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PART I.

PRELIMINARY EXPLANATIONS ON MAN, MATTER,
AND FORCE.

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CHAPTER I.

GENERAL CONSIDERATIONS ON THE CONSTITUTION OF MAN.

UNTIL quite recently the notion was universally entertained that human beings were, in many respects, quite different from all other beings, forming, as it were, a world by themselves. This notion is even now very generally held by those not versed in natural science, and is often put forward by those who are considered teachers of the people. The fact is, however, as all observation proves, that man is, in all respects, like other animals. His body is composed of the same elements, he has the same organs, acting in the same way, the same passions and propensities, and the same mental faculties, only more fully developed. In short, man is a part of the animal world, and not something separate and distinct from it. This is important to be borne in mind, because this notion of man being different, essentially, from other animated beings, is the source of most of our errors in regard to him. Instead of studying the real man, and so coming to properly understand his needs and requirements, we have all along been studying an imaginary being that had no real existence.

People who constantly repeat, parrot-like, the saying that "Man is but Dust," nevertheless do not in any way realize the fact that in man, as in all other animals, and also in the whole vegetable world, there is not a single material element but what is common to the whole world. When arranged in a certain way and in certain proportions, these same elements compose a plant, one of the lower animals, or a man, as the case may be, just as the same stones and mortar may build a palace, a bridge, or any other structure.

So far as we know at present the world is composed of about sixty-four elements, or different kinds of matter, of which the greater part are metals. In the composition of a human being there enters essentially only about eighteen of these, all told, and many of them only in small amounts.

Of these, several of the most important are known only in the form of gases. Analysis shows that a human body weighing one hundred and fifty-four pounds would be composed of eighty-eight pounds of water and sixty-six pounds of solid matter. The separate elements would be Oxygen, Hydrogen, Nitrogen, Chlorine, Fluorine (all gases), with Carbon, Phosphorus, Sulphur, Silicon, Potassium, Sodium, Calcium, Lithium, Magnesium, Iron, Manganese, Copper, and Lead (solids). The metals are in small amount, Iron being the most abundant, next to Lime (the oxide of the metal Calcium), which forms the bulk of the bones, the framework of the body. The whole eighty-eight pounds of water in the body is formed

of the two gases, Hydrogen and Oxygen, and Oxygen enters largely into the composition of other parts also. The solid portion of the body is composed nearly wholly of Oxygen, Nitrogen, and Carbon; the metals and other elements forming only a small part. To put it in another form, the constituents of the human body, taking elements the names of which will be familiar to the general reader, rather than compounds, are sixteen in number, seven of them being metals, nine non-metallic. The metals weigh altogether (eleven stone or one hundred and fifty-four pounds being taken as the standard weight of the whole body) something less than five pounds, nearly four of which are Calcium, the basis of Lime, supplying the chief part of the bones and teeth. Of Iron there are sixty-five grains, a small amount, but very important, as giving color to the blood. Among non-metallic elements Oxygen is the most important, amounting to no less than one hundred and nine pounds; and next to this Carbon, weighing not quite nineteen pounds. Of Phosphorus, which, if some physiologists are to be believed, supplies the motive power of the whole, there is one pound twelve ounces twenty-five grains.

Now, these are the same elements that make up nearly all other animal bodies, there being no substance known peculiar to man alone, nor, indeed, to animals generally, though Nitrogen is found more especially in animal substances than elsewhere, and is, therefore, usually spoken of as the Animal Element. Both Carbon and Nitrogen are obtained, principally, from the air we breathe. The Carbon, or solid wood of trees, is also obtained from the air in the same way, and not from the earth.

Although the various forms matter assumes are endless, they can all be resolved into the primitive elements above named, but these we cannot make undergo any further change, and they are indestructible. We may decompose matter, and re-compose its constituent parts in a thousand ways, but not an atom is ever either destroyed or created. A piece of wood may be burned, and apparently nothing but a few ashes be left, but careful observation can account for every grain of it, and if it be burned under proper conditions, every portion, weight for weight, can be shown in other forms, principally gas and water. There is never a grain more, nor less, of matter in existence at one time than another, though it may be presented to us in many different forms, and this is an important fact to bear in mind.

Some naturalists are of opinion that matter is essentially one; and that what we regard as different kinds of matter are only different states or conditions of it. There are many good reasons for considering this opinion well founded, and the time may come when it will be demonstrated to be true. Many of the so-called elements of the ancients have been decomposed into simpler ones—water and air, for instance,—and there is good reason for supposing that many of those we now call simple will be finally decomposed, and resolved into yet simpler ones in the same way.

The next thing to be observed is that matter is always possessed of certain properties, or attributes, which are always the same in the same form of matter. It also invariably exhibits what we call *force*, *energy*, or *power*, varying in degree and kind according as matter itself varies. There is no such thing as *dead*, or *inert* matter, though theologians and others often speak of it. Matter is always, under all conditions, endowed with force, or power, and cannot exist without it. There can be no matter without force, nor, so far as we know, can there be force of any kind without matter; they seem inseparable.

