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HUMAN BIOLOGY Made Simple

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Preface

This book is for anyone who requires an introduction to *Human Biology*—the study of biology in relation to people. It is, therefore, for you—if you are interested in yourself, in other people and in the interdependence of all living things. It is also an introductory course, including basic health education, for students who are preparing for a first examination in human biology.

The promotion of personal, community and world health depends upon a knowledge of other organisms as well as upon the study of people. *Part 1* of this book, therefore, is about people and about the other animals and plants which make our lives possible. *Part 2* is about your body and how it works; and about physical fitness, personal health and hygiene. *Part 3* is about our social life, the social consequences of many discoveries in biology, and some problems of community and world health.

Human biology is a subject which should help to bring people together. All people are essentially alike and a biological study of mankind should be the same whether you live in the tropics or in a cooler climate. All people should be aware of the problems of poverty and affluence, and of the problem of overpopulation which confronts all nations.

This book may be used for reference but it has been written so that it can be read as a whole. The chapters are in a logical sequence. No previous knowledge of biology is assumed, and the information needed for a proper understanding of each subject is provided not only on the page where the subject is considered but also in the preceding chapters. If you are studying alone, therefore, start at the beginning of the book and work through to the end.

Investigations are included in most chapters, to encourage scientific enquiry. Some of the investigations enable you to see things described in this book. Others provide guidance to help you to find things out for yourself. For some investigations you need only a pencil and a notebook: for others only inexpensive equipment and chemicals are required. However, some observations are possible only if you have the opportunity to use a microscope. For those who do not, colour transparencies provide an acceptable alternative in an introductory course (see Appendix 1). The investigations in which chemicals are required should be undertaken only in a laboratory in the presence of an experienced teacher.

To test your memory and your understanding, questions are included at the end of each chapter. The answers are given at the end of the book (Appendix 4). If you are preparing for an examination, read the advice on examination technique (Appendix 3).

The *Further Reading* (Appendix 2) is suitable for those who have read this book and wish to know more about human biology.

For ease of reference, and to help students in the last year of an introductory course who are preparing for an examination, the topics included in human and social biology syllabuses, and in health education syllabuses, are set out in the list of *Contents* and a detailed *Index* is provided. Technical terms are essential in science. They contribute to precision and to an economy of words.

The technical terms used in this book are included in the *Index*, and a definition, explanation or illustration which should make the meaning of the term clear is given either on the first page number in the entry or on the page number printed in bold. Synonyms of some of these terms are also given in the *Index*. Some other technical terms, which are not defined in the text, are included in the *Glossary* (Appendix 5).

ROBERT BARRASS

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I shall be pleased to receive suggestions for improving future editions.

ROBERT BARRASS
The Polytechnic
Sunderland
August 1980

By the same author

The Locust—A laboratory guide
Biology: Food and People—The economic importance of biology
Scientists Must Write—A guide to better writing for scientists, engineers and students
Modern Biology (Made Simple Books)

Key to Abbreviations and Symbols

Abbreviations

Fig.	figure (illustration)
e.g.	for example
L.	Latin
Gk.	Greek

Symbols

µm	micrometre (one thousandth of a millimetre = 10^{-6} m)	
mm	millimetre	length
cm	centimetre	
m	metre	
km	kilometre	
cm^2	square centimetre	area
m^2	square metre	
cm^3	cubic centimetre	volume
m^3	cubic metre	
g	gram	mass
kg	kilogram	
s	second	time
min	minute	
h	hour	
J	Joule—energy, work, quantity of heat	
MJ	megajoule (10^6 joules)	
°C	degree Celsius; also called the degree Centigrade	

Notes

1. The symbols for chemical elements are included in Table 6, p. 45.
2. For other abbreviations see Index.

1

PEOPLE AND OTHER LIVING THINGS

We are Organisms

Each living thing is called an **organism** and biology is the study of all kinds of organisms—including the animals and plants you see every day and others so small that to see them you would need a magnifying glass or microscope.

Human biology is the study of biology in relation to people—easy to recognise as living organisms and as animals, and yet easy to distinguish from even those animals most like ourselves—the apes.

Our lives are affected in many ways by other organisms that share this planet with us. We eat some plants and animals. From others we obtain natural fibres (including cotton and wool), rubber and many drugs. Many of the diseases of crops, farm animals and people are caused by living organisms. Soil fertility depends upon the process of decay which is caused by soil organisms. Even the relatively constant composition of fresh air is a result of a balance between the activities of different living organisms.

The first part of this book is about people and about the other living organisms that make our lives possible.

