Collage of pharmacy

University of Basra

Lab .sci. dept.

Human biology

Lecture no. 1

Dr. dawood ch.

Frist semester

Introduction to Biology and Chemistry Outline

I. Introduction to biology

A. Definition of biology : Biology is the study of life.

B. Characteristics of Life :

1. Form and size are characteristic. e.g. A whale is easily recognized by from and size. Nonliving forms vary in form and size, such as a single water droplet to an entire ocean.
2. Chemical composition
a. Primarily made of Carbon (C), Hydrogen(H), Oxygen(O), Nitrogen(N)
b. Complex organization but all living things are made of one or more Cells
3. Metabolism - Metabolism is the sum of all of the chemical reactions that occur in a cell. For example, the ability to breakdown energy from the environment (e.g. food) into useable forms of energy is metabolism and a characteristic of life.
4. Irritability - The ability to respond to the environment. e.g. a plant gradually turning its leaves towards the window with the sunlight.
5. Homeostasis - Balance; Equilibrium; The ability to maintain constancy internally.
6. Growth and life cycle
7. Reproduction occurs to propagate the species with all characteristic traits being inherited from the parents.

C. Human Uniqueness - Obviously humans meet the criteria of a living organism. In this course, we narrow down the field of biology to humans.

How are humans different to other living things?

1. Environmental alterations - Humans can build cities and houses. Certainly other living creatures, such as bees, can alter their environment as well.
2. Speech - Communication is NOT unique to humans, but our ability to articulate and speak is quite advanced in the animal kingdom.
3. Tools - Our ability to make and use tools is extraordinary. However, other species use tools, but not to the same extent as humans. (Birds can use a small twig to reach insects in a hole in a tree.)
4. Social organization & cultural heritage - Although other animal colonies have social organization, none is to the extent that humans organize into families,government, with a strong cultural heritage.
5. Reasoning; abstract concepts;- This ability it the primary trait that sets humans apart from all other living things. In fact, the scientific name of humans, Homosapiens, means "Knowing one".

II. Biology as a Science

A. Dynamic - Science is ever-changing as new discoveries are made.
B. Scientific Method - You need to understand how scientists approach problems.
1. Question/Problem - e.g. Does DDT pesticide affect the formations of any part of a bird's egg?
2. Hypothesis - Based on a scientist's background knowledge, the scientist proposes a reasonable answer to the problem. A hypothesis is an educated prediction. e.g. Because eagle populations declined when DDT was widely used, DDT must weaken the eggs.
3. Experiment; Collection of data - Next, a scientist must prove or disprove the hypothesis. This involves experimentation, when possible. For example, the scientist would set up an experiment exposing one group of birds with DDT in their feed and examine all eggs for integrity and shell consistency and another group as a control group. The control group makes the experiment meaningful, because it places the birds in exact conditions, but without the variable being tested. In this example, the control group lives in similar conditions, but is being fed birdseed without the DDT. Next the scientist collects data and results. In some cases, experimentation is not possible, such as studying the feeding habits of a dinosaur. In this case, one cannot run a dinosaur experiment. Instead, scientists must rely on available fossils and compare them to living creatures to investigate their question.
4. Conclusion - Theory / Principle - After all data is collected and analyzed a conclusion may be reached. The conclusion may or may not

support the hypothesis. The conclusion explains natural phenomena. If the conclusion withstands the test of time and other experimentation, it may be "upgraded" to a theory. With further support through testing and time, a theory may be "upgraded" to a principle.

III. Levels of organization in the human body

A. Chemicals - The chemical level is the simplest level of organization in the body.
Examples include water (H2O), glucose, carbon dioxide.
B. Cells - If you combine chemicals for a common function, you reach the cellular level.
Examples include muscle cells and neurons (nerve cells). The cell is the basic unit of life.
C. Tissues - If you combine cells together for a common function, such as lining an intestine, you reach the tissue level of organization. For example, many rectangular shaped cells line the intestine for the function of absorption of nutrients. This is a tissue - specifically epithelial tissue. There are four categories of tissues in the body: Epithelium, Connective tissue, Nervous tissue and Muscle tissue. These will all be studied later in the course.
D. Organs - If you combine tissues together for a common function, you reach the organlevel. For example, epithelium plus muscle tissue, plus connective tissue comprise the intestine, which is an organ.
E. Systems - A system is several organs combined for a common function. The mouth, esophagus, stomach, intestine, pancreas, and liver all combine for the function of digesting food, and thus make up the digestive system.
F. Organism - All systems together comprise a human being.

IV. Chemistry - There is such a close relationship between biology and chemistry when studying the human body; you must know the basic terminology used in chemistry.

