

# 1

## INTRODUCING BIOLOGY

[SCOPE AND BRANCHES]

*For general information only*

You are studying biology as a part of science. It is, therefore, necessary, first, to define science.

Science is an organised body of knowledge supported by **observation** and **experimentation**, derived from the study of natural phenomena of the entire material universe.

There are *three* major branches of science, namely, **Physics**, **Chemistry** and **Biology**. Of these, “Biology” is the study of living beings, that is, all plants and animals including humans.

Nowadays, scientists often prefer the term “Life Science” instead of “Biology” in an effort to emphasize the focus on the study of life processes. However, “Biology” itself means the study or science of life (Greek : *bios* = life; *logos* = study).

### 1.1 GROWTH OF BIOLOGY

No one can say when the study of biology exactly began. Primitive man lived in jungles and caves. He collected food from natural vegetation and hunted wild animals. Through this activity he learnt about the life and habits of different animals, and recognized various plants and their parts. That was the beginning of Biology. The drawings of animals and plants in the caves of prehistoric periods (Fig. 1.1) are proofs of primitive man’s interest in the plants and animals around him.

With the evolution of culture, man began to live in settled communities and started farming.

He domesticated animals such as the dog, cow, sheep, horse and buffalo. These practices gave him further opportunities for the study of the ways and life of these animals. Thus biology grew more and more.

Greeks were probably the pioneers of an organized study of Biology.

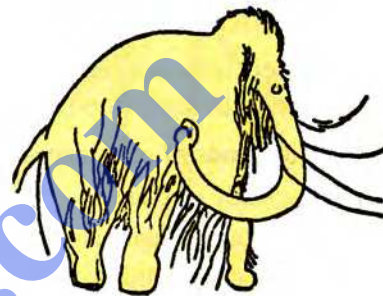
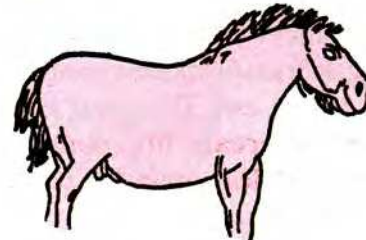


Fig. 1.1 Prehistoric drawing of a wild horse (above) and a mammoth (below)

**Aristotle** (384-322 B.C.) was the first person to study animals in sufficient detail and he is called the founder or “**Father of Biology**”.

**Theophrastus** (370-285 B.C.) mainly studied plants, and is said to be the “**Father of Botany**”.

**Hippocrates** (460-377 B.C.) rationalized the science of healing and treating the sick. He is called the “**Father of Medicine**”.

Biology had flourished a great deal in ancient India (2500 B.C. to 650 B.C.). Various systems of classifying animals and plants were developed, *for example*, *Jeevaj* (viviparous) animals who give birth to young one, *Andaj* (oviparous) animals who lay eggs, etc. Cultivation of rice was first introduced in India. It is estimated that more than 1,000 varieties of rice had been developed.

With the invention of microscope in the sixteenth century, a new world of minute animals and plants came to human knowledge. The cell as the basic unit of living things was seen through the compound microscope. Biology now began to grow faster.

In the nineteenth century, biology took several major leaps through the discovery of germs, wider acceptance of the theory of organic evolution, establishment of the cell theory, *etc.*

Now, the twenty-first century is poised to unravel more mysteries of nature, and miraculous innovations in medicine and agriculture. Biology has already progressed a great deal in the field of vitamins, hormones, genetics, genetic engineering, antibiotics, cancer research, cloning, stem cell research, organ transplant, environmental sciences, life in outer space, *etc.* The latest is that **scientists are planning to create life, some single-celled bacteria, from lifeless material using fatty acids and nucleotides, *etc.***

## 1.2 BRANCHES OF BIOLOGY

Biology is divided into several branches. This division can be made in at least three different ways:

### A. In terms of major kinds of organisms.

- **Botany** — the study of plants.
- **Zoology** — the study of animals.
- **Human Biology** — the study of man as a living organism and his relationship with other living organisms. The study of man and human society comes under Anthropology (Gk. *anthropos* : man; *logos* : study).

### B. In terms of special groups of organisms.

- **Bacteriology** — the study of bacteria.
- **Virology** — the study of viruses.
- **Mycology** — the study of fungi.
- **Entomology** — the study of insects.
- **Ichthyology** — the study of fishes.
- **Herpetology** — the study of lizards, snakes, etc.
- **Ornithology** — the study of birds.