Naming Organisms

We give names to things and to groups of things so that other people will know what we are talking about. Man, mouse, house-fly and garden pea are some of the names used in this book. These names immediately make you think of different kinds (**species**) of living organisms.

Biologists give each kind of organism two names. For example, all people belong to one species and are called *Homo sapiens*. This method of naming organisms, which is called the **binomial system** because every species has two names, was devised by a Swedish naturalist called Linnaeus in the eighteenth century. The domestic dog, *Canis familiaris*, has a different name in different languages: the dog (English); *le chien* (French); and *el perro* (Spanish). The value of scientific names, based on Latin or Greek words, is that they are the same in all scientific writing.

Sorting Organisms into Groups

Linnaeus also devised a natural system for classifying organisms: that is to say, a method for sorting them into groups. He called this a **natural system** because he believed it expressed the order which exists in nature. The organisms placed in each group had many things in common, by which they could be distinguished from the organisms placed in other groups.

In this classification, closely similar species are placed in the same genus and given the same generic name. For example:

Canis familiaris	domestic dog	worldwide distribution
Canis lupus	wolf	North temperate regions

Canis latrans	coyote	North and Central America
Canis dingo	dingo	Australia
Canis aureus	golden jackal	Africa and Middle East

And closely similar genera are placed in the same Family. For example, in addition to all species in the genus *Canis*, the Family Canidae includes several other genera: the different kinds of foxes, the racoon dog of eastern Asia and Japan, the maned wolf of South America, the hunting dog of Africa, and the wild dog of India and east Asia.

Similar families are placed in the same Order; similar orders in the same Class; similar classes in the same major group; and similar major groups in the same Kingdom.

We are Animals

This natural system of classification enables us to organise our knowledge of living things. People, for example, are classified as follows:

Species	*Homo sapiens* (specific name)
Genus	*Homo* (generic name)
Order	Primates (see p. 8–9)
Class	Mammalia (see p. 6–8)
Major group	Chordata (see p. 6)
Kingdom	Animal Kingdom

Differences between Plants and Animals

Plants Most plants live in one place;
have a branching body; and
green plants make their own food.

Animals Most animals eat either plants or other animals;
have a compact body; and
move from place to place.

These obvious differences between plants and animals (and other differences summarised on p. 61) should not lead you to think that plants and animals are essentially different. On the contrary, the similarities between all living things are more fundamental than the obvious differences. We emphasise that all living things are essentially alike by calling them all organisms (see p. 3 and p. 56).

Plants

We enjoy looking at plants and many plants are useful to man. Indeed, without flowering plants the life of many animals, including our own, would be impossible. The **flowering plants** include the grasses, eaten by farm animals, and all our other crop plants. The cereals are cultivated grasses with large dry fruits (grains) which can be stored from year to year (see p. 11 and p. 17). From broad-leaved plants we obtain vegetables, fruits and seeds, hardwood timber, cotton and flax fibres, rubber, and many spices and drugs (including quinine, see p. 238). Parts of some flowering plants are poisonous. Many flowering plants are weeds of cultivation.

The **cone-bearing plants** include the fir trees from which we obtain softwood timbers and the pulp used in making paper.

