stances, and the consequent formation of one or more new substances. For example, oxygen is a chief constituent of the air we breathe, of the water we drink, and of various foods which we consume. In all these substances, it is combined or united with other substances—with nitrogen gas, for example, to form the air, with hydrogen gas to form water, and with carbon and hydrogen to form fat.

If a piece of burning coal—which largely consists of carbon and hydrogen—is placed under a glass jar from which all the air has been pumped out, leaving what is termed "a vacuum," the coal will cease to burn, and will immediately die out. It only burns in fact because of the oxygen in the air, which uniting with the carbon of the coal forms carbonic acid, while the hydrogen unites with other particles of oxygen in the air to form steam. This is an example which it is well to remember, because it explains a number of processes which are constantly in progress in the human body. The breaking up of the various substances combined in the coal, causes heat and light, or what in physics is termed "kinetic energy." The energy was there before the coal was lighted, but it was passive, or what is called stored-up or "latent energy." When it is set free by combustion, it becomes active energy, that is to say, the heat will boil the water, and so generate the steam which drives an engine or the coal burnt in a closed vessel will form gas, which, properly purified, illuminates our houses; or again, the engine may be made by its working to generate electricity, which in its turn can be utilised for many purposes. This is an example of the transmission of energy or force from one form to another, while the method of its production also illustrates the chemical proverb that "nothing is lost in Nature," one variety of substance being merely transformed into another.

To go back to our example, however, it must be remembered that the presence of oxygen and the process of oxidation are essential to life. As a general rule, it may be said that when simple substances or elements are united together—as, for example, when, thousands of years ago, carbon and hydrogen were united together in the living tree which to-day we know as "coal"—energy is stored up; whereas in those cases where complex substances such as coal are broken down again into their elementary constituents, energy is given out. The human body then may briefly be said to be living because it is in a continual state of oxidation; the process is constantly going on within its tissues; the carbon for example is constantly being burnt off, and oxidised by the entrance of air into its lungs; in consequence the latent energy is being given out; and just as we know that the carbon in coal gives out heat when it is burnt, so the heat of the human body is maintained, to a very large extent, by the oxidation of the carbon which it contains. There is, however, this important difference that the chemical changes are not violent as they generally are when coal is burnt, but are gradual and steady; so the temperature of the body is evenly maintained and, in health, is almost stationary. If the dead body is cremated, oxygen unites with its complex constituents and at the end of the process only a handful of ashes remain. When the dead body decays precisely the same process of oxidation goes on, but it is of course much slower and much more gradual; in time, however, it is broken up by the action of oxygen and water into its constituent parts, carbonic acid and water, nitrogen and hydrogen are formed, and slowly pass away until finally only the same ashes are left as would have been the case if the body had been rapidly burnt up.

The body may be regarded as composed of a multitude of minute fragments, each one of which is called a "cell," and, to each one of these, oxygen is taken by the blood. If it were not so that cell would die, and when for any reason the blood is prevented from reaching any part of the body that part becomes dead, or "mortified." For example, if a piece of string is tightly tied round a finger the part beyond the constriction becomes bluish, and after a few minutes loses its sensibility; when the string is removed the blood flows again easily, the part resumes its natural colour, and its sensation returns. Sometimes Nature performs this experiment on a larger scale, and plugs up the chief artery of a limb. Then, under some conditions, the whole of that limb becomes white and cold; there is no blood flowing into it, and oxidising and warming and keeping alive its myriad cells; if the deprivation of blood continues the limb becomes shrunken, dry, and shrivelled, undergoing the change which used to be described as "dry gangrene"; finally the limb would in civilised countries be amputated, or, as often occurs amongst outcast lepers, gradually becomes loosened from the healthy tissue, and so drops off. The first essential, therefore, to the life of an animal is that the circulation of the blood shall remain free, and unimpeded in every part of the body. From this, it is possible to understand the essential importance of the action of the heart in health and how important a factor its strength is, in the determination of the course of a disease towards the recovery or towards the death of the patient.

(To be continued.)

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