and chemists are certainly doing what they can to compete with nature. But even if they are not sucessful, we may fall back upon the fact that the chemical and physical conditions in the early stages of the earth's life were utterly different from anything now known. It has been calculated that the earth's temperature, when it first started on its career as an independent plant, was something like 3,000,000 Fahr: at this heat probably all atoms would be dissociated; but as the temperature diminished they would come closer together with a great deal of motion, making wide excursions, which might bring many different atoms together in complex, though unstable combinations. Moreover, carbon, which is the basis of all combinations of the class of protoplasm, was far more abundant in those days in the form of carbonic dioxide, before the enormous amount of vegetable matter in the form of coal and other substances had been subtracted from it. In any case the first protoplasm must be etxremely ancient, for the remains of the sea-weeds are found in the oldest strata, and vegetation of any sort implies the manufacture of protoplasm from inorganic matter.

From Organic to Inorganic.

The passage from the organic into the inorganic world is best traced by following the line of Pasteur's researches on ferments. How does the world escape being choked up by the accumulation of dead organic matter throughout innumerable ages? The reply is—by what are called "ferments," inducing processes of fermentation and putrefaction, by which the course of life is reversed, and the organic elements are taken to pieces and restored to the inorganic world. Pasteur, in opposition to the older chemists, showed that this was not done directly by the oxygen of the air, but through the intermediate agency of living microbes, whose spores, floating in the air, took up their abode and multiplied wherever they found an appropriate habitation. Given air purified from germs, or a temperature low enough to prevent them from germinating, and putrescible substances would keep sweet forever. The practical realization of this is seen in the enormous commerce in canned meats and fruits, and the general system of cold storage.

But the question may be asked,—How are the microscopic organisms disposed of? We must remember that even microscopic bacteria would, in time, choke up the world by their residue, if they were not got rid of. Pasteur answered that the ferments are destroyed by a new series of organisms—aerobes—living in the air, and those by other aerobes in succession until the ultimate products are oxidized. Thus, in the destruction of what has lived all is reduced by the simultaneous action of the three great natural phenomena—fermentation, putrefaction, and slow combustion. A living being, animal or vegetable, or the debris of either, having just died, is exposed to the air. The life that has abandoned it is succeeded by life under other forms. In the superficial parts, accessible to the air, the germs of the infinitely little aerobes flourish and multiply. The carbon, hydrogen and nitrogen of the organic matter are transformed by the oxygen of the air and under the vital activity of the aerobes, into carbonic acid, the vapor of water and ammonia. The combustion continues as long as organic matter and air are present together. At the same time, while the superficial combustion is going on, fermentation and putrefaction are performing their work in the midst of the mass by means of the developed germs of the original microbes, which the reader must note, are in some instances killed by oxygen. Gradually the phenomena of destruction are at last accomplished through the work of latent fermentation and slow combustion. This seems a complete demonstration of the passages of the organic into the inorganic world in the way of analysis, or taking the puzzle to pieces. In the opposite way of synthesis, or putting it together, the nearest approach yet made has been in the manufacture of those organic compounds already referred to, which had previously only been known as products of animal or vegetable life.

Polarity

It remains to show how the fundamental law of polarity affects the more complex relations of life and of its varied combinations. And here it is important to bear in mind that as the factors of the problem become more intricate, so also do the laws which regulate their existence and action. Polarity is no longer a simple question of attraction and repulsion at the two ends of a magnet or at the opposite poles of an atom. It appears rather as a general law under which as the simple condition becomes differentiated by evolution into the manifold, it does so under the influence of developing contrasts. For every *plus* there is a *minus*, for every like an unlike; one cannot exist without the other; and, although apparently antagonistic, harmonious order is only possible by their co-existence and mutual balance.

The Earth and Comets.

Perhaps it would be well to make this idea clear by an illustration. The earth revolves around the sun in its annual orbit under the influence of two forces; the centripetal, or force of gravity, tending to make it dart away into infinite space. During half the orbit the centripetal seems to be gaining ground on the centrifugal, and the earth is approaching nearer to the sun. If this continued it would revolve ever nearer and soon fall into the sun; but the centrifugal force is gradually recruiting its strength from the increasing velocity of the earth, until it first equals the centripetal, and finally outstrips it, and for the remaining half of the orbit, it is constantly gaining ground. If this went on, the earth would fly off into outer space; but the centripetal force in its turn regains the ascendency; and thus by the balance of the two forces our planet describes its beautiful ellipse. Comets, upon the other hand, are in some cases in a different position, being if one or the other force preponderates for long periods, alternately drawn into fiery proximity to the sun, or sent careening through regions devoid of heat.

Mr. Spencer says, "There is nowhere balanced judgment and a balanced action, but always a cancelling of one another by opposite errors."

Origin of Life.

The reader will now begin to understand the sense in which polarity applies to these complex conditions of an advanced evolution. To return, however, to the origin of life. The material to which all life is attracted, from the speck of protoplasm to the brain of man, is strictly a chemical production of atoms and molecules bound together by the same polar laws as those of inorganic matter. In like manner all the essential processes by which life lives, moves, and has its being, are equally mechanical and chemical. If the brain, receiving a telegram from without through the optic nerve, sends a reply along an other nerve which liberates energy stored up in a mucsle and produces motion, the messages are received and transmitted like those sent by a volatic battery along the wires of a telegraph, and the energy is stored up by the slow combustion of coal. All this is mechanical, inorganic and polar. But when we come to the conditions of life proper, we find the influence of polarity mainly in this: that as vitality develops from simpler into more specialized forms, it does so under the law of developing contrasts which are necessary complements of each other's existence. Thus as we ascend in the scale of life, we find two primitive polarities developed: that of plant and animal, and that of male and female.

To be continued.