### C. In terms of approach on studying it.

- **Anatomy** — the study of gross structure of an organism as seen in dissection.
- **Morphology** — the study of form and structure of plants and animals. It includes (essentially) the understanding and *interpretation of structure* (both external and internal). [Sometimes students wrongly consider morphology to be concerned with the study of external parts only.]
- **Histology** — the study of minute structure of tiny bits of the body as seen with the help of a compound microscope.

- **Cytology** — the study of structure and function of animal and plant cells.
- **Physiology** — the study of functions and activities of organisms and their parts.
- **Embryology** — the study of formation and development of embryo of plants and animals.
- **Taxonomy** — the science of naming, grouping and classifying plants and animals. It is also called **Systematics**.
- **Ecology** — the study of the relationship of an organism to both its living and non-living environment.
- **Biogeography** — the study of geographical distribution of plants and animals.
- **Palaeontology** — the study of prehistoric forms of life through fossils of plants and animals.
- **Evolution** — the study of origin and descent of organisms.
- **Genetics** — the science of the transmission of body characteristics (both similarities and differences) from parents to offspring. [A story, "MY BEAUTY AND YOUR INTELLIGENCE!" It says that a young charming prostitute once approached the great litterateur Bernard Shaw with the proposal of marrying him so that the child they get shall be beautiful like her and intelligent like him. Shaw retorted saying if it happened the other way, that is, his appearance and her brain, then?] This is just one of the aspects of Genetics.
- **Parasitology** — the study of parasites (the organisms that live on or inside other organisms and draw nourishment from the hosts).
- **Pathology** — the study of diseases of plants and animals.
- **Immunology** — the science that deals with the phenomena and causes of immunity (resistance to or defence against diseases).
- **Eugenics** — the science which aims to improve the human race through controlled heredity. *For example*, discouraging a marriage that is likely to show unfavourable or harmful characters in children.
- **Biochemistry** — study of chemicals and reactions that take place inside the living things. One of its numerous applications is DNA fingerprinting.

