

of life. Nor do we admit that spontaneous generation was "a *necessary* event in the process of the development of the earth," because we contend that so far as observation and experiment go, they can tell us nothing more about the nature and origin of life than they tell us about the origin of matter. And yet, notwithstanding the last words of Van Beneden and Pasteur, regarding the origination of entozoa and microbes from antecedent life, it is quite conceivable that with the progress of research and the development of more delicate and powerful instruments of observation, it may one day be demonstrated that spontaneous generation not only can occur, but actually does occur daily in millions of cases, in forms of life as far below microbes in size and structure as these are below the entozoa. Without hesitation, therefore, we can subscribe to the declaration of Huxley when he states: "With organic chemistry, molecular physics and physiology yet in their infancy, and every day making prodigious strides, I think it would be the height of presumption for any man to say that the conditions under which matter assumes the properties we call 'vital,' may not, some day, be artificially brought together."<sup>1</sup>

#### Artificial Production of Life.

Should, then, such a discovery be made, as is possible and conceivable—I do not say probable—should some fortunate investigator some day detect,

<sup>1</sup> "Lay Sermons," p. 366.

in the great laboratory of nature, the transition of inorganic into organic and animated matter, or should he, by some happy chance, be able to transmute non-living into living matter, would there be in such a discovery aught that would contravene revealed truth, or militate against any of the received dogmas of the Church?

To this question we can at once, and without hesitation, return an emphatic negative. The reply has, indeed, been indicated in the preceding pages, when discussing the views of the Fathers and the Schoolmen respecting spontaneous generation. Not only were they all fully persuaded of the fact of abiogenesis, in the case of certain of the lower forms of life, but they also laid down principles which are quite compatible with the origination from brute matter not only of the lower, but also of the higher animals. Far from being opposed to the Evolution of living from non-living matter, they, in many instances, favored it as the more probable hypothesis. But their views as to the efficient causes of such Evolution differed *toto cælo* from those entertained by modern monists and agnostics. The latter attribute to brute matter, which, by its very nature, is passive and inert, the power of passing unaided from a lower to a higher plane. They completely ignore the true formal and efficient causes of development, and base their theories exclusively upon a cause which is purely material. Not so the Fathers and Doctors of the Church. They tell us that: "The primordial elements alone were created in the strict sense of the term, and that the rest of nature was

gradually developed out of these, according to a fixed order of natural operation, under the supreme guidance of Divine administration." They teach that if spontaneous generation be, indeed, a reality, the matter which undergoes change, "having been proximately disposed, by the action of heat and of other causes, of itself evolves into act by Divine intervention, rather than that the causal action of an inanimate body should be efficacious towards the generation of life."

It is not, then, in the case of spontaneous generation, the principle of Evolution, but the misapplication of this principle, which has led to the grave philosophical errors into which so many modern evolutionists have fallen. None of the agnostic or monistic theories account for life. "They begin with organism, but organism connotes life. Whence then, this life? Take the first instance—and the first instance there must have been—of an inanimate chemical compound showing signs of life; say phenomena of cleavage and of subsequent gastræan inversion. How is it that this particular inanimate chemical compound has taken such a start? If matter evolved itself spontaneously into life, without aid of formal or efficient Cause, why have not the metamorphic rocks through all these æons of time shaken off the incubus of their primitive passivity, and wakened up into protoplasm, and thus secured to themselves the privilege of self-motion, internal growth, reproduction? Again, is it possible to imagine that brute matter, inert and purely passive, could by its own unaided exertion pass straight from the

laboratory into the kingdom of life? And if one mass could do it, why not all? Why do those venerable metamorphic rocks remain at the root of the genealogical tree, unchanged? Perhaps this may prove another instance of the *survival of the fittest*. Here, then, is the flaw. These recent theorists accept life as a fact; and they start with it. They are superstitiously contented to begin and end with the mystery, because they are either afraid or unwilling to acknowledge the operation of a formal and efficient Cause in the Evolution of material substances."<sup>1</sup>

As to the artificial production of living from non-living matter, of which sundry enthusiastic chemists have so fondly dreamed, it can be positively asserted that if ever effected it will be along lines quite different from those which certain over-sanguine speculators have indicated.

The great feat achieved by Wöhler, in 1828, in making urea—an organic compound, previously supposed to be the result of vital forces alone—from inorganic matter, was but the prelude of those brilliant triumphs of synthetic chemistry which since have so frequently astonished the world. During the past few decades, especially, organic compounds of the most marvelous complexity have been manufactured in the laboratory, until now there are not wanting chemists who affect to hope, that they will one day be able to rival nature herself in the number and complexity of her products. Their powers of analysis, we are willing to concede, are practically unlimited. They can tell us not only the composi-

<sup>1</sup> Harper's "Metaphysics of the School," vol. II, p. 747.

tion of the divers compounds of the mineral world, but they are also able to give us the formulæ of the most complex constituents of vegetable and animal tissue. And as time rolls on, the chemist's mastery over matter and the forces of nature grows apace, and often at a rate that is astonishing to the chemist himself. He now plays with atoms and molecules as a juggler manipulates spheres of brass, and so great is his knowledge of affinities and equivalences, so complete his command over the hidden forces of allotropism and isomerism, that he can, with the utmost ease, accomplish what a few years ago would have been regarded as thaumaturgy of the highest order.

Protoplasm.

The compound which has received the greatest share of attention, from those who have been looking forward to the ultimate production of animate matter, is protoplasm. This is the substance to which Huxley has given so much notoriety under the designation of "The Physical Basis of Life."