In the same way that matter presents itself to us in many different forms, so

does force exhibit itself in many different ways, such as motion, light, heat, electricity, chemical action, and thought; but all these can be transformed into each other, backward and forward, so that they must all be regarded merely as modifications of the primal force. The most competent observers and reasoners now accept this view, of the *oneness* of force, as fully proved. Force cannot be destroyed any more than matter can be; it may be *changed*, but remains ever the same in amount. Thus light can be transformed into chemical action, and that into electricity, which again can be transformed into motion, heat, or back again into light. Force, like matter, is never created, never lost, never destroyed.

These are primary facts, of the first importance, when we come to study man bodily and mentally. To understand him as we should, we must never forget that he is composed of the common elements of the world, endowed only with the same properties and forces that we find in them when they form other bodies. As remarked before, man is not something apart from the world, but is a portion of it, and subject to the same laws and conditions as all other portions, both in his body and his mind. Startling as it may seem to some, man's thoughts and emotions are only forms or modifications of nervous force, which again is only a transformation of the chemical, electrical, and other forces inherent in his bodily structure. The light of the sun in past ages, stored up in the form of coal, may become light, heat, electricity, or motion in this age; and these may even become thought, or mind, by simple transformation.

CHAPTER II.

DIFFERENCE BETWEEN WHAT ARE CALLED LIVING BODIES AND INORGANIC MATTER.

ALTHOUGH all bodies, both those called living or organic, and those called dead or inorganic, are made of the same *elements*, yet there is a difference between them in the way these elements are compounded. In inorganic matter the elements are more numerous, and are primarily combined into *twos* only, or *threes*. Thus common limestone is composed of the metal calcium, oxygen, and carbon; clay is composed of the metal aluminum combined with oxygen, and rock crystal is composed of the metal silicum combined with oxygen; these are called *binary* and *ternary* compounds, and they exhibit only the more ordinary forms of force, chemical and mechanical.

Organic bodies, on the contrary, are composed for the most part of a smaller number of elements, combined into a more complex combination. They are almost always *threes* or *fours*. In all organic bodies also *water* is invariably found, which makes them more soft and mobile, and very liable to decomposition; and this is the reason why organic matter is not so fixed as inorganic. Albumen, for instance, or white of egg, is composed of oxygen, nitrogen, hydrogen, carbon, and sulphur. In organic bodies force also is exhibited in ways never seen in the inorganic, as, for instance, in the form of nerve power. The principal elements composing the human body, as in all other animals, are those found in albumen, as stated above; indeed, the lowest animated beings are composed almost wholly of albumen, to which lime and other mineral matters are added, merely to give strength and hardness. Inorganic bodies, such as stone, for instance, either have no particular form, or else they are crystallized, and then their sides are nearly always straight; but organic bodies usually have a regular form, or structure, with curved sides.

It used to be taken for granted that living or organized beings could not in any way spring from inorganic bodies, or *dead matter*, as it was called. It was thought that there was a peculiar *vital power*, upon which life depended, and which was totally distinct from any kind of force existing in inorganic bodies, so that all living beings had to be generated by other living beings like themselves, and that they never came into existence in any other way. Modern investigation has, however, modified this view very materially. We can now make artificially, from inorganic elements, many well-known organic compounds; and many competent and careful experimenters are confident that *living beings* can be, and are, formed artificially

also from these same compounds thus artificially produced. In other words, they believe that inorganic and organic matter can change from one into the other, and that *life* can originate independent of previous similar life. That is to say, they believe in *spontaneous generation*, or the origin of life without a preceding parentage. Many eminent scientific men, who are not yet convinced that life has thus been artificially produced, still admit its possibility, and believe that matter contains within itself all the powers necessary to produce every kind of life. They believe that all living beings have thus originated, from the inorganic elements, by the action of natural force, and that if they were to be all destroyed, and material conditions be as they have been, others would inevitably originate in their stead. Man, and every other animal, has thus been produced from the inorganic elements; not directly, in his present shape, but by gradual change from the simplest form of life, through numerous organic stages, up to his present development.

Once let matter assume the organized form, and what we call *life* begins at once. In its simplest manifestations life is not distinguishable from the motions of inorganic or dead matter, so that we cannot tell where one ends and the other begins. In short, life is only one mode in which the universal force inherent in matter shows itself. The first living organisms are neither animal nor vegetable, but simpler than either, and apparently may become either the one or the other. And yet, from these simple beginnings, by gradual change, or progressive development, the most perfectly organized beings, man himself included, may be slowly evolved.

We will now proceed to show, as far as can be done, how the inorganic elements pass into organic material, and how life first originates or shows itself in its simplest forms. This is called primary or spontaneous generation. Then we will show how organized beings, man included, continue their species, or originate other beings like themselves by the process of *reproduction*.