

thing akin to the idea contained in this beautiful passage, has been uppermost in my mind in the penning of the following pages. A kindred thought has been dominant in every topic discussed. It has given me courage to undertake, and strength to complete, a work which otherwise would never have been attempted, and which, during the whole course of its preparation, I would fain have seen intrusted to more competent hands. My sole, my ardent desire, has been to show that there is nothing in true science, nothing in any of the theories duly accredited by science and warranted by the facts of nature, nothing in Evolution, when properly understood, which is contrary to Scripture or Catholic teaching; that, on the contrary, when viewed in the light of Christian philosophy and theology, there is much in Evolution to admire, much that is ennobling and inspiring, much that illustrates and corroborates the truths of faith, much that may be made ancillary to revelation and religion, much that throws new light on the mysteries of creation, much that unifies and coördinates what were otherwise disconnected and disparate, much that exalts our ideas of creative power and wisdom and love, much, in fine, that makes the whole circle of the sciences tend, as never before, *ad majorem Dei gloriam*.

PART I.

EVOLUTION, PAST AND PRESENT.

CHAPTER I.

NATURE AND SCOPE OF EVOLUTION.

Early Speculation Regarding Nature and Man.

FROM time immemorial philosophers and students of nature have exhibited a special interest in all questions pertaining to the origin of man, of the earth on which he lives and of the universe to which he belongs. The earliest speculations of our Aryan forefathers were about the beginnings of things. Questions of cosmology, as we learn from the tablets preserved in the great library of Assurbanipal in Nineveh, received their meed of attention from the sages of ancient Assyria and Babylonia. And long before Assyria, Babylonia and Chaldea had reached the zenith of their power, and before they had attained that intellectual eminence which so distinguished them among the nations of the ancient world, the peoples of Accad and Sumer had raised and discussed questions of geogony and cosmogony. They were a philosophical race, these old Accadians and Sumerians, and, as we learn from the records which are constantly being exhumed in Mesopotamia,

they had a breadth of view and an acuteness of intellect, which, considering their environment and the age in which they lived, were simply astonishing. Well have they been called "the teachers of Greece," for all the subtlety of thought and keenness of perception, all the love of science, art and letters, which were so characteristic of the Greek mind, were possessed in an eminent degree by those old pre-Babylonian masters who thought and taught and wrote many long generations before Abraham left Ur of the Chaldees, untold centuries before Thales taught and Homer sang. And the musings of the mystic Hindu along the banks of the Indus and the Ganges; the meditations of the Egyptian priest in the temples of Memphis and Heliopolis; the speculations of the wise men of Attica and Ionia, all turned more or less on the same topics which possessed such a fascination for the sages of old Chaldea, and which were discussed with such zest in the schools of Nineveh and Babylon.

Whence are we? Whither are we going? Whence this earth of ours and the plants and animals which make it their home? Whence the sun, and moon, and stars—those distant and brilliant, yet mysterious representatives of our visible universe? Did they have a beginning, or have they existed from all eternity? And if they had a beginning, are they the same now as they were when they first came into existence, or have they undergone changes, and, if so, what are the nature and the factors of such changes? Are the development and mutations of things to be referred to the direct and immediate

action of an all-powerful Creator, or are they rather to be attributed to the operation of certain laws of nature—laws which admit of determination by human reason, and which, when known, serve as a norm in our investigations and experiments in the organic and inorganic worlds? Are there special interventions on the part of a Supreme Being in the government of the universe, and are we to look for frequent, if not constant, exhibitions of the miraculous in the natural world? Has God's first creation of the universe and all it contains, of the earth and all that inhabits it, been followed by other creations at divers periods, and if so, when and where has such creative power been manifested?

These are a few of the many questions about the genesis and development of things which men asked themselves in the infancy of our race. And these are questions which philosophers are still putting to themselves, and which, notwithstanding the many thousands of years during which they have been under discussion, have to-day a greater and more absorbing interest than in any former period of human history.