A. Atom - Chemicals are made of tiny, tiny particles called atoms. Atoms cannot be altered by any chemical reaction. Atoms are the smallest chemical units of matter - whether it is living or nonliving. For example, if you could take gold and chop it into tiny,tiny particles that all still have the properties of gold, those would be gold atoms.

1. Subatomic Particles - Physicists have been able to blast atoms in to even tinier particles, called subatomic particles. Three different particles are fundamental to the structure of an atom.

a. Neutron - A particle with no electrical charge.
b. Proton - A particle with a positive charge, as in a hydrogen ion: H+.
c. Electron - A particle with a negative charge. These light particles orbit around the neutrons and protons. For example, the chloride ion (Cl-) has one more electron than it has protons, and therefore carries a negative charge.
2. Ions - Ions are atoms (or molecules) with a positive or a negative charge.
B. Element - Periodic tables are chemical charts showing all of the different elements known. Each element has certain characteristic properties unique to that element (e.g.color, density, mass) Carbon, chlorine, nitrogen, oxygen, are all examples of elements.Elements contain only one kind of atom. For example, carbon only contains carbon atoms.
C. Compound - If one combines different elements, a compound is made. For example two hydrogens combine to one oxygen, via a chemical affinity termed a chemical bond and a compound, H2O or water is formed. Another example is NaCl which is salt.
D. Molecule - A chemical structure containing more than one atom is a molecule. The atoms may be the same or different. For example, if two oxygens combine, you make oxygen molecule, O2. By definition, all compounds must also be molecules as well.
E. Water - Water accounts for about 2/3 of our body, and is the single most important constituent in the body. Thus it is important to investigate some features of water. Water can break apart in a reversible reaction, into and hydrogen ions and hydroxide ions: {H2O <--> H+ + OH-} The levels of hydrogen ions in the body are so important, they are expressed in a logarithmical abbreviation termed pH. It represents the amount, or concentration, of Hydrogen ions.
1. pH scale - This scale ranges from 0-14 and measures the relative hydrogen ion concentrations. A pH of 7 is neutral, and the solution would have as many hydrogen ions as hydroxide ions. Distilled water has a pH of 7. Your body has a pH slightly above 7. Readings of 7-14 indicate fewer hydrogen ions, and more hydroxide ions. These substances are bases. For example, drain cleaner has a very high pH, about 13, and is a strong, strong base. Bleach has a pH of about 9.5 andis a weaker base than drain cleaner. Readings on the pH scale of 0-7 indicate more hydrogen ions and fewer hydroxide ions. These substances are acids. The lower the pH reading, the stronger the acid. For example, hydrochloric acid has a pH near one, and is a very strong acid. Coffee has a pH near 5 and is a weak acid.
2. Acids - Acids are substances which release hydrogen when mixed with water.pH less than 7.

3. Bases (= alkaline) - Bases are substances which release hydroxide ions when mixed with water. pH more than 7.
F. Organic Compounds - Organic compounds are based upon carbon and predominate in the human body.
1. Carbohydrates - These organic molecules are sources of energy and are comprised of sugars and starches. A common example of a simple sugar in thebody is glucose.
2. Lipids - These organic compounds are fats and oils. A substance is considered a fat if it is solid at room temperature and an oil if it is liquid at room temperature.
Lipids are great energy sources, as they are packed with calories. They are also important in the structure of cell membranes and in the synthesis (making) of some hormones.
3. Proteins - Proteins are quite important in the structure of the body. The skeleton and muscles are primarily made of protein. Your blood contains proteins. Proteins are important in fighting off disease - immunity. Proteins are made of simpler molecules, called amino acids, linked together. Proteins are important in structure and function of nearly every body part. Another example of a protein in your bodyis an enzyme. Structurally enzymes are proteins. Their job is to speed up chemical reactions in the body.
4. Nucleic acids - These organic compounds comprise the molecules necessary for inheritance.
a. DNA - These important three letters stand for deoxyribose nucleic acid. DNA makes up your genes which carry all of the inheritance information in your body.
1. DNA fingerprinting - With the exception of identical twins, everyone's DNA is slightly different. This information helps find persons committing violent crimes.
2. Genetic code - The Human Genome Project is a federally funded project to unravel the human genetic code. This information can be useful in detection and treatment of genetically-based diseases. This information is important in genetic engineering in which the genetic code of cells is altered (such as crossing two different fruit varieties, or inserting the human gene for insulin into laboratory bacteria that grow and reproduce rapidly).

\\b. RNA - This nucleic acid stands for ribose nucleic acid and is responsible for reading and carrying out the instructions of the DNA in the cell.
c. ATP - This high energy compound is adenosine triphosphate. It is the cell's energy source. Food must be converted into ATP in order for cells to be able to use it