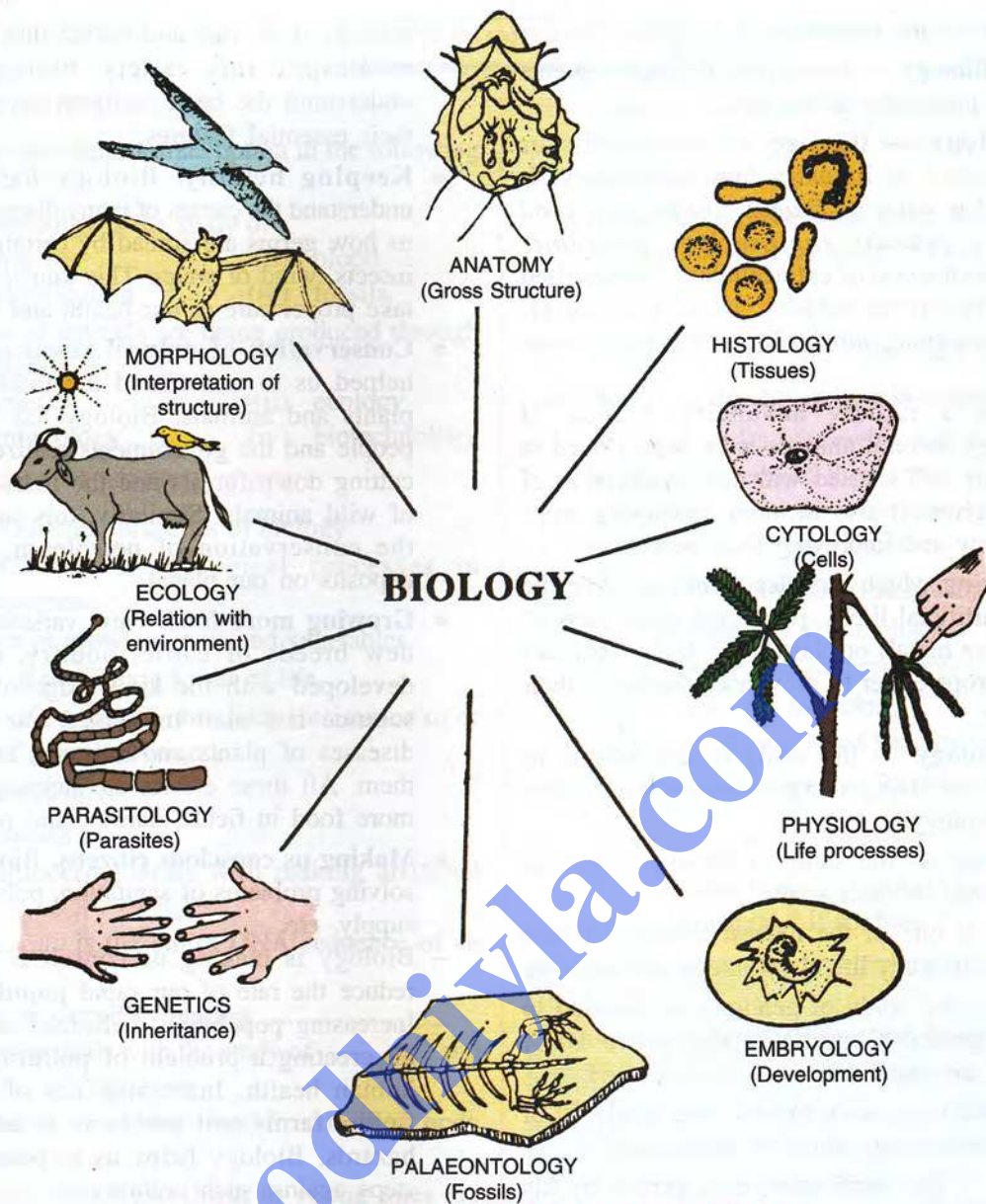


Fig. 1.2 Some of the principal sub-divisions of Biology



### PROGRESS CHECK

- Name the specific branches of Biology concerned with the study of
  - Fungi \_\_\_\_\_
  - Fishes \_\_\_\_\_
  - Insects \_\_\_\_\_
  - Transmission of body characteristics from parents to children \_\_\_\_\_
- Mention the kind of study made under the following branches of science :
  - Histology \_\_\_\_\_
  - Ecology \_\_\_\_\_
  - Cytology \_\_\_\_\_
  - Pathology \_\_\_\_\_

### APPLIED BIOLOGY

Biology has enormous applications in other branches of science. It forms an important part of the following :

- **Agriculture** — raising crops and livestock (cow, buffalo, *etc.*).
- **Veterinary science** — treatment and surgery of animals.
- **Marine biology** — study of life in the sea.
- **Household biology** — study of household animals, insects, *etc.*, including how to prevent damage to our own body and to our belongings.
- **Horticulture** — science and art of growing fruits, vegetables, flowers or ornamental plants.
- **Sericulture** — technique of producing silk by raising silkworms.

- **Pisciculture** — the technique of growing fish.
- **Molecular Biology** — interpreting biological events in terms of molecules in the cell.
- **Biotechnology** — the use of living cells or microorganisms in industry and technology. It includes areas such as *biogas production, food processing, genetic engineering, antibiotic production*, extraction of extracellular enzymes used as *bio-detergents* in laundry washing powders, *vaccine production, anti-bodies production, tissue culture, etc.*
- **Cloning** is a rapidly advancing branch of biotechnology. Several animals have been cloned in which a body cell is used with no involvement of the male sperms. It also includes modifying crops easier to grow and improving their quality.
- **Bioengineering** which includes techniques like the making of artificial limbs, joints and other parts of the body from metals or plastic, etc. It also includes modifying crops easier to grow and improving their food quality.
- **Nuclear Biology** — the study of the effects of radioactivity on living things which is also called Radiation Biology.
- **Space Biology** — the study of survival problems of living things in outer space.
- **Exobiology** is one of the newest sciences, which contemplates to study life elsewhere in the universe.
- **Genomics** — the study of genomes as opposed to individual genes. Genome is the entire DNA sequence of an organism.
- **Bioinformatics** — management and analysis of biological information stored in databases.
- **Biometrics** — the verification of a person by his certain body features such as the pattern of iris in the eye and behavioural characteristics.

### 1.3 STUDY OF BIOLOGY HELPS US IN MANY WAYS

- **Appreciation of Nature.** The world of plants and

animals is so vast and varied that one wonders at it. Despite this variety, biology helps us to understand the basic unity of all living things in their essential features.

