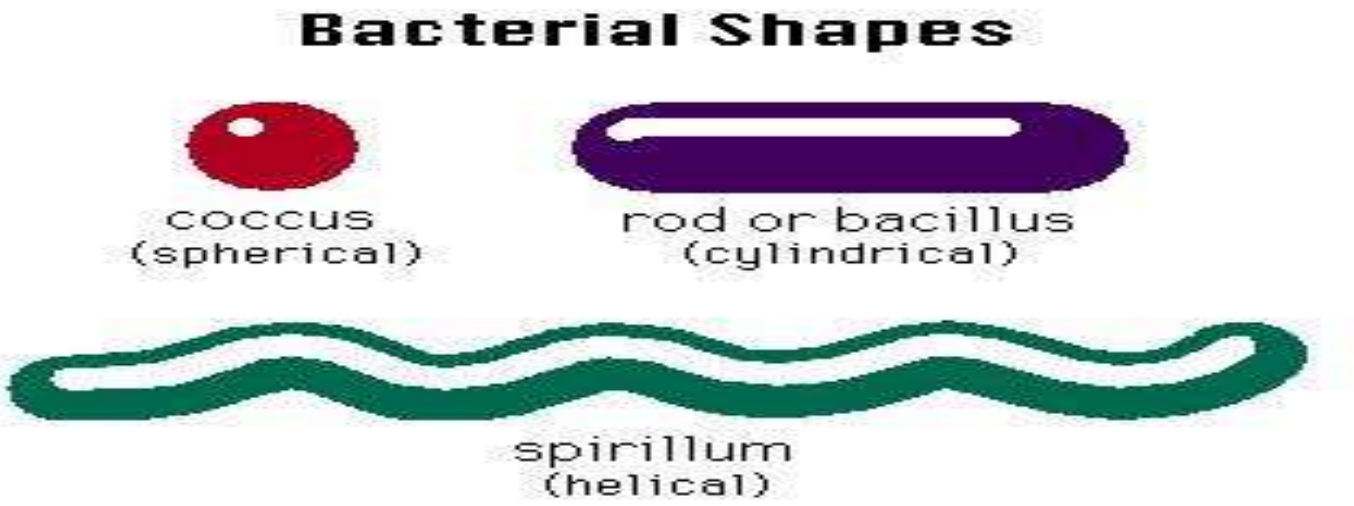
- Entomology is the study of insects.
- Such as mosquito and spider

Parasithology

- Parasithology is the study of parasites.
- Parasites are harmful organisms for living things.

BACTERIOLOGY

- Bacteriology is the study of bacteria

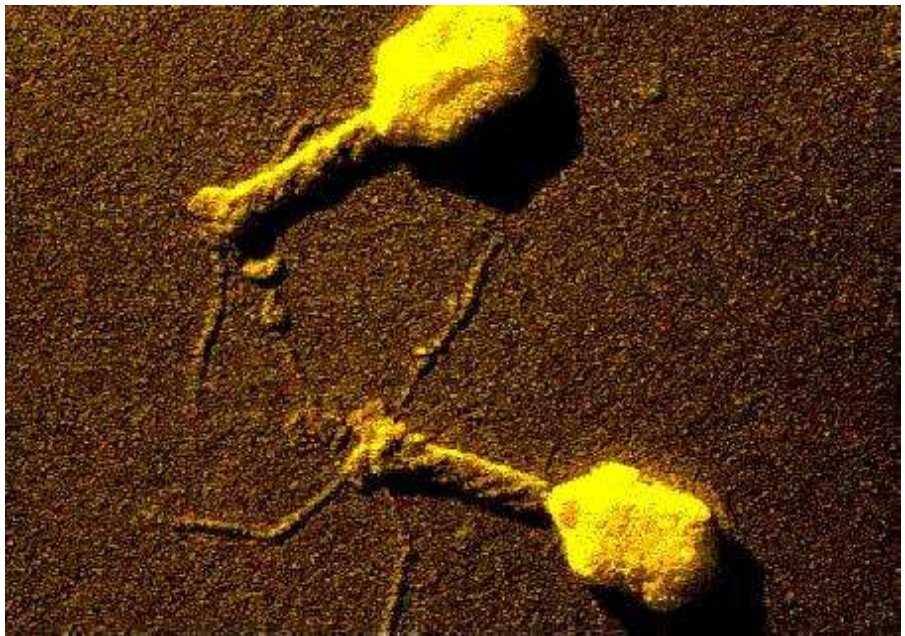


Mycology

- Mycology is the study of fungi.

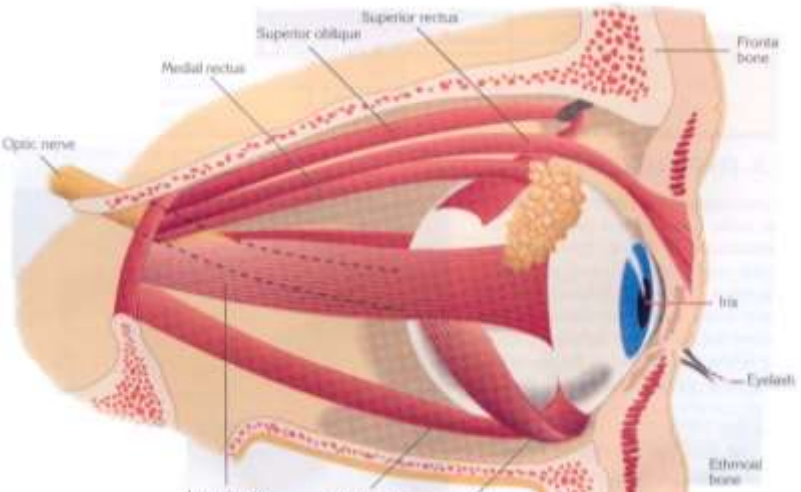
virology

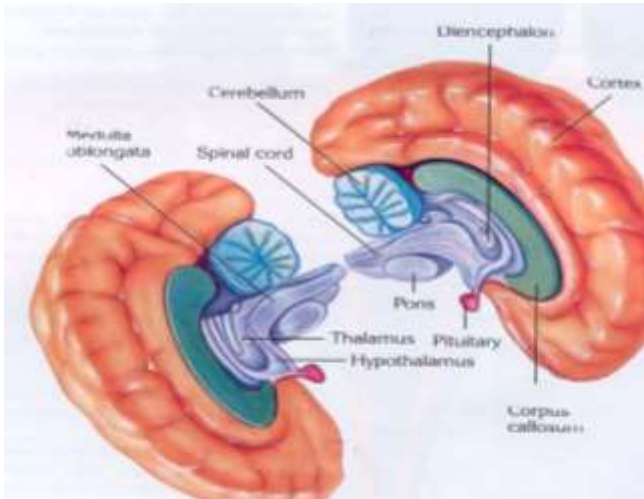
- Virology is the study of viruses.



