SNV Department

TCE3 (first year LMD) 2020/2021

Course 1

What is Biology?

Biology is the science of life. Its name is derived from the Greek words "bios" (life) and "logos" (study). Biologists study the structure, function, growth, origin, evolution and distribution of living organisms. There are generally considered to be at least nine "umbrella" fields of biology, each of which consists of multiple subfields.

Biochemistry: the study of the material substances that make up living things.

Botany: the study of plants, including agriculture.

Cellular biology: the study of the basic cellular units of living things.

Ecology: the study of how organisms interact with their environment.

Evolutionary biology: the study of the origins and changes in the diversity of life over time.

Genetics: the study of heredity.

Molecular biology: the study of biological molecules.

Physiology: the study of the functions of organisms and their parts.

Zoology: the study of animals, including animal behavior.

Adding to the complexity of this enormous idea is the fact that these fields overlap. It is impossible to study zoology without knowing a great deal about evolution, physiology and ecology. You can't study cellular biology without knowing biochemistry and molecular biology as well.

Framework of understanding

All the branches of biology can be unified within a framework of five basic understandings about living things. Studying the details of these five ideas provides the endless fascination of biological research.

Cell Theory: There are three parts to cell theory-the cell is the basic unit of life, all living things are composed of cells, and all cells arise from pre-existing cells.

Energy: All living things require energy, and energy flows between organisms and between organisms and the environment.

Heredity: All living things have DNA and genetic information codes the structure and function of all cells.

Equilibrium: All living things must maintain homeostasis, a state of balanced equilibrium between the organism and its environment.

Evolution: This is the overall unifying concept of biology. Evolution is the change over time that is the engine of biological diversity.

Biology is often studied in conjunction with other sciences, such as mathematics and engineering, and even social sciences. Here are a few examples:

Biophysics involves matching patterns in life and analyzing them with physics and mathematics, according to the **Biophysical Society**.

Astrobiology is the study of the evolution of life in the universe, including the search for extraterrestrial life, according to **NASA.**

Biogeography is the study of the distribution and evolution of life forms and the causes of the distribution, according to **Dartmouth College.**

Biomathematics involves creating mathematical models to better understand patterns and phenomena within the biology world, according to **North Carolina State University.**

Bioengineering is the application of engineering principles to biology principles and vice versa, according to the **University of California Berkeley.**

Sociologists often study how biology can shape social structures, cultures, and interactions, according to the **American Sociological Association.**

History of biology

Our fascination with biology has a long history. Even early humans had to study the animals they hunted and know where to find the plants they gathered for food. The invention of agriculture was the first great advance of human

civilization. Medicine has been important to us from earliest history as well. The earliest known medical texts are from China (2500 B.C.), Mesopotamia (2112 B. C.), and Egypt (1800 B. C.).

In classical times, Aristotle is often considered to be the first to practice scientific zoology. He is known to have performed extensive studies of marine life and plants. His student, Theophrastus, wrote one of the West's earliest known botanical texts in 300 B. C. on the structure, life cycle and uses of plants. The Roman physician Galen used his experience in patching up gladiators for the arena to write texts on surgical procedures in A. D. 158.

During the Renaissance, **Leonardo da Vinci** risked censure by participating in human dissection and making detailed anatomical drawings that are still considered among the most beautiful ever made. Invention of the **printing press** and the ability to reproduce woodcut illustrations meant that information was much easier to record and disseminate. One of the first illustrated biology books is a botanical text written by German botanist Leonhard Fuchs in 1542. Binomial classification was inaugurated by Carolus Linnaeus in 1735, using Latin names to group species according to their characteristics.

Microscopes opened up new worlds for scientists. In 1665, Robert Hooke, used a simple compound microscope to examine a thin sliver of cork. He observed that the plant issue consisted of rectangular units that reminded him of the tiny rooms used by monks. He called these units "cells". In 1676, Anton von

Lecuwenhoek published the first drawings of living single celled organisms. Theodore Schwann added the information that animal tissue is also composed of cells in 1839.

During the Victorian era, and throughout the 19th century, "Natural Science" became something of mania. Thousands of new species were discovered and described by intrepid adventures and by backyard botanists and entomologists alike. In 1812, Georges Cuvier described fossils and hypothesized that Earth had undergone "successive bouts of Creation and destruction" over long periods of time. On Nov. 24, 1859, **Charles Darwin** published "On the Origin of Species", the text that forever changed the world by showing that all living things are interrelated and that species were not separately created but arise from ancestral forms that are changed and shaped by adaptation to their environment.

While much of the world's attention was captured by biology questions at the macroscopic organism level, a quiet monk was investigating how living things pass traits from one generation to the next. **Gregor Mendel** is now known as the father of genetics although has papers on inheritance, published in 1866, went largely unnoticed at the time. His work was rediscovered in 1900 and further understanding of inheritance rapidly followed.

The 20th and 21st centuries may be known to future generations as the beginning of the " Biological Revolution". Beginning with Watson and Crick explaining the **structure and function of DNA** in 1953, all fields of biology

have expanded exponentially and touch every aspect of our lives. Medicine will be changed by development of therapies tailored to a patient's genetic blueprint or by combining biology and technology with brain-controlled prosthetics. Economies hinge on the proper management of ecological resources, balancing human needs with conservation. We may discover ways to save our oceans while using them to produce enough food to feed the nations. We may "grow" batteries from bacteria or light buildings with bioluminescent fungi. The possibilities are endless; biology is just coming into its own.