It is beside my present purpose to enumerate the various theories in science to which the discussion of the questions just propounded have given rise, or to dwell on the divers systems of philosophy and religion which have been the natural outgrowth of such or similar discussions. Materialism, Pantheism, Emanationism, Hylozoism, Traducianism, Atheism and other isms innumerable have always been, as they are to-day, more or less closely identified with many

of the speculations regarding the origin and constitution of the visible universe. And despite the great advances which have been made in our knowledge of nature and of the laws which govern the organic and inorganic worlds, many of the questions which so agitated the minds of the philosophers of the olden time, are still as far from solution as they were when first proposed. New facts and new discoveries have placed the old problems in a new light, but have diminished none of their difficulties. On the contrary, the brilliant search-light of modern science has disclosed new difficulties which were before invisible, and proved that those which were considered before are in many respects far graver than was formerly imagined. With the advance of science, and the progress of discovery, many problems, it is true, find their solution, but others, hydra-like, arise in their place and obtrude themselves on the scientist and philosopher, and will not down until they have received due recognition.

Comprehensiveness of Evolution.

To answer some, if not all, of the questions just alluded to; to explain the phenomena of the cosmos; to solve the problems of life and mind, and throw light on the beginning and development of things, recourse is now had to a system of philosophy and science which, within the last few decades, has attained a special vogue under the name of Evolutionism, or, as its adepts prefer to call it, Evolution. Evolution, we are assured, is the magic word which explains all difficulties; the "open sesame" which ad-

mits us into the innermost arcana of nature. We are told of the Evolution of the earth, of the Evolution of the solar system, of the Evolution of the sidereal universe. Men discourse on the Evolution of life, the Evolution of the organic and inorganic worlds; the Evolution of the human race. We have similarly the Evolution of society, government, religion, language, art, science, architecture, music, literature, chemistry, physics, mathematics, and the various other branches of knowledge as well. We now talk of the Evolution of the steamboat, the locomotive, the dynamo, the machine-gun, the telescope, the yacht and the bicycle. All that ministers to comfort, luxury and fashion are objects of Evolution. Hence it is that we hear people speak of the Evolution of the modern house-furnace and the cooking-stove; the Evolution of the coach and the dog-cart; the Evolution of seal-skin sacques, high-heeled shoes and of that periodically recurrent *bête noire* of fond husbands and indulgent papas—the latest pattern of a lady's hat. Anything which has developed or improved—and what has not?—is spoken of as having come under the great law of Evolution, and, presto! all is explained, and any little enigmas which before may have existed instantly vanish.

As is evident from the foregoing, Evolution may mean a great deal, or it may mean little or nothing. It is manifestly a term of very general application and may often be very misleading. Properly understood it may be of signal service to the searcher after truth, while, on the contrary, if it is constituted an ever-ready *deus ex machina*, capable of solving all

difficulties, it may lead to inextricable confusion and tend to obscure what it was designed to illumine. It is obvious, too, that we must restrict the meaning of the word Evolution, for it does not come within the scope of our work to speak of Evolution in general. We have to consider only a particular phase of it, and for this purpose it is important to have a definition of what is meant by Evolution.

Evolution Defined.

Herbert Spencer, who is regarded by his admirers as the great philosopher of Evolution, defines it to be a "change from an indefinite, incoherent homogeneity, to a definite, coherent heterogeneity; through continuous differentiations and integrations."¹ And the operation of Evolution," continues the same authority, "is absolutely universal. Whether it be in the development of the earth, in the development of life upon its surface, in the development of society, of government, of manufactures, of commerce, of language, of literature, science, art, this same advance from the simple to the complex, through successive differentiations, holds uniformly. From the earliest traceable cosmical changes down to the latest results of civilization, we shall find that the transformation of the homogeneous into the heterogeneous, is that in which Evolution essentially consists."²

Spencer's definition, however, exact as it may be deemed, embraces far more than we shall have occasion to consider, for my task shall be confined

¹ "First Principles," p. 216.

² *Id.*—p. 148.

to the Evolution of the earth and its inhabitants, and only incidentally shall I refer to cosmic Evolution. Indeed, properly speaking, the Evolution of which I shall treat shall be limited almost entirely to organic Evolution, or the Evolution of the plants and animals which live or have lived on this earth of ours. All references, therefore, to the Evolution of the earth itself from its primeval nebulous state, and to the Evolution of organic from inorganic matter, will be mostly by way of illustration, and in order to show that there is no breach of continuity between organic Evolution, which is my theme, and inorganic or cosmic Evolution.

Literature of Evolution.

The subject is a vast one, and to treat it adequately would require far more space than I have at my disposal. It has indeed a literature and a bibliography of its own—a literature whose proportions are already stupendous, and are daily, and with amazing rapidity, becoming more colossal. For the past third of a century, since the publication of Darwin's "Origin of Species," it has been uppermost in the minds of everyone given to thinking on serious subjects. Everybody talks about Evolution, and more write about it than about any other one subject.