Physiology

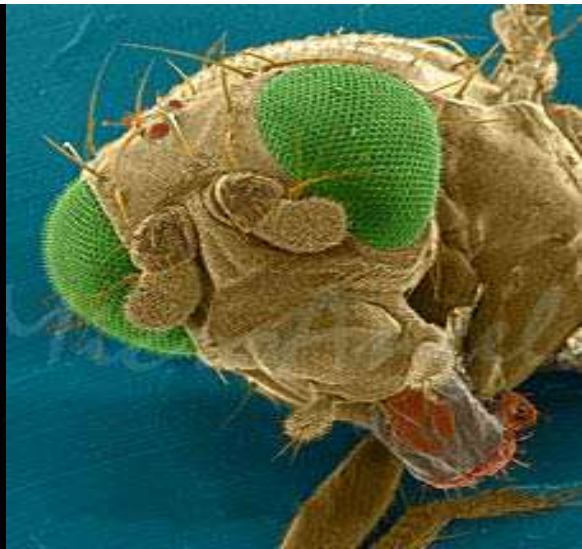
- Physiology is concerned function of tissue, organs and systems.





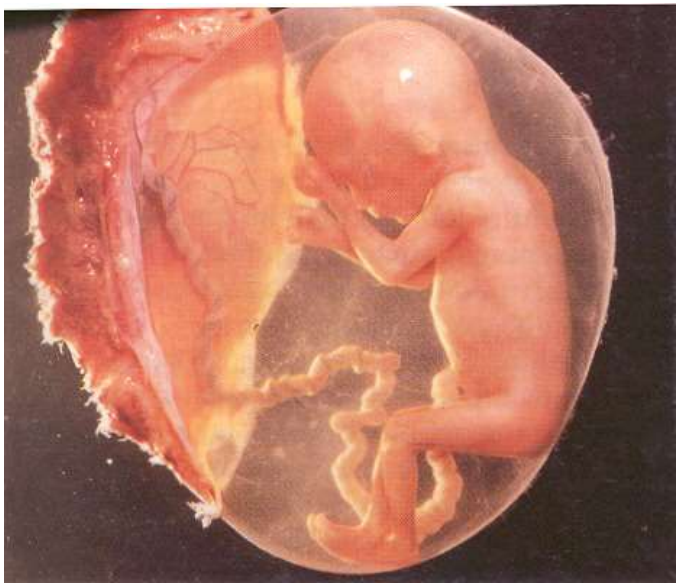
morphology

- Morphology is concerned with phenotype (Apearance) of living things.



Embryology

- Embryology studies the developmental patterns of organisms from zygote to birth.



- Aerobiology – the study of airborne organic particles
- Agriculture – the study of producing crops from the land, with an emphasis on practical applications

- Arachnology – the study of arachnids
- Astrobiology – the study of evolution, distribution, and future of life in the universe—also known as exobiology, exopaleontology, and bio astronomy
- Biochemistry – the study of the chemical reactions required for life to exist and function, usually a focus on the cellular level
- Bioengineering – the study of biology through the means of engineering with an emphasis on applied knowledge and especially related to biotechnology

- Biogeography – the study of the distribution of species spatially and temporally
- Bioinformatics – the use of information technology for the study, collection, and storage of genomic and other biological data
- Biomathematics (or Mathematical biology) – the quantitative or mathematical study of biological processes, with an emphasis on modeling

- Biomechanics – often considered a branch of medicine, the study of the mechanics of living beings, with an emphasis on applied use through prosthetics or orthotics
- Biomedical research – the study of the human body in health and disease
- Bio musicology - study of music from a biological point of view.
- Biophysics – the study of biological processes through physics, by applying the theories and methods traditionally used in the physical sciences

- Cell biology – the study of the cell as a complete unit, and the molecular and chemical interactions that occur within a living cell
- Conservation biology – the study of the preservation, protection, or restoration of the natural environment, natural ecosystems, vegetation, and wildlife
- Cryobiology – the study of the effects of lower than normally preferred temperatures on living beings
- Developmental biology – the study of the processes through which an organism forms, from zygote to full structure

- Environmental biology – the study of the natural world, as a whole or in a particular area, especially as affected by human activity
- Epidemiology – a major component of public health research, studying factors affecting the health of populations
- Epigenetics – the study of heritable changes in gene expression or cellular phenotype caused by mechanisms other than changes in the underlying DNA sequence
- Ethology – the study of animal behavior
- Evolutionary biology – the study of the origin and descent of species over time

- Biotechnology – a new and sometimes controversial branch of biology that studies the manipulation of living matter, including genetic modification and synthetic biology

- Building biology – the study of the indoor living environment

- Hematology - the study of blood and blood - forming organs.
- Herpetology – the study of reptiles and amphibians
- Histology – the study of cells and tissues, a microscopic branch of anatomy
- Ichthyology – the study of fish
- Integrative biology – the study of whole organisms
- Limnology – the study of inland waters

- Mammalogy – the study of mammals
- Marine biology (or Biological oceanography) – the study of ocean ecosystems, plants, animals, and other living beings
- Molecular biology – the study of biology and biological functions at the molecular level, some cross over with biochemistry

