

à a point de discontinuité dans ses parties, ou qui, du moins, n'en a toujours pas eu, s'il est vrai que, par suite de quelques espèces perdues, il s'en trouve quelque part. Il en résulte que les espèces qui terminent chaque rameau de la série générale tiennent, au moins d'un côté, à d'autres espèces voisines qui se nuancent avec elles. Voilà ce que l'état bien connu des choses me met maintenant à portée de démontrer. Je n'ai besoin d'aucune hypothèse ni d'aucune supposition pour cela : j'en atteste toutes naturalistes observateurs.

3. In a remarkable essay¹ Meckel remarks—

"There is no good physiologist who has not been struck by the observation that the original form of all organisms is one and the same, and that out of this one form, all the lowest as well as the highest, are developed in such a manner that the latter pass through the permanent forms of the former as transitory stages. Aristotle, Haller, Harvey, Kiemeyer, Autenrieth, and many others have either made this observation incidentally, or, especially the latter, have drawn particular attention to it, and drawn therefrom results of permanent importance for physiology."

Meckel proceeds to exemplify the thesis, that the lower forms of animals represent stages in the course of the development of the higher, with a large series of illustrations.

After comparing the Salamanders and the perenni-branchiate *Urodela* with the Tadpoles and the Frogs, and enunciating the law that the more highly any animal is organized the more quickly does it pass through the lower stages, Meckel goes on to say—

"From these lowest Vertebrata to the highest, and to the highest forms among these, the comparison between the embryonic conditions of the higher animals and the adult states of the lower can be more completely and thoroughly instituted, than if the survey is extended to the Invertebrata, inasmuch as the latter are in many respects constructed upon an altogether too dissimilar type; indeed they often differ from one another far more than the lowest vertebrate does from the highest mammal; yet the following organs will show that the comparison may be also extended to them with interest. In fact, there is a period when, as Aristotle long ago said, the embryo of the highest animal has the form of a mere worm, and, devoid of internal and external organization, is merely an almost structureless lump of polype-substance. Notwithstanding the origin of organs, it still for a certain time, by reason of its want of an internal bony skeleton, remains worm and mollusk, and only later enters into the series of the Vertebrata, although traces of the vertebral column even in the earliest periods testify its claim to a place in that series."—*Op. cit.* pp. 4, 5.

If Meckel's proposition is so far qualified, that the comparison of adult with embryonic forms is restricted within the limits of one type of organization; and, if it is further recollected, that the resemblance between the permanent lower form and the embryonic stage of a higher form is not special but general, it is in entire accordance with modern embryology; although there is no branch of biology which has grown so largely, and improved its methods so much since Meckel's time, as this. In its original form, the doctrine of "arrest of development," as advocated by Geoffroy Saint-Hilaire and Serres, was no doubt an over-statement of the case. It is not true, for example, that a fish is a reptile arrested in its development, or that a reptile was ever a fish; but it is true that the reptile embryo, at one stage of its development, is an organism which, if it had an independent existence, must be classified among fishes; and all the organs of the reptile pass, in the course of their development, through conditions which are closely analogous to those which are permanent in some fishes.

4. That branch of biology which is termed Morphology is a commentary upon, and expansion of, the proposition that widely different animals or plants, and widely different parts of animals or plants, are constructed upon the same plan. From the rough comparison of the skeleton of a bird with that of a man by Belon, in the sixteenth century (to go no further back), down to the theory of the limbs and

¹ "Entwurf einer Darstellung der zwischen dem Embryozustände der höheren Thiere und dem permanenten der niederen stattfindenden Parallelen." *Beiträge zur Vergleichenden Anatomie*, Bd. II. 1811.

the theory of the skull at the present day; or, from the first demonstration of the homologies of the parts of a flower by C. F. Wolff, to the present elaborate analysis of the floral organs, morphology exhibits a continual advance towards the demonstration of a fundamental unity among the seeming diversities of living structures. And this demonstration has been completed by the final establishment of the cell theory, which involves the admission of a primitive conformity, not only of all the elementary structures in animals and plants respectively, but of those in the one of these great divisions of living things with those in the other. No *a priori* difficulty can be said to stand in the way of evolution, when it can be shown that all animals and all plants proceed by modes of development, which are similar in principle, from a fundamental protoplasmic material.

