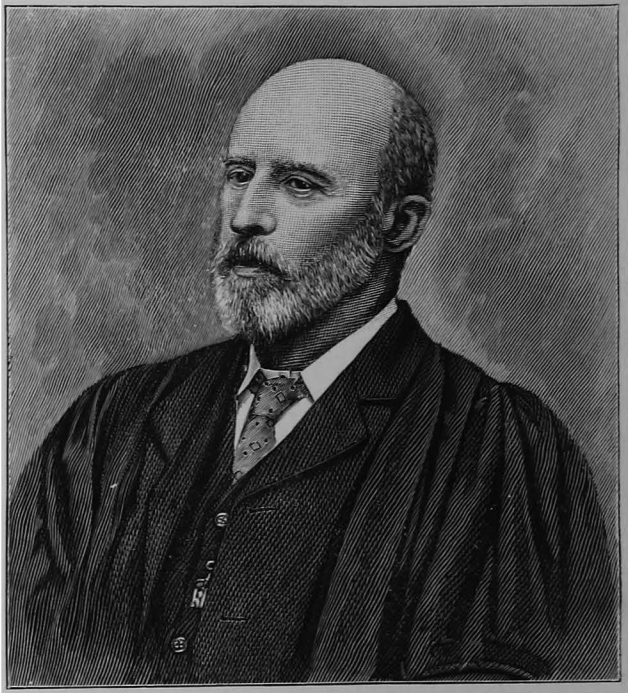


AN EASY OUTLINE
OF EVOLUTION

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BY

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PREFACE

THIS book is written for those who have not yet read any connected account of Evolution. Many technical matters have, therefore, been sacrificed to the primary objects of simplicity and clearness. There are plenty of books on this important subject to be read by the more advanced student, and a list of these is given at the end of the present work.

The doctrine of Evolution does not explain everything: many things will become clearer when the investigation of the world has been carried to a sufficiently advanced stage. Still, the teaching of Evolution has done more to clear up the mysteries of life than has any previous view of the origin of things. And it is a striking fact that every new discovery in regard to plants and animals helps to show that the theory of Evolution is the true and natural account of the world and all its inhabitants.

When we try to give a popular statement of Evolution, we are met by two difficulties—first, the overwhelming number of facts which go to prove the truth of the doctrine; second, the many hard words used by scientific men.

It must always be borne in mind that in this outline I am not able to furnish one-tenth of the facts on which the doctrine of Evolution is based.

As for the words, I have explained all those of a special character which I have been compelled to use. If the student who may still have some doubts as to the meanings will carefully read three or four chapters aided by a dictionary, he will soon find his difficulties disappear.

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DENNIS HIRD.

Bletchley, April, 1903.

AN EASY OUTLINE OF EVOLUTION

INTRODUCTION

In order to make our subject easier, it is well to explain some words.

We are to deal with the facts of science. Science (from the Latin *scire*, to know) is the knowledge of the order of nature, as found out by observation, experiment, and reason.

Professor Ray Lankester puts it thus: "Science is that knowledge which enables us to demonstrate, so far as our limited faculties permit, that the appearances which we recognise in the world around us are dependent in definite ways on certain properties of matter; science is that knowledge which enables, or tends to enable, us to assign to its true place in the series of events constituting the universe any and every thing we can perceive."

This may be put more briefly: Science is the knowledge of the laws governing the forces of nature. Or: Science is exact knowledge.

Substance is another word for the matter of which all things are made. It has the properties of extension, inertia, weight, motion, etc.

Law is a generalised, arranged statement of facts—a general rule, or constant mode of action of forces or phenomena.

A phenomenon at first simply meant anything manifest to the senses. The plural is phenomena, and the word is used to include all the objects, and motions, and changes which make up the universe. Phenomena are the only things we can know. Anything not a phenomenon would lie outside the range of man's experience and reason, and

could not, therefore, be known to him. Some philosophers divide all things into the phenomenal and the *real*. What the real is we have no means of knowing, because, if it is something different from phenomena, it is outside of human experience. Perhaps Dr. Paul Carus is right when he says "the phenomenal is real." At any rate, it is the real for us, who know and can know nothing else. By some thinkers all phenomena have been reduced to matter and motion, or matter and energy. Of the "*real*" nature of matter and energy we know nothing yet.

But it has been found that neither matter nor energy can ever be destroyed. So that we know that matter and energy never had a beginning, and cannot have an end.

This important truth is often called the indestructibility of matter and the persistence of force. Force is another word for energy. But some writers use force for the power which drives the particles of matter together, and energy for the power which drives them apart. If we adopt this distinction, then force is said to be centripetal (making to a centre), and energy is said to be centrifugal (making *from* the centre).

As a rule, we know matter in the mass, or, as we say, in large pieces or forms. These forms are made up of very small bodies, called molecules, and the molecules are made up of atoms.

Molecule (from *molecula*, a little mass) is the smallest quantity into which the mass of any substance can be physically divided and retain its characteristic

properties, or the smallest quantity that can exist in a free state. A molecule may be *chemically* separated into two or more atoms.

The integrity and properties of a substance reside in its molecules.

Molecular means that which belongs to or is made up of molecules.

Molecular motion is the movement of the molecules of a substance *within* that substance.

Atom (what cannot be divided : from *a*, not ; *temno*, I cut) is the smallest unit of an element ; that part of a substance incapable of further division, or the smallest part which can enter a chemical compound, or unite with another atom to form a molecule.