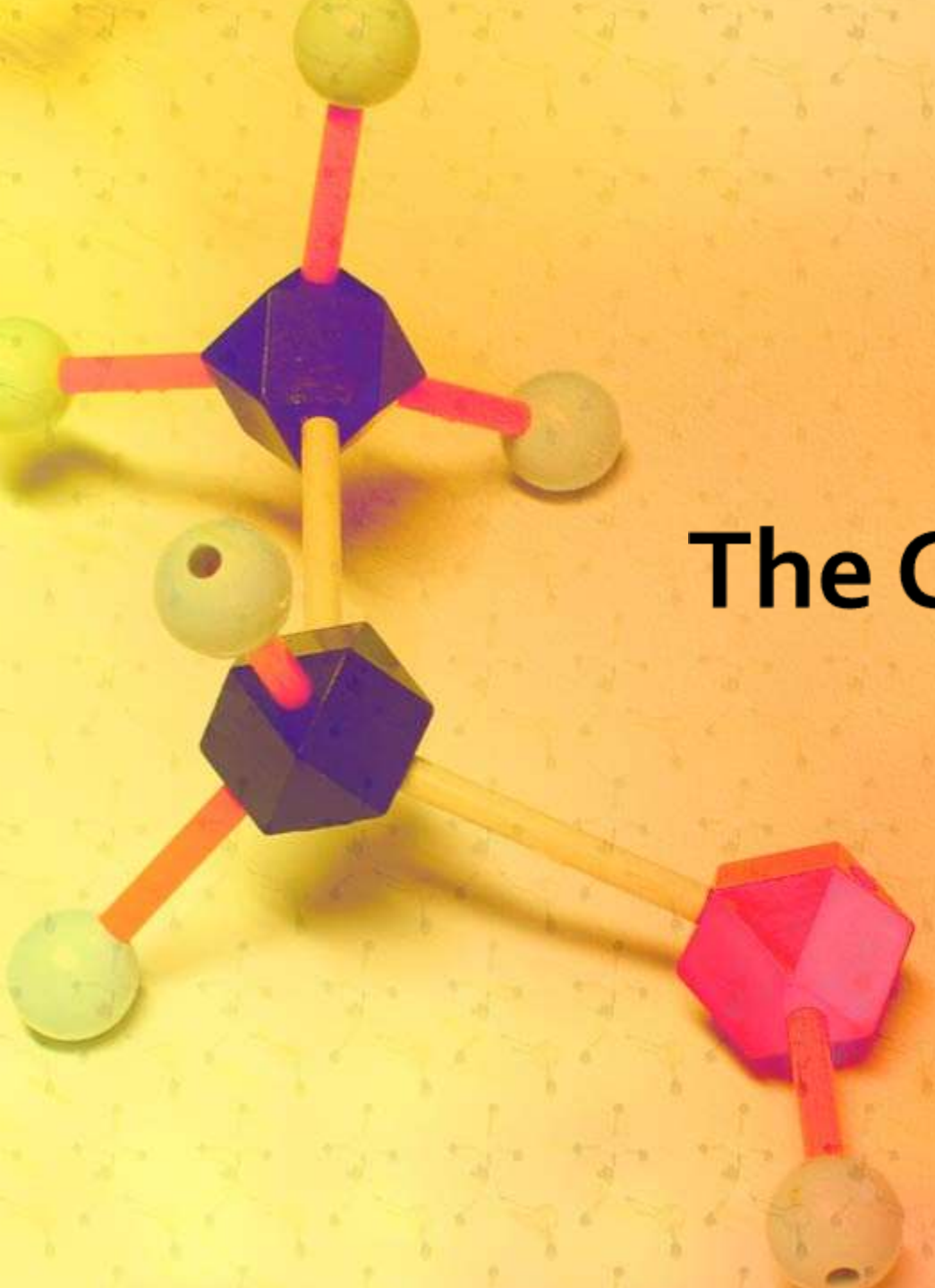
- Neurobiology – the study of the nervous system, including anatomy, physiology and pathology

- Oncology – the study of cancer processes

- Population biology – the study of groups of conspecific organisms, including
  - Population ecology – the study of how population dynamics and extinction
  - Population genetics – the study of changes in gene frequencies in populations of organisms
- Paleontology – the study of fossils and sometimes geographic evidence of prehistoric life
- Pathobiology or pathology – the study of diseases, and the causes, processes, nature, and development of disease

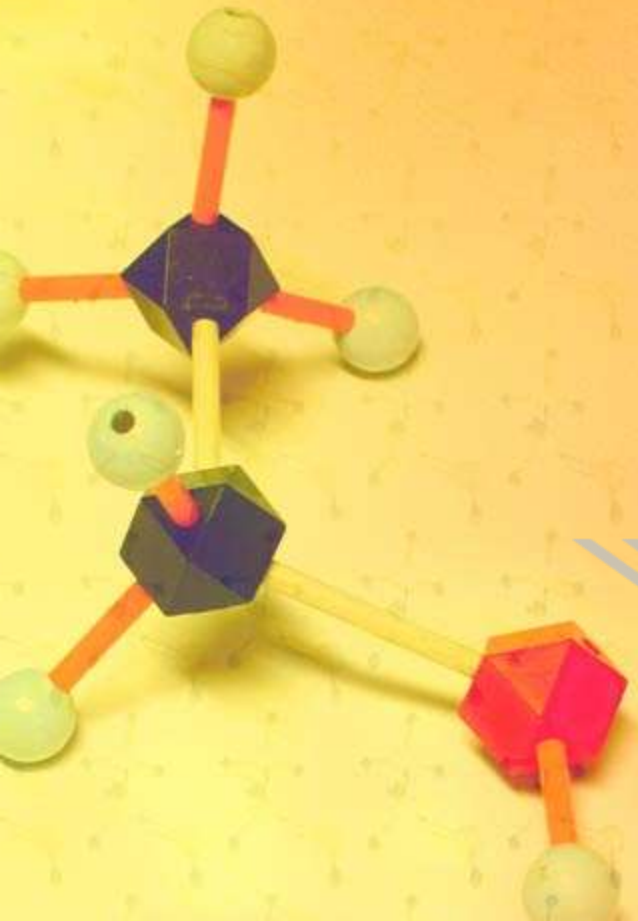
- Pharmacology– the study and practical application of preparation, use, and effects of drugs and synthetic medicines
- Physiology – the study of the functioning of living organisms and the organs and parts of living organisms
- Phytopathology – the study of plant diseases (also called Plant Pathology)
- Psychobiology – the study of the biological bases of psychology

