THE PROBLEM OF LIFE.

BY LAWRENCE IRWELL.

PART I.

There are two senses in which a treatise may be said to be popular. It may be intended to serve as a substitute for real and serious study, by communicating the results of study in so clear and agreeable a form as to send the reader away full of a glowing and newly-discovered sense of his own requirements, while it satiates his curiosity and paralyzes his industry; or it may be intended to do no more than to translate technical terms back again into the terms familiar in common speech; to examine afresh the meaning and scope of conceptions which the persistent jargon of specialists has clouded; to bring persons of various pursuits and tastes into intellectual contact with one another; and, by opening out to novices an unsuspected region of interest, to arouse their curiosity and to stimulate them to further research. It need not be said that it is my aim to be popular in the latter sense, and not to be so in the former.

Words are, after all, only coins with which to facilitate the interchange of ideas, and the best word is that which serves the purpose most clearly. Thus, instead of using the verbiage of a legal document to express the ideas comprised in such words as "theism", we coin them for general use, as Huxley did the word "agnosticism," in order to convey our meaning. The word "polarity" is defined in the Century dictionary as "The having of two opposite poles; variation in certain physical properties, so that in one direction they are the opposite of what they are in the opposite direction." There are, however, a vast variety of facts, outside of magnetism and electricity, connected by an underlying idea, which inevitably suggests analogy to them, and which can be most conveniently expressed by the word "polarity." In Emerson's "Essay on Compensation," we find these words:

"Polarity, or action and reaction, we meet in every part of nature; in darkness and in light; in the ebb and flow of waters; in male and female; in the expiration of animals and plants; in the undulations of fluids and of sound; in the centripetal and centrifugal gravity; in electricity, galvanism and chemical affinity. Superinduce magnetism at one end of a needle, the opposite magnetism takes place at the other end. An inevitable dualism besets nature, so that each thing is a half, and suggests another to make it whole: As spirit, matter; man, woman; odd, even; subjective, objective in, out; upper, under; motion, rest; yea, nay."

While there may be something about this quotation which is not scientific, I am giving it as a lucid explanation of certain facts which enter into all biological questions.

Among the primitive polarities is that of author and reader. It is my part to endeavor to present the leading facts and laws of the material universe in such plain language that they may be apprehended without excessive effort, or extraordinary powers of perception. But it is the reader's part to supply an average amount of attention, and above all to feel an interest in science generally. Ability and curiosity are almost convertible terms, and the clearest exposition is thrown away on the torpid mind which views the marvelous universe in which he has had the privilege to live with the apathy of a savage, taking things as they come without caring to know anything about them.

Laws of Nature.

For the reader's part of the work I am in no way responsible; for my own part I am, and I proceed therefore to give in my own way, and with the best faculty that I possess, a clear summary of some of the fundamental facts and laws of nature.

What I propose to call the "ultimate forces" of the universe are ether, energy and matter.

First, ether: a universal, all-pervading medium, infinitely light, and almost infinitely elastic, in which all matter, from suns and planets down to molecules and atoms, floats as in a boundless ocean and whose tremors or vibrations, propagated as waves, transport the different forms of energy—heat, light and electricity—across space. The existence of ether is still hypothetical, as it has not been conclusively established; but I know of no worker in the cause of scientific truth who denies that some such ultimate force undoubtedly exists.

Secondly, energy: a primitive indestructible something, which causes motion and manifests itself under its many diversified forms, such as gravity, mechanical work, molecular and atomic forces, light, heat and electricity, all which are merely transformations of some one form of fundamental energy and are convertible into each other.

Thirdly, matter: the ultimate elements of this are atoms, which, when combined, form molecules, or little quantities of ordinary substances, with the presence of all their qualities. These are the bricks used in building the varied structures of the organic and inorganic world. Of these atoms some seventy-five have never been divided, and therefore, although we may suspect that they are merely combinations or transformations of one original matter, we must, for the present, regard them as chemical elements. In like manner we may suspect that matter is, in reality, only another form of energy, and that the impression of solidity is given by the action of a repellent force which is very energetic at short distances. If this were established we might look forward to the generalization that energy was the one reality of nature; but for the present it is a mere speculation, and we must be content with our seventy elementary atoms as ultimate facts. In any case this much is certain, that matter, like energy, is indestructible. We have absolutely no experience of either of them being created or annihilated. Further, we have no faculties to enable us even to perceive how something can be made out of nothing, and all we know about these primitive constituents of the universe is of their laws of their existence, their evolutions and transformations.

Minute as the atoms and molecules are, we must think of them, not as stationary and permanently connected, but rather as little solar systems in which revolving atoms form the matter, held together as distinct individuals by their proper energies and motions, until some superior force breaks up the system and sets its components free to form new combinations.

At this point I propose to leave the purely physical aspect of the problem of life. I have included these few words because I considered that they might demonstrate the intimate relation between physics, chemistry and biology.

At first ight there seems to be a great gulf between the living and the dead which no bridge can span. But first impressions are very apt to deceive us, and when things are traced up to their origins we often find them getting nearer and nearer, until it is difficult to say where one begins and the other ends. Take, for example, such an antithesis as "eating or being eaten." If a hunter meets a bear one would say that no distinction could be sharper than whether the bear eats the man or the man the bear. In one case there is a man, and in the other a bear, less in the world. But look through a microscope at a drop of water, and you may see two specks of jelly-like substance swimming in it. They are living creatures, for they eat and grow, and thrust out and retract parts of their formless mass, which serve as temporary legs and arms for seizing food, and for voluntary motion. In short, they are each what are called strictly individual amoebae, forming separate units of the animated creature, as much as the man and the bear. But if the two come in contact, what happens? The two slimy masses involve one another