More than five thousand distinct works, relating to Goethe, who died in 1832, have, it is estimated, already been printed, and additions are continually being made to this enormous number. Peignot, who wrote in 1822, declared that up to his day more than eighty thousand distinct works had appeared on the

history of France. The number of volumes that have been written on our Civil War can soon be enumerated by myriads, and still other works on the same subject are being published in rapid succession. Startling, however, as these figures may appear, they are insignificant in comparison with those relating to the subject of Evolution. In every language of the civilized world, books, brochures, and magazine articles innumerable, have been written on Evolution, and the number of publications of various kinds specially treating of this topic is now almost beyond computation.

Such being the case, it will evidently be impossible for me to do more than give a brief sketch of the history of Evolution, and of its status to-day in the world of thought, religious, scientific and philosophic. It is something that one cannot develop *dans un mot*, as a certain French lady expected of a noted savant, when asking him to explain his system of philosophy. For a similar reason, also, I can discuss but briefly the bearings of Evolution on religion and Catholic dogma. I shall, therefore, have to limit myself to a few general propositions, and refer those who desire a more exhaustive treatment of the subjects discussed, to the many elaborate and learned works that have been given to the world during the past few decades.

Freedom From Bias in the Discussion of Evolution.

I may here be permitted, before going further, to remind the reader that it is of prime importance, in the discussion of the subject of Evolution, especially

in its relation to religion and dogma, for one to weigh fairly and dispassionately the arguments and objections of evolutionists, and to divest one's self of all bias that may proceed from prejudice or early education, to consider the question on its merits, and not to let one's mind be swayed by preconceived, or it may be, by erroneous notions. Let the value of the evidence adduced be estimated by the rules of logic and in the light of reason. This is essential. In the discussion of the subject during the past thirty and odd years much has been said in the heat of controversy, and on both sides, that had no foundation in fact. There have been much exaggeration and misrepresentation, which have given rise to difficulties and complications that might easily have been avoided if the disputants on both sides had always been governed by a love of truth, and the strict rules of dialectics, rather than by passion and the spirit of party. Misguided zeal and ignorance of the true teachings of the Church, always betray one into making statements which have no foundation in fact, but, in the discussions to which the subject of Evolution has given rise, there has often been exhibited, by both the defendants and the opponents of the theory, a lack of fairness and a bitterness of feeling that are certainly not characteristic of those whose sole desire is the attainment of truth. Such polemics have injured both parties, and have delayed a mutual understanding that should have, and would have, been reached years ago if the ordinary rules of honest controversy had always been inviolably observed.

Now that the smoke of battle is beginning to vanish, and that the participants in the contest have time to reckon results and to look back to the causes which precipitated the struggle, it is found, and I think generally conceded, that certain of the representatives of science were the ones who brought on an imbroglio for which there was not the slightest justification. But it is the old story over again—hatred of religion concealed behind some new discovery of science or enveloped in some theory that, for the nonce, was raised to the dignity of an indisputable dogma. It was not, it is true, so much the chief representatives of science who were to blame as some of their ill-advised *asseclæ*, who saw in the new teachings an opportunity of achieving notoriety, and, at the same time, of venting their spleen against the Church and casting obloquy on religion and Scripture.

CHAPTER II.

EARLY EVOLUTIONARY VIEWS.

First Studies of Nature.

EVOLUTION, as we now know it, is a product of the latter half of the present century. It would, however, be a mistake to imagine that Minerva-like it came forth from the brain of Darwin or Spencer, or that of anyone else, as the fully-developed theory which has caused so great a stir in the intellectual world. No; Evolution, as a theory, is not the work of one man, nor the result of the work of any body of men that could be designated by name. Neither is it the product of any one generation or epoch. On the contrary, it has been the joint achievement, if such it can be called, of countless thinkers and observers and experimenters of many climes and of many centuries. It is the focus towards which many and divers lines of thought have converged from the earliest periods of speculation and scientific research down to our own. The sages of India and Babylonia; the priests of Egypt and Assyria; the philosophers of Greece and Rome; the Fathers of the early Church and the Schoolmen of the Middle Ages, as well as the scholars and discoverers of subsequent ages, contributed toward the establishment of the theory on the basis on which it now reposes.