- Sociobiology – the study of the biological bases of sociology
- Structural biology – a branch of molecular biology, biochemistry, and biophysics concerned with the molecular structure of biological macromolecules
- Synthetic Biology- research integrating biology and engineering; construction of biological functions not found in nature



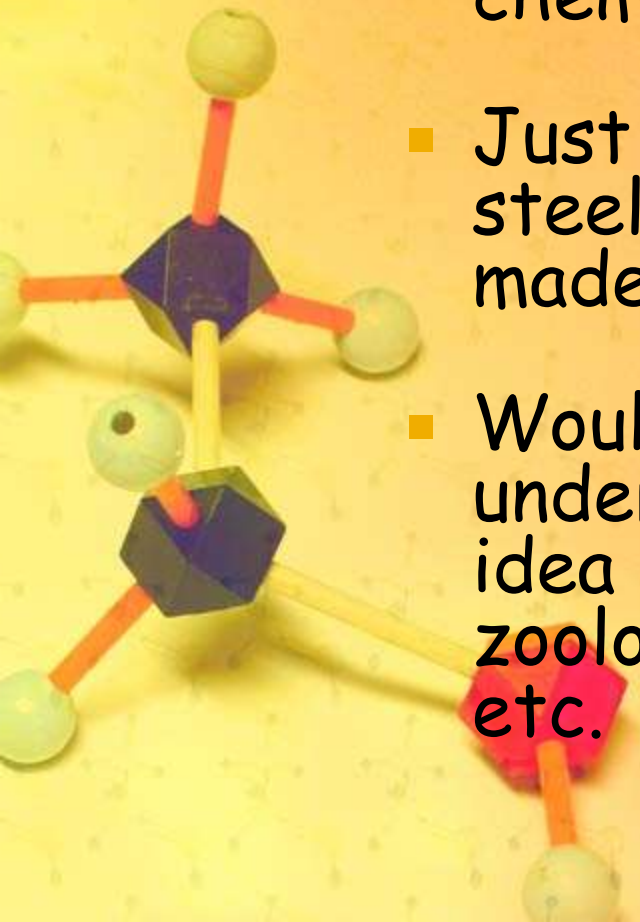
The Chemistry of Life

Why should we study chemistry in Biology?



Life depends on chemistry!

Life depends on chemistry!



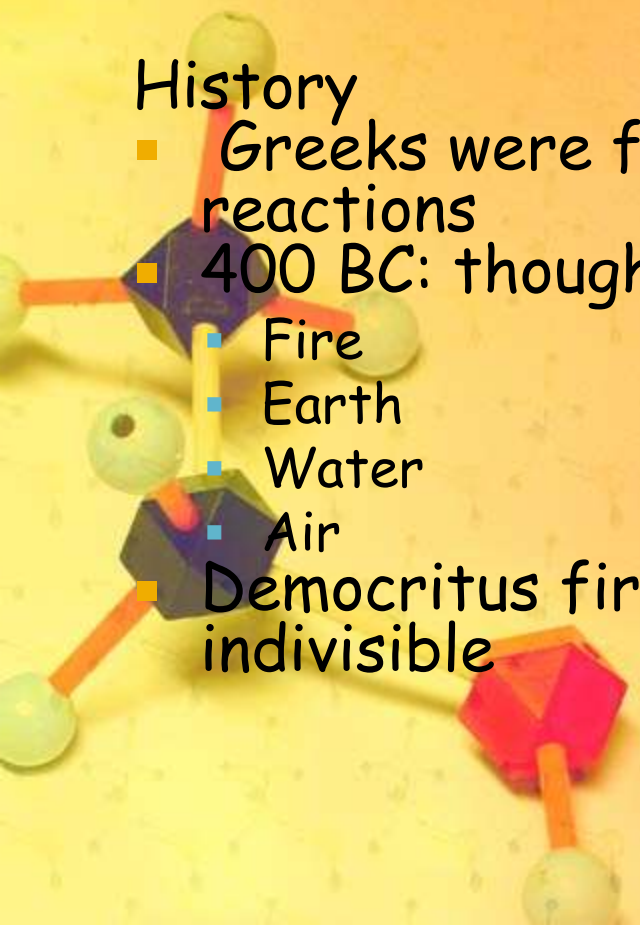
- When you eat food or inhale oxygen, your body uses these materials in chemical reactions that keep you alive.
- Just as buildings are made from bricks, steel, glass, and wood, living things are made from chemical compounds.
- Wouldn't you want an architect to understand building materials? Same idea applies to geneticists, ecologists, zoologists, botanists, biologists, and etc.