5. The innumerable cases of structures, which are rudimentary and apparently useless, in species, the close allies of which possess well developed and functionally important homologous structures, are readily intelligible on the theory of evolution, while it is hard to conceive their *raison d'être* on any other hypothesis. However, a cautious reasoner will probably rather explain such cases deductively from the doctrine of evolution, than endeavour to support the doctrine of evolution by them. For it is almost impossible to prove that any structure, however rudimentary, is useless—that is to say, that it plays no part whatever in the economy; and, if it is in the slightest degree useful, there is no reason why, on the hypothesis of direct creation, it should not have been created. Nevertheless, doubled as is the argument from rudimentary organs, there is probably none which has produced a greater effect in promoting the general acceptance of the theory of evolution.

6. The older advocates of evolution sought for the causes of the process exclusively in the influence of varying conditions, such as climate and station, or hybridization, upon living forms. Even Treviranus has got no further than this point. Lamarck introduced the conception of the action of an animal on itself as a factor in producing modification. Starting from the well-known fact that the habitual use of a limb tends to develop the muscles of the limb, and to produce a greater and greater facility in using it, he made the general assumption that the effort of an animal to exert an organ in a given direction tends to develop the organ in that direction. But a little consideration showed that, though Lamarck had seized what, as far as it goes, is a true cause of modification, it is a cause the actual effects of which are wholly inadequate to account for any considerable modification in animals, and which can have no influence at all in the vegetable world; and probably nothing contributed so much to discredit evolution, in the early part of this century, as the floods of easy ridicule which were poured upon this part of Lamarck's speculation. The theory of natural selection, or survival of the fittest, was suggested by Wells in 1813, and further elaborated by Matthew in 1831. But the pregnant suggestions of these writers remained practically unnoticed and forgotten, until the theory was independently devised and promulgated by Darwin and Wallace in 1858, and the effect of its publication was immediate and profound.

Those who were unwilling to accept evolution, without better grounds than such as are offered by Lamarck or the author of that particularly unsatisfactory book, the *Vestiges of the Natural History of the Creation*, and who therefore preferred to suspend their judgment on the question, found in the principle of selective breeding, pursued in all its applications with marvellous knowledge and skill by Mr Darwin, a valid explanation of the occurrence of varieties and races; and they saw clearly that, if the explanation would

apply to species, it would not only solve the problem of their evolution, but that it would account for the facts of teleology, as well as for those of morphology; and for the persistence of some forms of life unchanged through long epochs of time, while others undergo comparatively rapid metamorphosis.

How far "natural selection" suffices for the production of species remains to be seen. Few can doubt that, if not the whole cause, it is a very important factor in that operation; and that it must play a great part in the sorting out of varieties into those which are transitory and those which are permanent.

But the causes and conditions of variation have yet to be thoroughly explored; and the importance of natural selection will not be impaired, even if further inquiries should prove that variability is definite, and is determined in certain directions rather than in others, by conditions inherent in that which varies. It is quite conceivable that every species tends to produce varieties of a limited number and kind, and that the effect of natural selection is to favour the development of some of these, while it opposes the development of others along their predetermined lines of modification.

7. No truths brought to light by biological investigation were better calculated to inspire distrust of the dogmas intruded upon science in the name of theology, than those which relate to the distribution of animals and plants on the surface of the earth. Very skillful accommodation was needful, if the limitation of sloths to South America, and of the ornithorhynchus to Australia, was to be reconciled with the literal interpretation of the history of the deluge; and, with the establishment of the existence of distinct provinces of distribution, any serious belief in the peopling of the world by migration from Mount Ararat came to an end.

Under these circumstances, only one alternative was left for those who denied the occurrence of evolution; namely, the supposition that the characteristic animals and plants of each great province were created, as such, within the limits in which we find them. And as the hypothesis of "specific centres," thus formulated, was heterodox from the theological point of view, and unintelligible under its scientific aspect, it may be passed over without further notice, as a phase of transition from the creational to the evolutionary hypothesis.

8. In fact, the strongest and most conclusive arguments in favour of evolution are those which are based upon the facts of geographical, taken in conjunction with those of geological, distribution.

Both Mr Darwin and Mr Wallace lay great stress on the close relation which obtains between the existing fauna of any region and that of the immediately antecedent geological epoch in the same region; and rightly, for it is in truth inconceivable that there should be no genetic connection between the two. It is possible to put into words the proposition, that all the animals and plants of each geological epoch were annihilated, and that a new set of very similar forms was created for the next epoch, but it may be doubted if any one who ever tried to form a distinct mental image of this process of spontaneous generation on the grandest scale, ever really succeeded in realizing it.

