Environment and Humans

Environment is "all that which is external to the individual host. It can be divided into physical, biological, social, and cultural factors, any or all of which can influence health status in populations.

Health refers to the avoidance of human illness and injury through efficient use of the environment, a properly functioning society, and an inner sense of well-being.

Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, biological, social, and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations.
To understand the relationship of the environment to humans and to understand how to protect humans from illness and injury, it will be necessary to discuss the following:

1. The ecosystem, ecosystem dynamics, and energy.
2. Human impact on the environment and the various approaches, including risk assessment, epidemiological, economic, legal, and governmental aspects used to evaluate and resolve environmental problems.
3. Understand abnormal physiology, and the basis of human illness and injury, brief discussions on normal physiology, toxicology, and epidemic infectious disease.
4. Finally, it is necessary to understand the role of professional environmental health practitioners, the skills that they need, and how they address the expanding scope of environmental problems.

ECOSYSTEM

Environments

Earth is divided into the lithosphere, or land masses, and the hydrosphere, or the oceans, lakes, streams, and underground waters. The hydrosphere includes the entire aquatic environment. Our world, both lithosphere and hydrosphere, is shaped by varying life forms. Permanent forms of life create organic matter and, in combination with inorganic materials, help establish soil. Plants cover the land and reduce the potential for soil erosion — the nature and rate of erosion affects the redistribution of materials on the surface of Earth. Organisms assimilate vast quantities of certain elements and molecules, such as carbon and oxygen. Animals, through respiration, release carbon dioxide into the atmosphere — carbon dioxide affects the heat transmission of the atmosphere. Organisms affect the environment and in turn are affected by it.

Two environments, biotic (living) and abiotic (nonliving), combine to form an ecosystem. An ecosystem can also be subdivided by more specific criteria into the following four categories:

(1) Abiotic, the nutrient minerals that are synthesized into living protoplasm.

(2) Autotrophic, the producer organisms (largely the green plants) that assimilate the nutrient minerals using energy and combine them into living organic substances.

(3) Heterotrophic, the consumers, usually the animals, that ingest or eat organic matter and release energy;

(4) Heterotrophic reducers, the bacteria or fungi that return the complex organic compounds to their original abiotic state and release the remaining chemical energy.

The biotic group in the ecosystem complex is essentially composed of the autotrophs, or producer organisms that synthesize organic substances, and the heterotrophs, or consumer or reducer organisms that decompose organic substances.

The ecological niche is the combination of function and habitat of each of the approximately 1.5 million species of animals and 0.5 million species of plants on Earth. There are many interactions between species in the ecosystem. The law of limiting factors states that a minimum quantity of essentials, such as nutrients, light, heat, moisture, and space, must be available within the ecosystem for survival of the organisms. The ecosystem is always in a dynamic instead of a static balance, changes in one part of the ecosystem cause changes in another.

ECOSYSTEM DYNAMICS

Cycles

The ecosystem changes frequently. Several of the cycles that are important and that may be affected by humans include the hydrologic cycle, the carbon cycle, the nitrogen cycle, the phosphorous cycle, and energy flow. The hydrologic cycle is the movement of water from the atmosphere to Earth and back into the atmosphere.

The carbon cycle begins with the fixation of atmospheric carbon dioxide by means of photosynthesis performed by plants and algae. During this process carbon dioxide and water react to form carbohydrates, and free oxygen is simultaneously released into the atmosphere. Some of the carbohydrates are stored in the plant, and the rest are utilized by the plant as a source of energy. Some of the carbon that has been fixed by the plants is then consumed by animals, who respire and release carbon dioxide. The plants and animals die, decomposing by action of microorganisms and other catalysts in the soil, and the carbon in their tissues is then oxidized to carbon dioxide and returned to the atmosphere. The carbon dioxide is recycled through the plants and the process repeats itself.