Atoms

- The study of chemistry begins with the basic unit of matter…the **Atom**

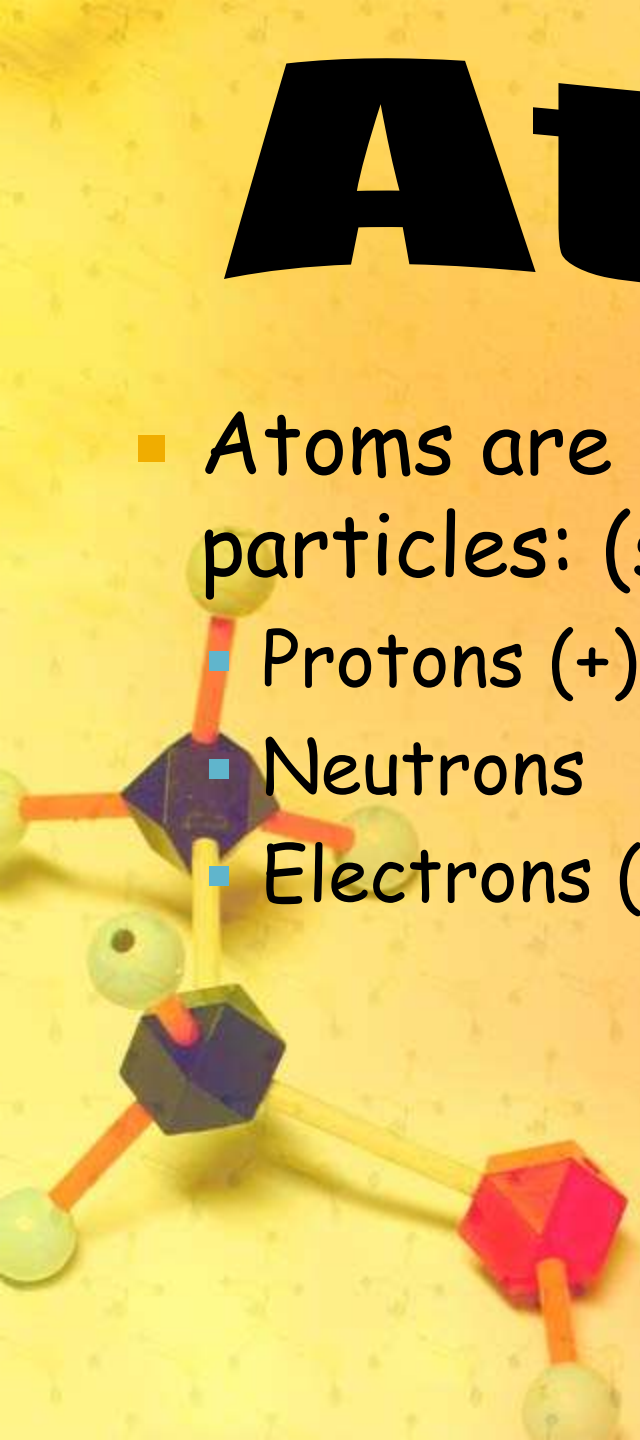
History

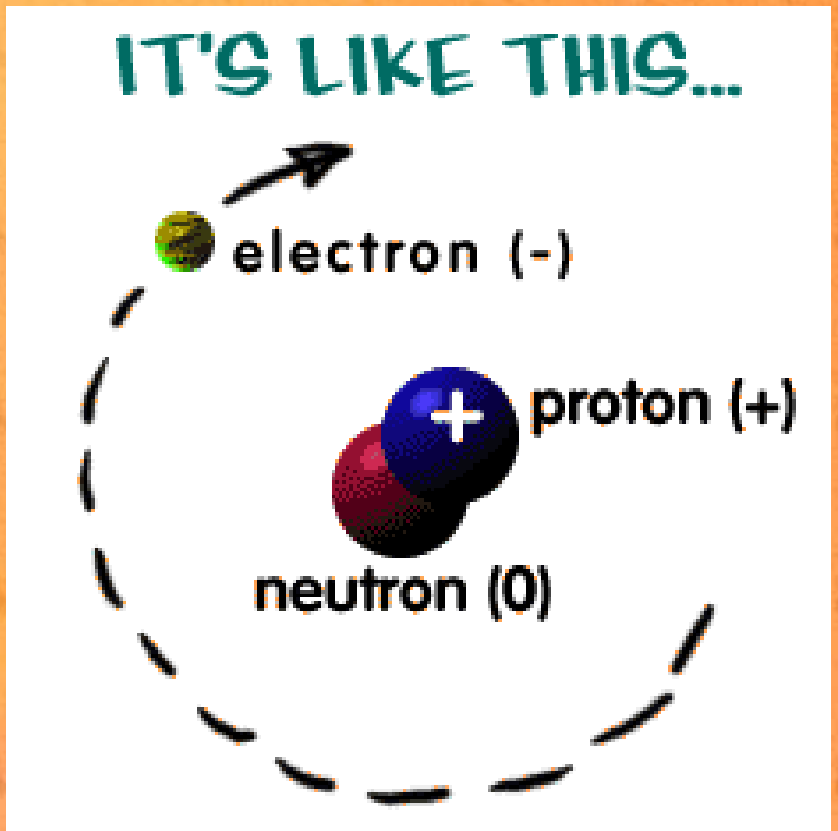
- Greeks were first to try to explain chemical reactions
- 400 BC: thought all matter composed of:
  - Fire
  - Earth
  - Water
  - Air
- Democritus first used word "atomos", meaning indivisible



Atoms

- Atoms are composed of 3 main particles: (subatomic particles)
  - Protons (+)
  - Neutrons
  - Electrons (-)