This being the case, it will help us to a more intelligent appreciation of the theory to take a brief retrospect of the work accomplished by the earlier workers in the field, and to review some of the more important observations and discoveries which led up to the promulgation of Evolution as a theory of the universal application which is now claimed for it. Such a review will likewise serve another purpose. We are often disposed to imagine that all the great discoveries and generalizations in science are entirely the result of modern thought and investigation. We forget that the way has been prepared for us by those who questioned nature thousands of years ago, but who, not having the advantages or appliances of modern research, were unable to possess themselves of her secrets. We underrate and disparage the work of the earlier students and speculators, because we are oblivious of the fact that they planted the germ which we see developed into the full-grown tree, because we do not realize that we are reaping what others have sown. All great movements in the world of thought are, we should remember, simply the integration of infinitesimals; the summation of an almost infinite series of factors which are ordinarily ignored or disregarded. The successful generalizer and the framer of legitimate scientific theories are, as a rule, those who avail themselves of the data and patient indications of others, who accumulate and correlate disjointed and independent observations which, separately considered, have little or no value, and which tell us little or nothing of the operations of nature and nature's laws. Thus

Kepler's laws were based on the observations of Tycho Brahe; Newton's great discovery of the law of universal gravitation was founded on Abbé Picard's measurement of the earth's meridian; and Leverrier's discovery of the planet Neptune was suggested by the perturbations which various astronomers had observed in the motion of Uranus. So, too, is it, but to a greater extent, in respect of the theory of Evolution. It is the result not only of the observations of the immediate predecessors of those who are now regarded as the founders of the theory, but of data which have been amassed and of reflections which philosophers have been making since our Aryan forefathers first began to interrogate nature and seek a rational explanation of the various mutations which were observed to characterize the earth's surface and its inhabitants.

Evolution Among the Greeks.

Thales, who was one of the first philosophers that attempted a natural explanation of the universe, in lieu of the myths which had so long obtained, taught that all life had its origin in water. Anaximander, who flourished six centuries B.C., seems to forestall certain evolutionary theories which were taught twenty-five hundred years later. "The first animals," τὰ πρῶτα ζῶα, he tells us, "were begotten in moisture and earth." Man, according to the same philosopher, "must have been born from animals of a different form, ἐξ ἄλλοειδῶν ζῶων, for, whereas other animals easily get their food by themselves, man alone requires long rearing. Hence, had

man been originally such as he is now, he could never have survived." He first propounded the theory of "fish-men," which, in a modified form, was adopted by Oken. Anaximenes, a pupil of Anaximander, made air the cause of all things, while Diogenes of Appolonia held that all forms of animal and plant life originated from primordial slime—the prototype of Oken's famous *Urschleim*. Anaxagoras sought the beginnings of animated nature in germs which preëxisted in nature, and were distributed throughout the air and ether. In Empedocles, who is sometimes spoken of as the father of the Evolution idea, we find the germ of what Darwin calls "natural selection,"¹ and what Spencer denominates "the survival of the fittest." With the representatives of the Ionian schools, he was a believer in spontaneous generation, or abiogenesis, but he approximated more closely to the teachings of modern Evolution than did any of his predecessors or contemporaries. He recognized the gradual development of the higher from the lower forms of life, and taught that plants made their appearance before animals.

Aristotle's Observations.

But the greatest of the Greek naturalists, as he was also the greatest of Greek philosophers, was

¹ In his "Physics," II, cap. VIII, Aristotle refers to natural selection and the survival of the fittest, as taught by Empedocles and others, as follows: "For when the very same combinations happened to be produced which the law of final causes would have called into being, those combinations which proved to be advantageous to the organism were preserved; while those which were not advantageous perished, and still perish, like the minotaurs and sphinxes of Empedocles."

Aristotle. Unlike Plato, who laid special stress on *a priori* reasoning as the source of true knowledge, even in the natural and physical sciences, he insisted on observation and experiment. "We must not," he tells us in his "History of Animals," "accept a general principle from logic only, but must prove its application to each fact. For it is in facts that we must seek general principles, and these must always accord with facts. Experience furnishes the particular facts from which deduction is the pathway to general laws."

When we consider how happy the Stagirite was in his generalizations from the meager facts at his command, how remarkable was his prevision of some of the most important results of modern investigation, how he had not only a true conception of the modern ideas of Evolution, but had likewise a clear perception of the principle of adaptation, when we remember that he was cognizant of the analogies, and probably also of the homologies between the different parts of an organism, that he was aware of the phenomena of atavism and reversion and heredity, and that he foreshadowed the theory of epigenesis in embryonic development, as taught by Harvey long ages afterwards, when we call to mind all these things, we are forced, I repeat, to conclude that the immortal Greek not only fully understood the value of induction as an instrument of research, but also that he was quite as successful in its use, considering his limited appliances for work, as was any one of his successors who lived and labored in more favored times.