- **Keeping healthy.** Biology has helped us to understand the causes of many diseases. It has shown us how germs are spread by certain agents such as insects, wind or water. This knowledge helps us to take proper care of our health and live longer.
- **Conservation of natural resources.** Biology has helped us to understand the inter-dependence of plants and animals. Biology has made both, the people and the governments realize the dangers of cutting down forests and the indiscriminate killing of wild animals. Similarly, this science advocates the conservation of petroleum, coal or metal deposits on our planet.
- **Growing more food.** New varieties of plants and new breeds of cattle, poultry, etc., are being developed with the knowledge of Biology. This science has also increased our knowledge of diseases of plants and animals, and how to cure them. All these efforts are helping us to produce more food in fields, dairies, and poultry farms.
- **Making us conscious citizens.** Biology helps us in solving problems of sanitation, public health, water supply, etc.
  - Biology is making us conscious of the need to reduce the rate of our rapid **population growth**.
  - Increasing population, industries and transport are all creating a problem of **pollution**, endangering human health. Increasing use of insecticides in fields, farms and godowns is adding to health hazards. Biology helps us to recognize and take steps against such pollution.
- **Biology is necessary for certain careers.** There are many careers which are open to students of Biology. One may choose to be a doctor, a dentist, a bacteriologist, a pathologist, a druggist, an entomologist, a forester, a teacher, a veterinary doctor, biotechnologist, etc.

#### POINTS TO REMEMBER

- *Biology is the study of living beings.*
- *Biology has slowly grown through the ages but very fast in the twentieth century and is showing signs of even faster growth in the twenty-first century.*
- *Biology has numerous branches — Zoology, Botany, Mycology, Cytology, Ecology, Genetics, etc.*
- *Biology is a basic science required for pursuing several professional courses, such as medicine, agriculture, pharmacology, etc.*
- *The study of biology helps us in many ways — appreciation of nature, keeping people healthy, growing more food, tackling of population and pollution problems, etc.*

## REVIEW QUESTIONS

### A. MULTIPLE CHOICE TYPE

1. Choose the most appropriate option in the following statements.
  - (a) Palaeontology is the study of
    - (i) embryos
    - (ii) blood
    - (iii) classification
    - (iv) fossils
  - (b) Clones of animals are being produced through the practice of
    - (i) genetics
    - (ii) ecology
    - (iii) embryology
    - (iv) biotechnology

### B. VERY SHORT ANSWER TYPE

1. Name the following branches of biology
  - (a) Application of biological processes in technologies.
  - (b) Science of growing fruits and vegetables.
  - (c) Study of prehistoric forms of life.
  - (d) Study of causes of immunity (resistance to or defence against diseases).
  - (e) Study of fishes.
2. Fill in the blanks :
  - (a) Bioengineering deals with making artificial .....
  - (b) ..... is the entire DNA sequence of an organ.
  - (c) Silk is produced by rearing .....
  - (d) Evolution deals with the study of ..... and ..... of organisms.
  - (e) Organisms which draw food from the host body are called .....
  - (f) Animals which give birth to young ones are known as .....
  - (g) ..... is called the Father of Medicine.
3. Match the *branches of biology* in Column A with the respective *areas of study* in Column B.

#### Column A

Ichthyology  
Ornithology  
Ecology  
Virology  
Herpetology  
Palaeontology  
Cytology  
Pathology

#### Column B

Viruses  
Fishes  
Birds  
Cells  
Diseases  
Fossils  
Snakes  
Environment

4. Name any *two* borderline sciences which are connected with Biology.

5. Name the respective sub-divisions of Biology which deal with the study of insects, birds, fungi and heredity.
6. Name some professions other than medicine which require a basic knowledge of Biology.

### C. SHORT ANSWER TYPE

1. What is Biology and when did it begin ?
2. How does Biology help us in leading a healthier life ?
3. A farmer and a housewife may have never studied biology, yet both of them know some of its general principles through experience. State any *two* principles which they know.
4. Distinguish between the following pairs of sciences :
  - (a) Zoology and Entomology
  - (b) Genetics and Embryology
  - (c) Botany and Mycology
  - (d) Space Biology and Exobiology
  - (e) Biotechnology and Bioinformatics

### D. LONG ANSWER TYPE

1. Do you think Biology can help in further increasing the yield of food ? If so, **how** ?

#### IS IT SO ???

##### Some of our superstitions and beliefs

1. Head lice are produced from sweat and dirt.
2. A cobra turns blind if it happens to see a pregnant woman.
3. A cobra dances to the music of a snake-charmer's pipe.
4. Snakes suck milk from the teats of cattle.
5. Earthworms fall from the raining clouds.
6. Growing wings in ants is a sign of their approaching death.
7. The "Dumui" snake has two mouths - one at the front end and the other at the tail end.
8. The tears rolling down from the peacock's (*i.e.* male's) eye are taken up by the peahen (*i.e.* female) which leads to fertilization of her egg.
9. Eating seedless papaya leads to infertility.  
**A biologist would say "NO" to all these.**