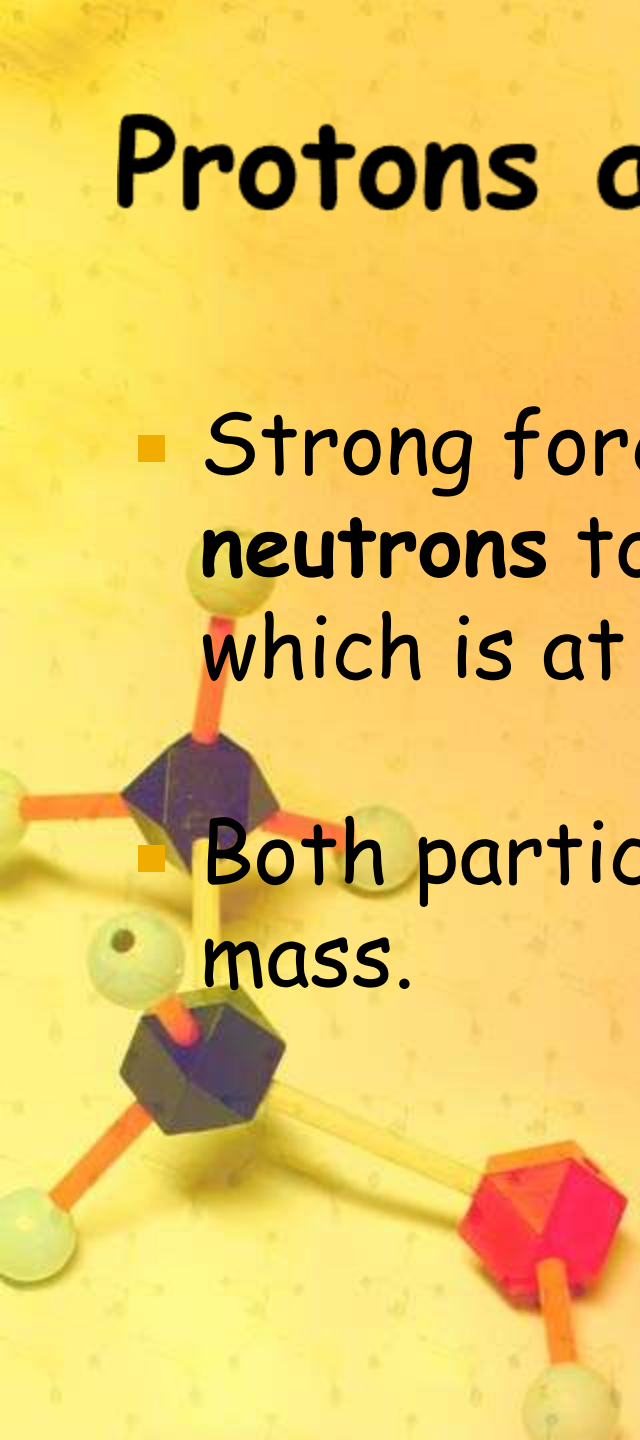




Protons and Neutrons

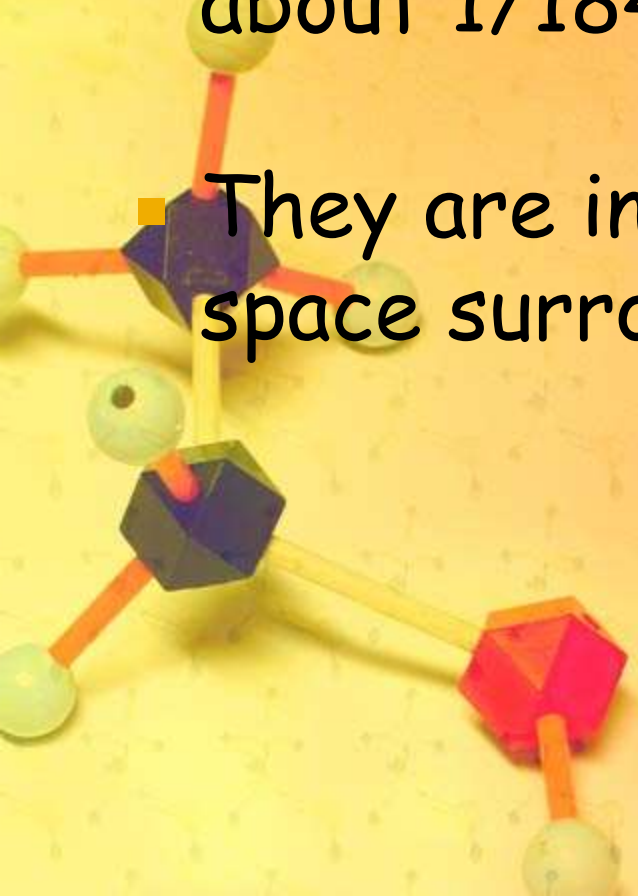
- Strong forces bind **protons and neutrons** together to form the **nucleus**, which is at the center of the atom.

- Both particles have about the same mass.



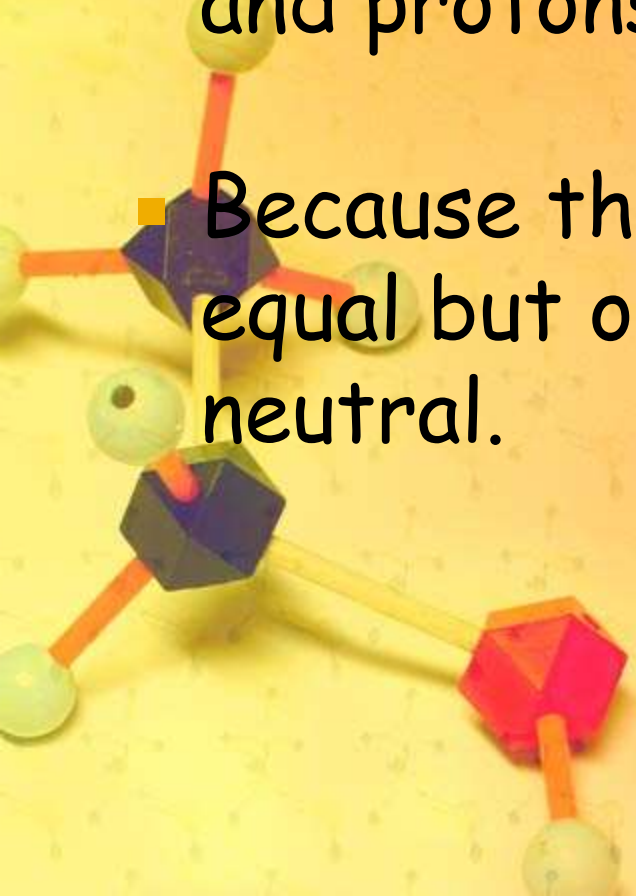
Electrons

- Electrons are negatively charged with about 1/1840 the mass of a proton.
- They are in constant motion in the space surrounding the nucleus.