He, then, and not Empedocles, should be regarded as the father of the Evolution theory. The poet-naturalist of Agrigentum made, indeed, some observations in embryology, the first recorded, and may thus have been led to some of his fortunate guesses at the truth of Evolution; but there is reason to believe that most, if not all of his theories, were based on a *a priori* speculation rather than on experiment. He had by no means the wide acquaintance with nature which so distinguished Aristotle; neither did he possess the logical acumen, nor the skill in inductive reasoning we so much admire in the Samian philosopher. So far as was possible in his time, the Stagirite based his evolutionary views on observation and experiment, rather than on metaphysical ratiocination, and this is more than can be said of any of his predecessors, whether of the Ionian, Pythagorean or Eleatic schools, or of those immediately subsequent.¹

Mediæval Writers.

The foregoing views of the Greek philosophers found acceptance at a later date with the philosophers of Rome, and prevailed, with but slight modifications, during the entire period of the Middle Ages. They were commented on by a number of Arabian writers, notably Avicenna, Avempace, Abu-

¹ For an exhaustive exposition of the views of the Greeks, on the subjects discussed in the foregoing paragraphs, consult Zeller's "Philosophy of the Greeks." See also Ueberweg's "History of Philosophy."

bacer,¹ and Omar "the learned," as well as by many of the Schoolmen, especially Albertus Magnus. The last-named scholar was remarkable for his extended knowledge of nature. Besides discussing the theories which had been framed by his predecessors, he was a keen observer and skillful experimenter, and it is not too much to say that he contributed more towards the advance of science than anyone who had lived since the time of Aristotle.

The illustrious pupil of Albertus Magnus, St. Thomas Aquinas, deserves a special mention here for his teachings respecting organic Evolution. Accepting the views of Aristotle, St. Gregory of Nyssa and St. Augustine, regarding the origin and development of animal and plant life, he laid down principles concerning derivative or secondary creations, which

¹ In a curious philosophical romance Abubacer writes as follows on the birth of what he designates the "nature-man:" "There happens to be," he says, "under the equator an island, where man comes into the world without father or mother. By spontaneous generation he arises directly, in the form of a boy, from the earth, while the spirit, which, like sunshine, emanates from God, unites with the body, growing out of a soft, unformed mass. Without any intelligent surroundings, and without education, this 'nature-man,' through simple observation of the outer world, and through the combination of various appearances, rises to the knowledge of the world and of the Godhead. First, he perceives the individual, and then he recognizes the various species as independent forms, but as he compares the varieties and species with each other, he comes to the conclusion that they are all sprung from a single animal spirit, and, at the same time that the entire animal race forms a single whole. He makes the same discovery among the plants, and finally he sees the animal and plant forms in their unity, and discovers that among all their differences they have sensitiveness and feeling in common; from which he concludes that animals and plants are only one and the same thing." How like unto many modern speculations this fancy of the old Arab philosopher!

scientists and theologians now recognize to be of inestimable value. As we shall have occasion, in the sequel, to examine at length the teachings of the Angelic Doctor on this topic, it will suffice for the present simply to advert to them, and to signalize in advance their transcendent importance.

CHAPTER III.

FOSSILS AND GIANTS.

Early Notions Regarding Fossils.

IN the beginning of the sixteenth century geological phenomena began to attract more attention than they had hitherto received. Special interest was centered in fossils, which were so universally distributed over the earth's surface, and their study contributed materially towards placing the theory of Evolution on a firmer basis than it ever before possessed. Aristotle and other Greek writers had, indeed, made mention of them, but did not, as it appears, devote to them any particular study.

Theophrastus, a pupil of Aristotle, supposed them to be due to "a certain plastic virtue" of the earth, which possessed the power of fashioning inorganic matter into organic forms.

The distinguished painter, Leonardo da Vinci, one of the most gifted men that ever lived, was among the first to dispute the absurd theories which were currently accepted regarding the nature and origin of fossils. "They tell us," he says, "that these shells were formed in the hills by the influence of the stars; but I ask, where in the hills are the stars now forming shells of distinct ages and species? And how can the stars explain the origin of gravel,