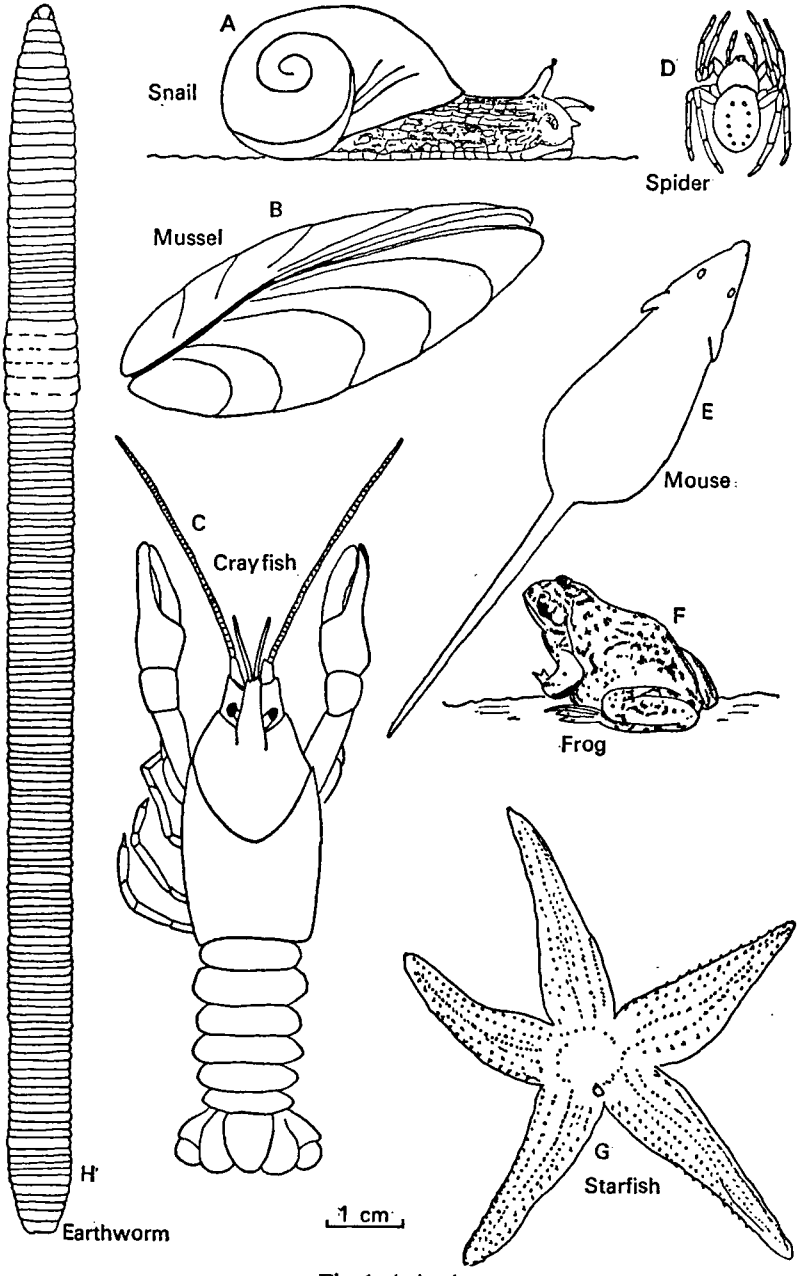

Fig. 1. Animals.

The **fungi** include the yeasts used in brewing and bread-making, and the mushrooms and toadstools (of which some are edible but some contain deadly poisons). The moulds, which help in the decay of dead organisms are fungi, and from some of these we extract antibiotics (p. 242) used to cure many diseases. Other fungi (called blights, mildews, smuts, rusts and wilts) cause diseases of crop plants; and some fungi cause diseases of animals (including people, see p. 257).

Other kinds of plants are the **algae** (including all the seaweeds), and the **mosses, liverworts** and **ferns.**

Animals

We are animals, and we make use of many kinds of animals. Many animals are pests, and many cause diseases.

The different kinds of animals are placed in different major groups. The **flatworms** include the flukes and tapeworms that cause diseases of farm animals, domestic animals and people (see p. 234). Some **roundworms** infect farm animals and people (see Fig. 125, p. 237) and cause diseases; others live in the soil and contribute to decay, and others in the soil cause diseases of crop plants. The **segmented worms** include the earthworms (Fig. 1H) which tunnel in the soil and help to improve soil aeration and fertility.

All **spiny-skinned animals** (Fig. 1G) live in the sea. Many **molluscs** (Fig. 1A, and B) are edible (e.g. the oyster and octopus) but some, including the slugs and land snails, are pests of crop plants. Some **jointed-limbed animals** (Fig. 1C and D) are edible (shrimps, crabs and locusts, for example); some transmit diseases (fleas, mosquitoes, house-flies and tsetse flies, for example); some live on people (lice and itch-mites, for example); and others are pests of crops and stored products (locusts and grain weevils, for example). Most kinds of **chordates** (Fig. 1E and F) have a skull and are called vertebrates because they also have backbones (or vertebrae): see p. 119.

The animals with backbones include several classes of fishes as well as the four classes of four-legged and mostly land-living animals: (1) Amphibia (frogs, toads, newts and salamanders) which return to the water in the breeding season; (2) Reptilia (lizards, snakes and crocodiles); (3) Aves (birds) which, like the reptiles, lay an egg with a shell; and (4) the Mammalia (mammals). Most young mammals develop inside their mother—until they are born: the duck-billed platypus and the spiny ant eater, which lay eggs with a shell, are exceptions.

We are Mammals

If we find the animals with backbones more interesting than others, and if we think that mammals are the most interesting, then perhaps this is because we are mammals. The following are some of the great variety of mammals still living on Earth: shrews, hedgehogs and moles; bats; rats, mice and squirrels; monkeys, apes and people; rabbits and hares; whales and dolphins; dogs, bears, cats and seals; elephants; horses and rhinoceroses; pigs, camels, deer and giraffes; and cattle, sheep and goats. Some of these mammals have been reared by people for thousands of years as companions (domestic animals), as farm animals (for meat, milk, hides and hair) and to work on the farm and as beasts of burden (pulling ploughs and goods and people).