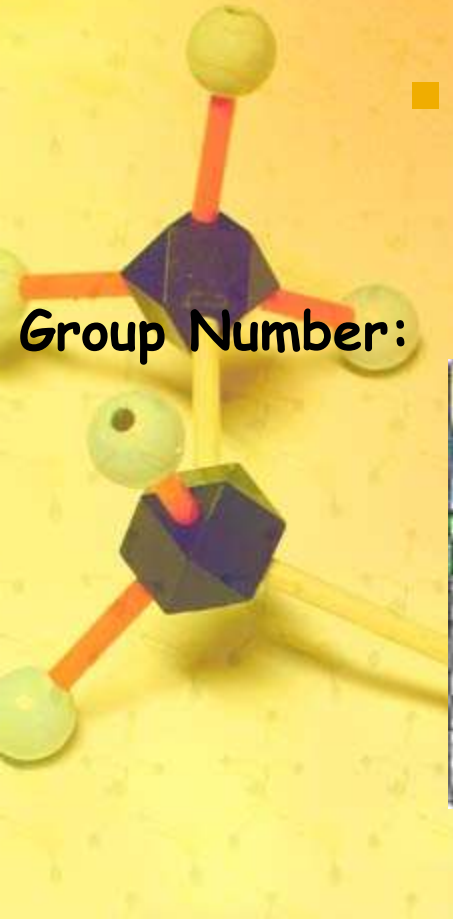
Atoms

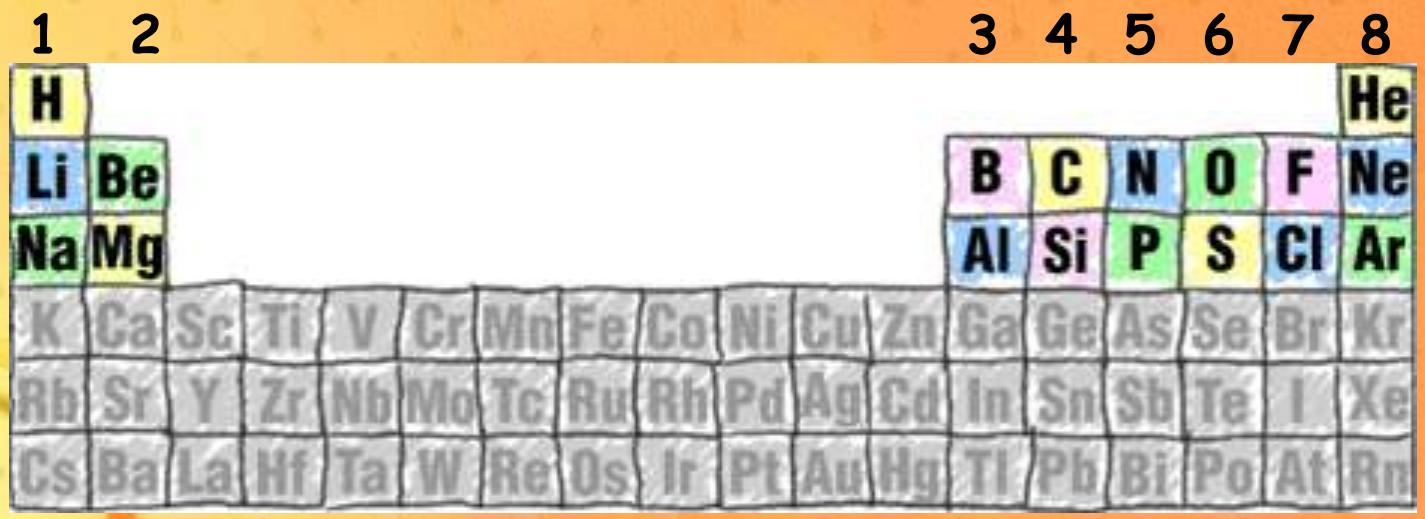
- Atoms have equal numbers of electrons and protons.
- Because these subatomic particles have equal but opposite charges, atoms are neutral.



Elements

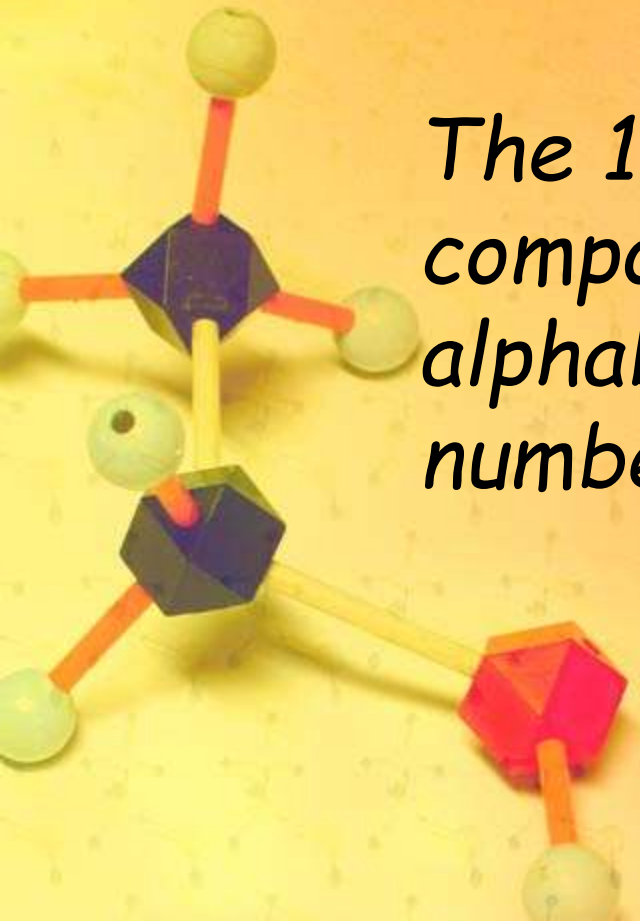
- Elements are the building blocks of all matter.
- Elements cannot be decomposed into simpler matter.