Within the last twenty years, the attention of the best palæontologists has been withdrawn from the hodman's work of making "new species" of fossils, to the scientific task of completing our knowledge of individual species, and tracing out the succession of the forms presented by any given type in time.

Those who desire to inform themselves of the nature and extent of the evidence bearing on these questions may consult the works of Rüttimeyer, Gaudry, Kowalewsky,

Marsh, and the writer of the present article. It must suffice, in this place, to say that the successive forms of the Equine type have been fully worked out; while those of nearly all the other existing types of Ungulate mammals and of the *Carnivora* have been nearly as closely followed through the Tertiary deposits; the gradations between birds and reptiles have been traced; and the modifications undergone by the *Crocodylia*, from the Triassic epoch to the present day, have been demonstrated. On the evidence of palæontology, the evolution of many existing forms of animal life from their predecessors is no longer an hypothesis, but an historical fact; it is only the nature of the physiological factors to which that evolution is due which is still open to discussion. (T. H. H.)

II. EVOLUTION IN PHILOSOPHY.

Definition.—The modern biological doctrine of evolution, which regards the higher forms of life as gradually arising out of the lower, owes its chief philosophic significance to the fact that it renders definite and precise one part of a general theory of the world viewed as an orderly succession of events or as a process of becoming. This theory is put forward as an answer to one of the two problems of philosophy conceived as an interpretation of real existence. The first of these problems concerns itself with what may be called the static aspect of the world, and inquires into the ultimate nature of all reality (matter and mind), viewed as coexistent and apart from time. The second problem treats of the dynamical aspect of the world, and has to do with the process by which the totality of things has come to be what it is, and is still being transformed. It is this latter problem which the various theories of evolution seek to solve.

The most general meaning of evolution may be defined as follows: Evolution includes all theories respecting the origin and order of the world which regard the higher or more complex forms of existence as following and depending on the lower and simple forms, which represent the course of the world as a gradual transition from the indeterminate to the determinate, from the uniform to the varied, and which assume the cause of this process to be immanent in the world itself that is thus transformed. All theories of evolution, properly so called, regard the physical world as a gradual progress from the simple to the complex, look upon the development of organic life as conditioned by that of the inorganic world, and view the course of mental life both of the individual and of the race as correlated with a material process. This definition covers roughly the principal historical systems bearing the name of evolution, as well as others which have hardly as yet been characterized by this title.

It is clear by this definition that we cannot now press the etymological force of the word. Evolution has no doubt often been conceived as an unfolding of something already contained in the original, and this view is still commonly applied to organic evolution both of the individual and of the species. It will be found that certain metaphysical systems of evolution imply this idea of an unfolding of something existing in germ or at least potentially in the antecedent. On the other hand, the modern doctrine of evolution, with its ideas of elements which combine, and of causation as transformation of energy, does not necessarily imply this notion. It may be remarked that some of the arguments brought against the modern doctrine rest on the fallacious assumption that the word is still used in its etymological sense, and that consequently that which evolves must contain in some shape what is evolved (*e.g.*, inorganic matter must contain life and consciousness).

Evolution is thus almost synonymous with progress,

though the latter term is usually confined to processes of development in the moral as distinguished from the physical world. Further, this idea, as Mr Spencer remarks, has rather a subjective than an objective source, since it points to an increased *value* in existence as judged by our feelings. At the same time, inasmuch as conscious and more particularly human life is looked on by the evolutionist as the highest phase of all development, and since man's development is said to be an increase in well-being and happiness, we do not greatly err when we speak of evolution as a transition from the lower to the higher, from the worse to the better. Another respect in which the whole process of evolution may be said to be a progress is in its relation to our perceptions as æsthetic spectators, the higher phases of the process being the more varied, the fuller, and the more perfect. Apart from these subjective estimates, evolution is first of all as a whole a progress from the lower to the higher, in the sense that it is a substitution of a complex for a simple type of existence; and it is such a progress, secondly, in the narrow sense of organic development if not in the wider sense of cosmic development, inasmuch as all advance implies a larger measure of adaptation and so of permanence.

