

# THE OUTLINE OF SCIENCE

## INTRODUCTION

THERE is abundant evidence of a widened and deepened interest in modern science. How could it be otherwise when we think of the magnitude and the eventfulness of recent advances?

But the interest of the general public would be even greater than it is if the makers of new knowledge were more willing to expound their discoveries in ways that could be "understood of the people." No one objects very much to technicalities in a game or on board a yacht, and they are clearly necessary for terse and precise scientific description. It is certain, however, that they can be reduced to a minimum without sacrificing accuracy, when the object in view is to explain "the gist of the matter." So this OUTLINE OF SCIENCE is meant for the general reader, who lacks both time and opportunity for special study, and yet would take an intelligent interest in the progress of science which is making the world always new.

The story of the triumphs of modern science is one of which Man may well be proud. Science reads the secret of the distant star and anatomises the atom; foretells the date of the comet's return and predicts the kinds of chickens that will hatch from a dozen eggs; discovers the laws of the wind that bloweth where it listeth and reduces to order the disorder of disease. Science is always setting forth, on Columbus voyages, discovering new worlds and conquering them by understanding. For Knowledge means Foresight, and Foresight means Power.

The idea of Evolution has influenced all the sciences, forcing us to think of *everything* as with a history behind it, for we have travelled

far since Darwin's day. The solar system, the earth, the mountain ranges, and the great desps, the rocks and crystals, the plants and animals, man himself, and his social institutions—all must be seen as the outcome of a long process of Becoming. There are some eighty-odd chemical elements on the earth to-day, and it is now much more than a suggestion that these are the outcome of an inorganic evolution, element giving rise to element, going back and back to some primeval stuff, from which they were all originally derived, infinitely long ago. No idea has been so powerful a tool in the fashioning of New Knowledge as this simple but profound idea of Evolution, that the present is the child of the past and the parent of the future. And with the picture of a continuity of evolution from nebula to social systems comes a promise of an increasing control—a promise that Man will become not only a more accurate student, but a more complete master of his world.

It is characteristic of modern science that the whole world is seen to be more vital than before. Everywhere there has been a passage from the static to the dynamic. Thus the new revelations of the constitution of matter, which we owe to the discoveries of men like Professor Sir J. J. Thomson, Professor Sir Ernest Rutherford, and Professor Frederick Soddy, have shown the very dust to have a complexity and an activity heretofore unimagined. Such phrases as "dead" matter and "inert" matter have gone by the board.

The new theory of the atom amounts almost to a new conception of the universe. It bids fair to reveal to us many of nature's hidden

secrets. The atom is no longer the indivisible particle of matter it was once understood to be. We know now that there is an atom within the atom—that what we thought was elementary can be dissociated and broken up. The present-day theories of the atom and the constitution of matter are the outcome of the comparatively recent discovery of such things as radium, the X-rays, and the wonderful revelations of such instruments as the spectroscope and other highly perfected scientific instruments.

The advent of the electron theory has thrown a flood of light on what before was hidden or only dimly guessed at. It has given us a new conception of the framework of the universe. We are beginning to know and realise of what matter is made and what electric phenomena mean. We can glimpse the vast stores of energy locked up in matter. The new knowledge has much to tell us about the origin and phenomena; not only of our own planet, but other planets, of the stars, and the sun. New light is thrown on the source of the sun's heat; we can make more than guesses as to its probable age. The great question to-day is: is there *one* primordial substance from which all the varying forms of matter have been evolved?

But the discovery of electrons is only one of the revolutionary changes which give modern science an entrancing interest.

As in chemistry and physics, so in the science of living creatures there have been recent advances that have changed the whole prospect. A good instance is afforded by the discovery of the "hormones," or chemical messengers, which are produced by ductless glands, such as the thyroid, the supra-renal, and the pituitary, and are distributed throughout the body by the blood. The work of physiologists like Professor Starling and Professor Bayliss has shown that these chemical messengers regulate what may be called the "pace" of the body, and bring about that regulated harmony and smoothness of working which we know as health. It is not too much to say that the discovery of hormones has changed the whole of physiology. Our knowledge of the human body far surpasses that of the past generation.

The persistent patience of microscopists and technical improvements like the "ultra-microscope" have greatly increased our know-

ledge of the invisible world of life. To the bacteria of a past generation have been added a multitude of microscopic *animal* microbes, such as that which causes Sleeping Sickness. The life-histories and the weird ways of many important parasites have been unravelled; and here again knowledge means mastery. To a degree which has almost surpassed expectations there has been a revelation of the intricacy of the stones and mortar of the house of life, and the microscopic study of germ-cells has wonderfully supplemented the epoch-making experimental study of heredity which began with Mendel. It goes without saying that no one can call himself educated who does not understand the central and simple ideas of Mendelism and other new departures in biology.

The procession of life through the ages and the factors in the sublime movement; the peopling of the earth by plants and animals and the linking of life to life in subtle inter-relations, such as those between flowers and their insect-visitors; the life-histories of individual types and the extraordinary results of the new inquiry called "experimental embryology"—these also are among the subjects with which this OUTLINE will deal.

The behaviour of animals is another fascinating study, leading to a provisional picture of the dawn of mind. Indeed, no branch of science surpasses in interest that which deals with the ways and habits—the truly wonderful devices, adaptations and instincts—of insects, birds, and mammals. We no longer deny a degree of intelligence to some members of the animal world—even the line between intelligence and reason is sometimes difficult to find.

Fresh contacts between physiology and the study of man's mental life; precise studies of the ways of children and wild peoples; and new methods like those of the psycho-analysts must also receive the attention they deserve, for they are giving us a "New Psychology" and the claims of psychical research must also be recognised by the open-minded.

The general aim of the OUTLINE is to give the reader a clear and concise view of the essentials of present-day science, so that he may follow with intelligence the modern advance and share appreciatively in man's continued conquest of his kingdom.

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