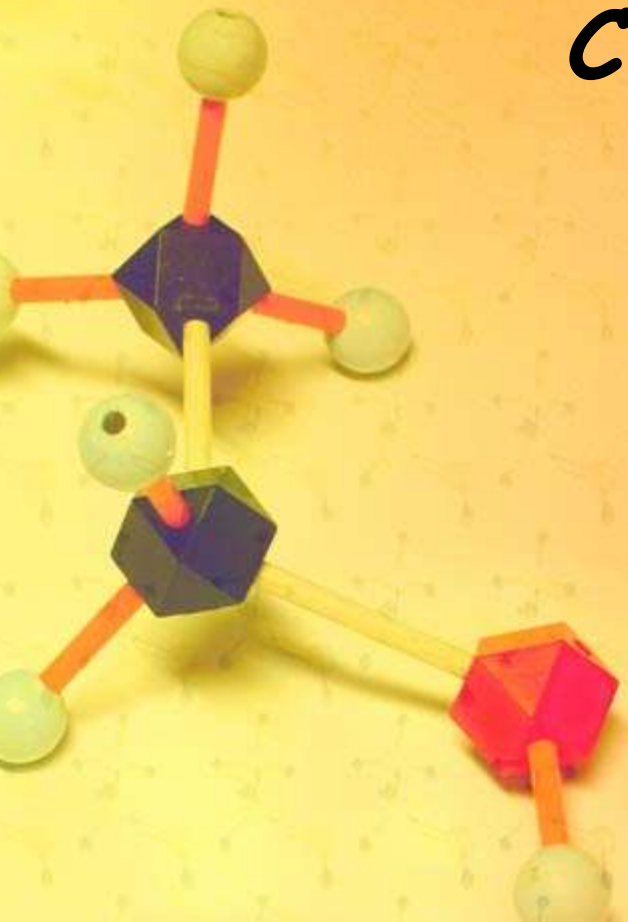
The Elements

- 110 known elements
- 88 occur naturally



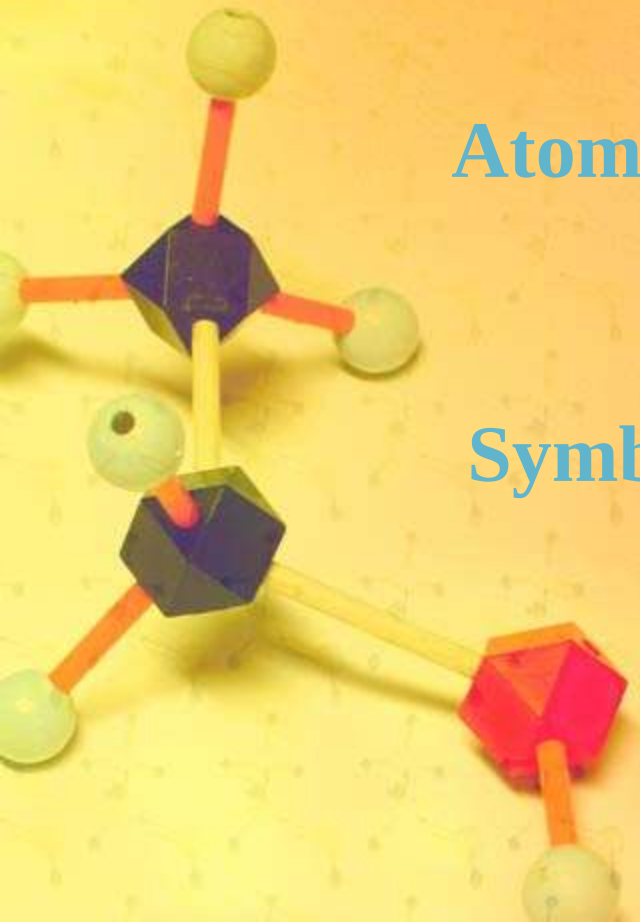
The 110 elements form a plethora of compounds, just as 26 letters of the alphabet make a seemingly endless number of words.

Atomic Number



Counts the number of protons in an atom

Atomic Number on the Periodic Table

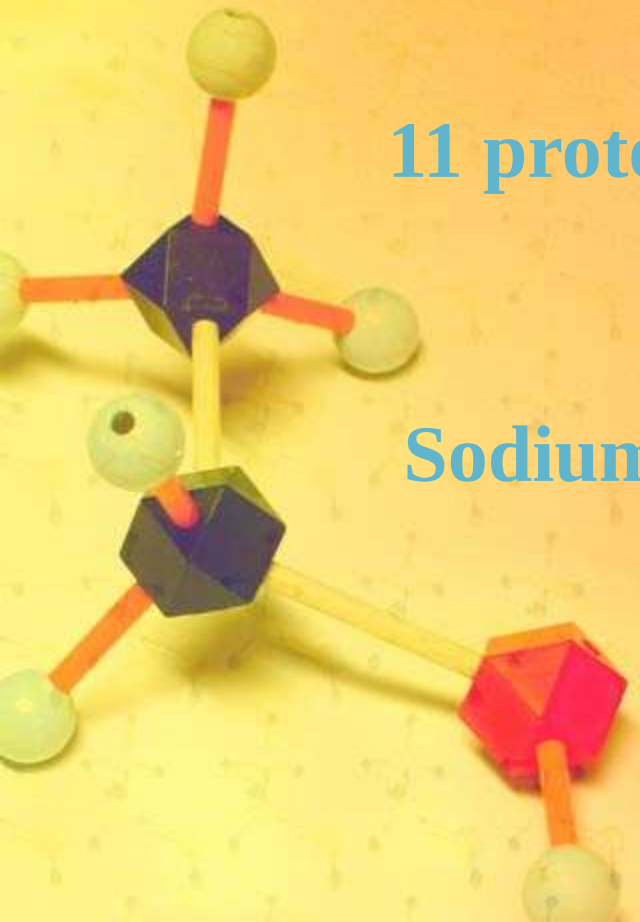


Atomic Number →

Symbol →

11
Na

All atoms of an element have the same number of protons



11 protons →

Sodium →

11
Na

Atomic Mass

- Mass of an atom.
- Approximately equal to the number of protons and neutrons
- Find number of neutrons by subtracting the number of protons from the mass.