Atom is of or belonging to atoms.

Atomicity is the chemical power of an atom.

Certain substances are called elements.

An element (from *elementum*, a first principle) in *chemistry* is a body which cannot be decomposed into simpler substances. The recognised elements now number about seventy-three, such as hydrogen, oxygen, iron, lead, etc.

In ancient times men thought there were four elements—earth, air, fire, and water ; but none of these are elements.

Now, elements have different chemical powers—that is, when they combine with one another to form molecules they have different capacities.

Hydrogen is an element with the lowest combining power, so its power is represented by one ; oxygen, compared with hydrogen, has twice this power, and so is represented by two ; carbon is represented by four ; and so forth.

If we think of these powers acting like hands, we may understand it better. Oxygen has two hands ; so, when it combines with hydrogen, one atom of oxygen joins with two atoms of hydrogen. This is how water is formed. If we have fifty atoms of oxygen and one hundred of hydrogen in a vessel, and cause them to unite, then water is formed.

The science which treats of the laws by which the molecules and atoms are

governed is called chemistry. All the familiar things we use—as sugar, fats, eggs, fruit—are made up of molecules which contain atoms of the different elements arranged in many ways. This is a most important science if we wish to understand the nature and action of matter ; and, with physics, it chiefly helps us to explain the basis of intelligence and the origin of life.

The word “chemistry” appears to come from the name of the Egyptian god Khem. He was the god of generation, productiveness, and vegetation. He was also the god of simple and curative herbs. The words “chemistry” and “chemist” have thus come to us from Egypt, first through the Arabic and then through the Spanish, the Arabs having adopted the word in Egypt and transmitted it through the Moors to Spain.

In biology (the science of living things, from *bios*, life) elements mean the smallest structures of a tissue which can be seen by the aid of a microscope. The word “tissue” means any web-like structure. Or the term “tissue” may be applied to a mass of similar cells. This mass may be without any well-defined form ; but, if cut in any direction, it is found to be made up of a number of cells.

Atmosphere (from *atmos*, vapour ; and *sphaira*, a sphere) is the mixture of gases, vapour of water, and other suspended matters surrounding the earth as an elastic fluid envelope to the height of about two hundred miles. We commonly speak of the atmosphere as the air.

Function (from *fungor*, I perform) is the usual or special action of a tissue, organ, or parts of the body. Functional is that which belongs to the special action of an organ ; for instance, it is the function of the lungs to breathe.

Physics (from *phusis*, nature) is the science that treats of the properties of matter and of the laws governing it in conditions of rest and motion, and in its solid, fluid, and gaseous states.

Physiology is the science which treats of the *functions* of organic beings.

Nature: this word is used with different meanings. It is from the Latin *natura*, which means birth, origin. Nature is the existing universe with all things that it contains, their phenomena and laws. The causes and forces that work in nature are often spoken of as one power and personified as she; and we say, She is the energy by which the many phenomena that we see are produced. Of course, nature includes the organic and the inorganic.*

Mechanics is the science that treats of forces and powers and their application, either directly or by the intervention of machinery. It may treat of bodies at rest (statics) or in motion (dynamics).

Metaphysics (*meta*, beyond; *phusis*, nature), the branch of philosophy which includes the investigation of the *nature* of mind and all things *beyond* the senses. Metaphysics, therefore, deals with the conceptions or principles behind all phenomena, including being, becoming, reality, time, space, etc. Sometimes it is called the philosophy of the ultimate nature, causes, or reason of things. It is not a science, and, as its theories can neither be proved nor disproved, it must be left to the individual judgment to decide its value.

* All natural objects in the world may be divided into the organic and inorganic worlds; the organic world including all bodies which either are or have been alive, and the inorganic comprising all others (as sand, stones, water). Inorganic bodies are treated of in geology and mineralogy. Biology deals with organisms; it is divided into botany, the study of plants, and zoology, the study of animals. Inorganic bodies increase in size by the addition of *similar particles* to the *outside*. Organic bodies grow by receiving matter into the interior and assimilating it.

Philosophy at first meant the love of wisdom (from *sophia*, wisdom; and *phileo*, to love). It is now used in many ways, but as a system it means "the science of principles," "perfectly unified knowledge," or "the investigation of those principles on which all knowledge and all being ultimately rest."

Now, as we do not know the ultimate nature of anything, it is clear that any philosophy must be speculative, or, in other words, rest on assumption. This accounts for the fact that one system of philosophy usually contradicts another.

Evolution is rather a science than a philosophy, though Ernst Haeckel, Herbert Spencer, and others, have done much to give us a system of "perfectly unified knowledge."

The following is a bare outline of the most important factors of Evolution:—

- | | |
|------------------------------|----------------------------|
| 1. Pressure of environment. | } The factors of Lamarck. |
| 2. Use and disuse of organs. | |
| 3. Natural selection. | } The discovery of Darwin. |
| 4. Sexual selection. | |

5. Physiological selection. (Romanes and Gulick; not yet universally recognised.) "This means selection of those varieties the individuals of which are fertile among themselves, but sterile or less fertile with other varieties and the parent stock."

6. In human evolution a higher factor is present—"conscious, voluntary co-operation in the work of evolution..... This factor consists essentially in the formation and pursuit of ideals."