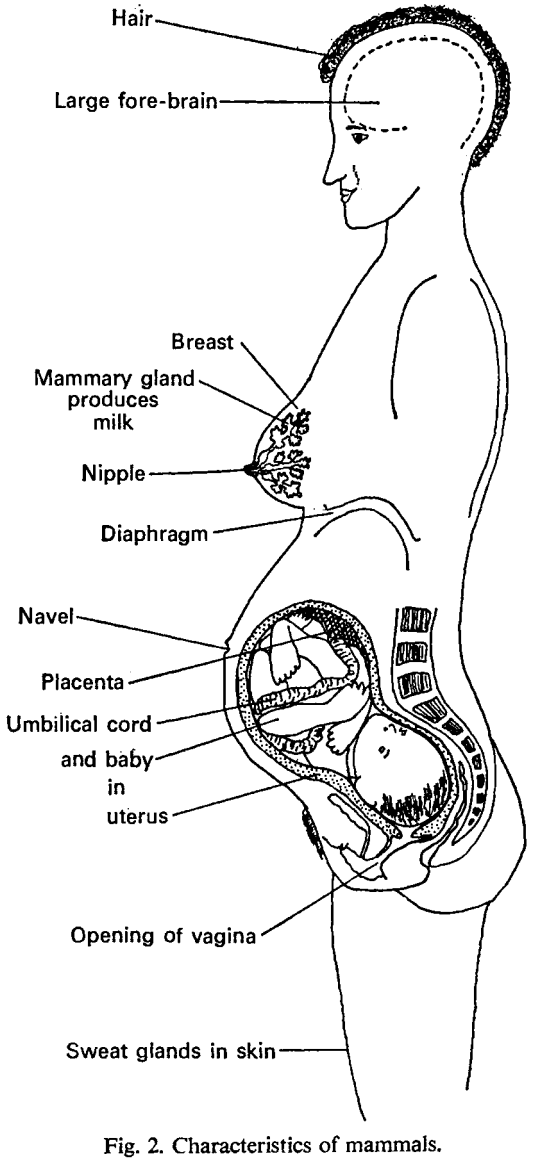

Fig. 2. Characteristics of mammals.

Characteristics of Mammals (see also Fig. 2)

1. Young mammals develop inside their mother.
2. The mother has mammary glands (L. *mamma* = a breast), which gives the mammals their name.
3. The young are born and then suckled by their mother.
4. Young mammals are cared for by their parents.
5. Only mammals have hair.
6. Only mammals have sweat glands in their skin.
7. Most mammals have four kinds of teeth (see Fig. 58, p. 109).
8. The roof of the buccal cavity (mouth cavity) of a mammal comprises a hard bony palate and a movable soft palate (see Fig. 60, p. 111) which prevents food from entering the nose cavity during chewing and swallowing.
9. The body of a mammal is divided internally by a muscular diaphragm (see Fig. 74, p. 128) into the thorax and abdomen.
10. Only mammals have ears with pinnae (external flaps).
11. The cerebral hemispheres, the memory centres of the brain (see Fig. 101, p. 171), are large compared with the rest of the brain.

We are Primates

Monkeys, apes and people are called primates (see Fig. 3). Primates have a smaller nose and a flatter face than other mammals. Their eyes are close together and they have binocular vision (see p. 164). Some kinds of primates have a very large fore-brain, compared with the rest of their brain.

Primates are mammals that find food by sight rather than by smell, and they avoid their enemies and other dangers by reacting quickly and behaving intelligently.

Many primates live in trees where they use their limbs (and tail) in jumping, swinging and grasping; and they have flat nails—not claws. Moreover, many primates can sit, stand on two legs or walk upright. And whether they are sitting, standing or walking, their hands are free and can be used for exploring and testing, and for grasping and holding.

Kinds of Primates

1. Lemurs, lorises and tarsiers
2. New World monkeys
3. Old World monkeys
4. Anthropoid apes: the gibbon, orang-utan, chimpanzee and gorilla

} Live in trees

5. Hominids: people and extinct animals, similar to people, who walked and ran on two legs with their arms free (see p. 12).

Investigation: *looking at plants and animals.* The study of organisms in their natural surroundings is called natural history. If you take an interest in natural history you will see many kinds of organisms and learn about their way of life and how they affect one another.

Do anything you can to conserve plants and animals and the places in which they live. Study organisms without disturbing them. Make notes and drawings, and take photographs, as a record of what you have observed but do not collect specimens. If you pick up an organism to examine it, try to leave it as you found it.