The nitrogen cycle begins when atmospheric nitrogen is fixed or changed into more complex nitrogen compounds by specialized organisms, such as certain bacteria and blue-green algae. Some fixation may occur as a result of lightning, sunlight, or chemical processes; however, the most efficient nitrogen fixation is carried out by biological mechanisms. Basically the atmospheric nitrogen is changed into a nitrate NO_3 that is absorbed by plants, eventually combining with other

elements and becoming a plant protein. The plant protein decays when the plant dies, releases nitrogen as ammoniaNH_4, and through bacterial oxidizing action becomes a nitrite NO_2; with further bacterial action the protein is reduced and released as atmospheric nitrogen. The plant protein may also be eaten by animals, may be broken down into molecules (amino acids), and eventually may be synthesized into an animal protein. In the phosphorus cycle, the element moves rapidly through similar stages, becoming locked in sediment or in biological forms such as teeth or bones.

Food Chain

The cycle of energy flow may also be described as the food web. The food web, or food chain, indicates that an organism has consumed a smaller organism and is then consumed by a larger organism. The importance of the food chain is illustrated by biomagnification, in which the impurities found in water are concentrated in the lower forms of life and are reconcentrated during the movement of the impurities through the food chain.

Current Ecosystem Problems

People and advanced technology affect the ecological niche by interfacing with the intricate function and habitat of various species of animals and plants. Discharges to air, water, and soil, including toxic and infectious chemical wastes, biological wastes, and radiological wastes create an environmental pressure that is unfavorable to all life forms, including people. We are wasting our greatest natural resource on which we depend for food, oxygen, clean water, energy, building materials, clothing, medicine, sociological well-being, and countless other benefits.

ENVIRONMENTAL PROBLEMS RELATED TO ENERGY

The major environmental problems related to energy are caused by pollutants created by fossil fuels; destruction of the natural environment by removal or spillage of fossil fuels; and effects of the continued rise in cost of fossil fuels on the economy, and therefore, on our way of life. With an increased need for fossil fuels comes an increase in the destruction of the natural environment.

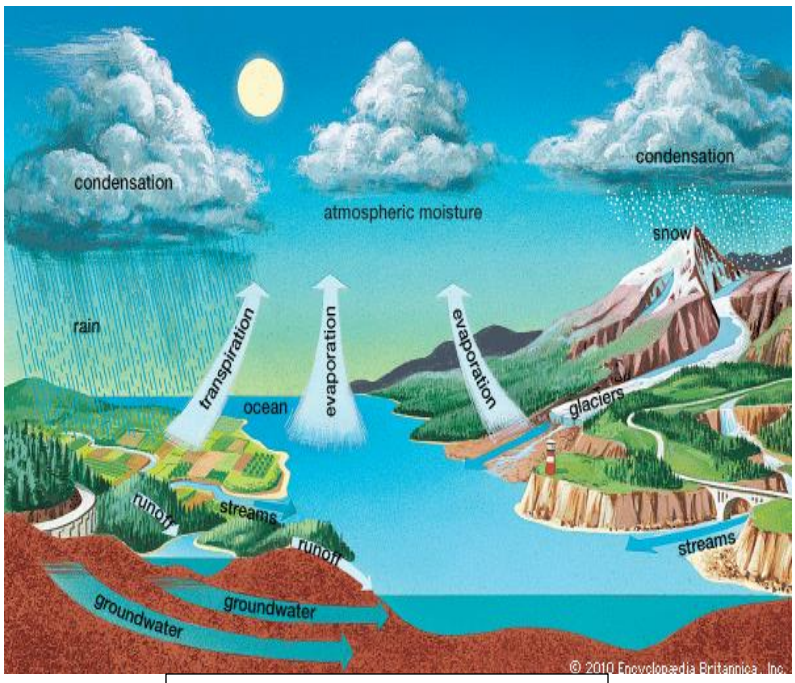
ENVIRONMENTAL HEALTH PROFESSION

The environmental health profession is composed of individuals whose efforts are directed toward controlling, preserving, or improving the environment so that people may have optimum health, safety, comfort, and well-being now and in future generations. Environmental health, composed of specialists in three basic types of categories:

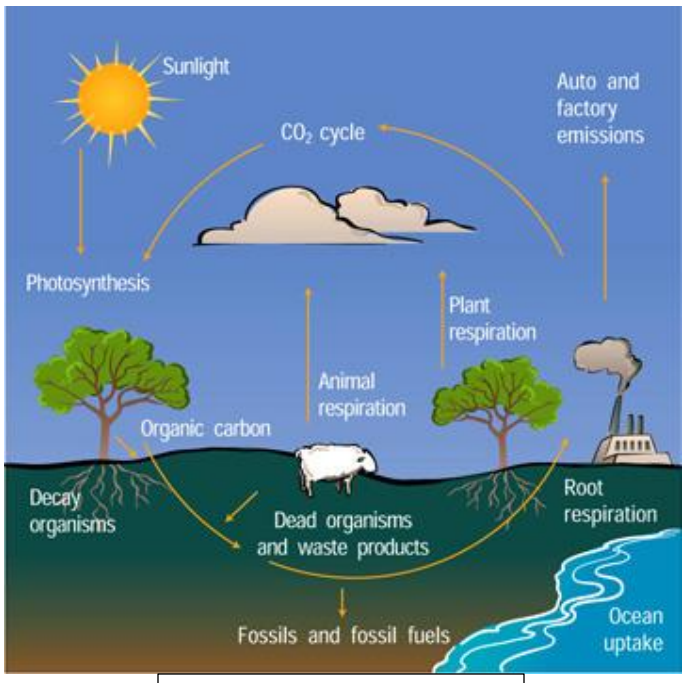
(1) Sampling and analysis, routine inspections, and distribution of public information.

(2) Investigation consultation, planning, and education.

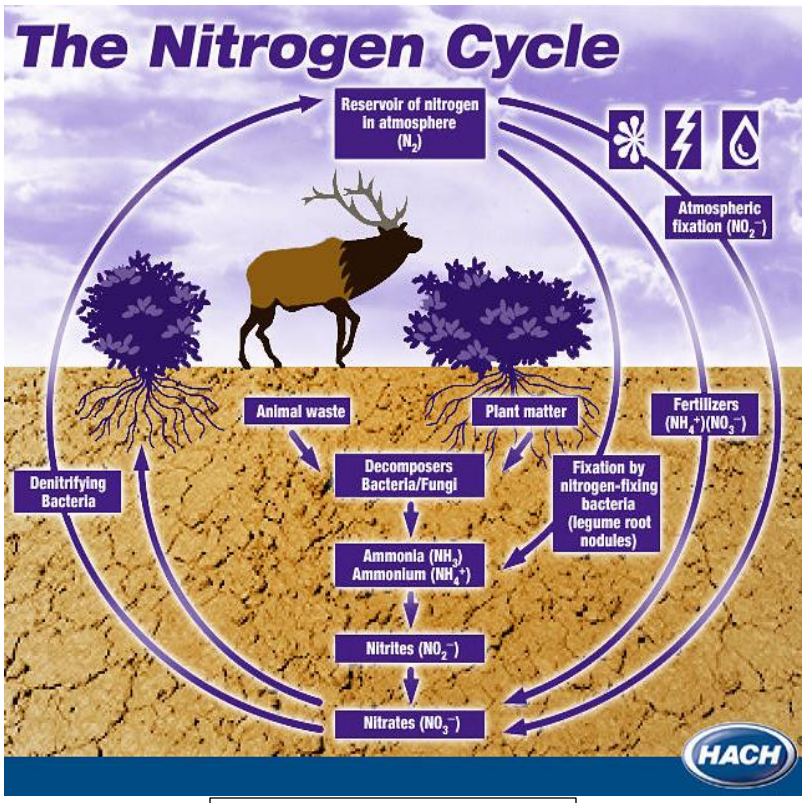
(3) Supervision, administration planning, application, and public relations.