Chemically, protoplasm is composed of carbon, oxygen, hydrogen and nitrogen. At first it was regarded as a kind of albumen, called protein, and was viewed as a single compound of homogeneous structure. It was spoken of as "a kind of matter which is common to all living beings," plants as well as animals; "a single physical basis of life underlying all the diversities of vital existence." "It is," says Huxley, "the potter's clay," out of which all the Protean forms of animal and plant life are fashioned.

Now, however, all this is changed. Protoplasm, it has been discovered, is not a single chemical compound with a definite and constant molecular structure, as was formerly taught. It is something vastly different. Microscopy and micro-chemistry have demonstrated that it is composed of a dozen or more substances, all of the greatest complexity. Far from being a single, homogeneous, transparent, structureless jelly, as described some years ago, and as still conceived by many who glibly talk about it, protoplasm, on the contrary, is a most highly organized structure, composed of complex liquid matter, granules, fibres, tubules, nuclein, and exhibiting in the living organism the most marvelous properties and the most wonderful activity. Indeed, protoplasm is a word that has almost vanished from the nomenclature of the cytologist. And in its place we have a score or more of new terms, to designate the constituents of what was but a few years ago regarded, even by the ablest exponents of science, as a single chemical compound of uniform composition. Thus, in lieu of protoplasm, we now have nuclein, pyrenin, and nucleoplasm; paranuclein, amphipyrenin, and karyoplasm, not to mention other compounds equally remarkable and complicated.

Such being the case, there is obviously no more hope of the chemist eventually being able to manufacture protoplasm, than there is of his being able to produce a polyp or a sea-urchin. He may build up from their simple elements complex compounds like urea, formic acid and indigo, because these have a definite molecular composition, but he can no more

make even a microscopic speck of protoplasm than he can fashion a rose or a butterfly.

Another consequence follows from the recent discoveries regarding protoplasm, and that is, the impossibility of originating life. If protoplasm is the simplest form of matter in which life exists, and if it is impossible to manufacture even the smallest particle of inanimate protoplasm, much less living protoplasm, it is *a fortiori* impossible to produce an entity exhibiting the phenomena characteristic of a living being.

For a similar reason, all likelihood of discovering evidence in favor of spontaneous generation has vanished. One may not, indeed, assert that it is entirely impossible. So far, it is true, protoplasm is the simplest substance which exhibits the phenomena of life, and we know of no kind of protoplasm which is simpler than that above mentioned. This, however, does not imply that there are not simpler forms of living matter. It is possible that there are living beings so simple that their composition may be represented exactly by a chemical formula; that they have a fixed, definite, molecular arrangement, like some of our complex organic compounds. It is possible that ultimately the chemist may discover the proximate constituents of such a substance, and be able to indicate how it is produced by nature, or how it may be manufactured in an inanimate condition in the laboratory. All this is possible, all conceivable. The past triumphs of organic chemistry, as well as our increasing knowledge of the lower forms of life, permit such an assumption. Yet it is only an assump-

tion. But so far as protoplasm is concerned, so far as there is question of the simplest unicellular moner which the microscopist has yet observed, we can unhesitatingly say that spontaneous generation is impossible. We may conceive how simple chemical forces can produce a chemical compound of even the greatest complexity. But we cannot picture to ourselves how such forces, unaided and alone, can produce an intricate organism, such as is even the lowest representative of animate nature. It were as easy to imagine a watch evolving itself spontaneously from the raw material which composes it; to picture a man-of-war arising spontaneously from the piles of wood and stores of iron and brass in a shipyard.

If, then, spontaneous generation is not a chimera, it is something which has far humbler beginnings than has ordinarily been supposed. If it ever took place at all, it must have occurred in some homogeneous chemical compound which was the product of known chemical forces. And if this be true, the time which elapsed from the formation of such a living compound, until its development into the highly organized protoplasm which we now know, must have embraced as many long æons as intervened between the advent of protoplasm and the first appearance of the higher orders of animal and plant life.

The mechanical theory of life, it is thus seen, is far from being borne out by the known facts of science. It assumed the homogeneity of protoplasm; and in this it was in error. It assumes the origin of life by the action on the elements of forces which

are resident in matter, and teaches that living differs from brute matter only in the relative complexity of molecular structure, and of the higher integration of forces which is the natural result of complexity of structure. When such assumption denies, as it usually does deny, the existence of any force outside of matter; when it makes matter, as such, the sole cause of the countless evolutions which have occurred in the past development of the universe; when it attempts, as does Virchow, to resolve the production of the divers forms of life from inanimate matter into a question of mere mechanics; when, finally, it not only ignores, but positively denies, the ever present, unceasing action of the Divine administration; then we can as unhesitatingly pronounce it false, as it is demonstrably so in predicating homogeneity of protoplasm. Under such circumstances it is as difficult for the theist, without assuming the intervention of a miracle, to conceive of the formation of a single chemical compound from its constituent elements, not to speak of the spontaneous origination of living matter, as it was to Darwin to picture to his mind the production of an elephant by the sudden flashing of certain elemental atoms into living tissues. Given matter, however, and forces competent to transform matter—such forces, as well as the matter which they affect, being always under the guidance of the Divine administration—and there is nothing in the theory of the origination of living from not-living matter, that is contrary either to faith or philosophy. On the contrary, such a view is, as we have seen, quite in harmony with both the one and the

other. Under such conditions the spontaneous generation, either in the laboratory of nature or in that of the chemist, presents no greater difficulties than does the conversion of a bar of steel into a magnet. In both cases it is God who is the author of the change, yet God acting not directly, but through the instrumentality of natural agencies; through the "seminal reasons" and the laws of nature which He conferred on matter in the beginning.