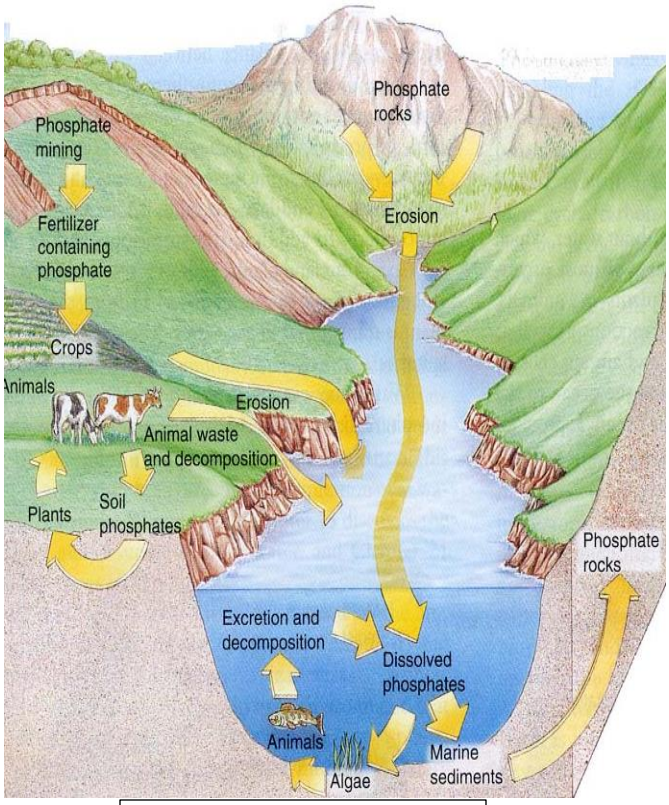
Hydrologic (Water) cycle



Carbon cycle



Nitrogen cycle



Phosphorus cycle

Environmental Health Practitioner

The environmental health practitioner is an applied scientist and educator who uses the knowledge, comprehension, and skills of the natural, behavioral, and environmental sciences to prevent disease and to promote human well-being. The environmental health practitioner makes inspections; conducts special studies; samples air, water, soil, and food; reviews plans; acts as an educator, public relations officer, and community organizer; plans programs; acts as a consultant to civic groups, business, industry, and individuals; and enforces or uses environmental and public health laws.

The environmental specialist of today and the future must be a highly skilled, well-educated, and trained generalist possessing a multitude of competencies as an effective member of the health team. These competencies are divided into general and specific areas as follows:

A-General Competencies

1. General Science 2. Communications and Education 3. Planning and Management 4. General Technical Skills 5. Administrative and Supervisory Skills 6. Professional Attitudes

B. Specific Competencies

1. Environmental Chemical Agents 2. Environmental Biological Agents 3. Environmental Physical Agents 4. Air 5. Water and Liquid Wastes 6. Food 7. Solid Wastes 8. Hazardous Waste 9. Population and Space Utilization 10. Indoor Environment 11. Environmental Injuries

Environmental Changes and Their Consequences

To understand environmental changes and their consequences, it is necessary to know the movement from the point of exposure to the end point of disease. There are four stages in environmental toxicology. They include:

1. Exposure is where the ambient condition brings the organism into contact with the hazard, for example, a toxic material that may be found in the air or water.

2. The dose reaches the point where the quantity of the hazard creates a specific body load that may be toxic to an organ or cell.

3. Effects seen are markers of intermediate biological effects that are either a step in the toxicologic process or a parallel manifestation of effect. These indicators of exposure or dose are predictors of toxicity. They may include chromosome aberrations, mutations, and cell or cell killing enzyme activity.

4. The end point is the ultimate toxicological effect, which may be cancer, heart disease, or other diseases.