Problems solved by Evolution.—The hypothesis of evolution aims at answering a number of questions respecting the becoming or genesis of things. Of these the first is the problem of explaining change, that is to say, of accounting for that incessant process of transformation which the world manifests. The form which this question has commonly taken is, "What is motion, and how does it arise?" The second inquiry relates to the factor of intelligible order in the world, to the existence of general classes of things, including minds, of universal laws, and finally to that appearance of a rational end towards which things tend. Thirdly, it is necessary to account for the origin of organic beings which appear to be subordinated to different principles from those which control inorganic bodies. Lastly, we have the apparent mystery of a genesis of conscious minds in dependence on physical bodies. These are the principal inquiries which the various theories of evolution aim more or less completely at answering. As a subordinate question, we may mention the meaning of human history, and its relation to physical processes.

Evolution, Creation, and Emanation.—In seeking to answer these questions, the hypothesis of an evolution of the cosmos with all that it contains competes, in part at least, with two other principal doctrines respecting the origin of the world. These are the theory of direct creation by a personal Deity and that of emanation.

It is clear that the doctrine of evolution is directly antagonistic to that of creation. Just as the biological doctrine of the transmutation of species is opposed to that of special creations, so the idea of evolution as applied to the formation of the world as a whole, is opposed to that of a direct creative volition. It substitutes within the ground which it covers the idea of a natural and necessary process for that of an arbitrary volitional process.

The theory of a personal Creator answers the questions enumerated above by referring the form of the world to an act of direct creation. As an extreme doctrine, it views matter as well as form as the product of divine volition; in a modified form, it conceives the Deity as simply fashioning the uncreated material of the world; and in a still more restricted form, it regards the universal laws or forms which are impressed on things as co-eternal with the Deity. Advancing knowledge has gradually limited the sphere of direct creative activity, by referring the present order of the world to the action of secondary causes. Hence this theory only now competes with the hypothesis of evolution at one or two points, more especially the production of living forms, the origin of the human mind, and

the nature of history,—which last is conceived as somehow controlled by divine action in the shape of Providence. The question how far the doctrine of evolution, in its most extended and elaborate form, absolutely excludes the idea of creative activity need not be dwelt on here. It is sufficient to say that the theory of evolution, by assuming an intelligible and adequate principle of change, simply eliminates the notion of creation from those regions of existence to which it is applied.

The doctrine of emanation, which had its origin in the East, and was developed by the Neoplatonists, Gnostics, and Cabalists, is a philosophic transformation of the idea of an original creation of the world. It regards the world as a product of the divine nature, and so far it is a theory of creation. On the other hand, it conceives of this production as necessary, and analogous rather to a physical than to a moral action. In this respect it agrees with the doctrine of evolution. It further coincides with this doctrine in the recognition of a scale of existence. It differs from this last inasmuch as it reverses the order of evolution, by making the original stage the most perfect and all later stages a succession of degradations. In one respect, the theory of emanation has a curious relation to that of evolution. As we have seen, the process of evolution is from the indeterminate to the determinate. This is often expressed as a progress from the universal to the particular. Thus the primordial matter assumed by the early Greek physicists may be said to be the universal substance out of which particular things arise. The doctrine of emanation again regards the world as a process of particularization. Yet the resemblance here is more apparent than real. The universal is, as Mr Spencer remarks, a subjective idea; and the general forms, existing *ante res*, which play so prominent a part in Greek and mediæval philosophy, do not in the least correspond to the homogeneous matter of the physical evolutionists. The one process is a logical operation, the other a physical. The theory of emanation, which had its source in certain moral and religious ideas, aims first of all at explaining the origin of mental or spiritual existence as an effluence from the divine and absolute spirit. In the next place, it seeks to account for the general laws of the world, for the universal forms of existence, as ideas which emanate from the Deity. By some it was developed into a complete philosophy of the world, in which matter itself is viewed as the lowest emanation from the absolute. In this form it stands in sharp antithesis to the doctrine of evolution, both because the former views the world of particular things and events as essentially unreal and illusory; and because the latter, so far as it goes, looks on matter as eternal, and seeks to explain the general forms of things as we perceive them by help of simpler assumptions. In certain theories known as doctrines of emanation, only mental existence is referred to the absolute source, while matter is viewed as eternal and distinct from the divine nature. In this form the doctrine of emanation approaches, as we shall see, certain forms of the evolution theory.

Forms of Doctrine of Evolution.—Let us now see how the doctrine of evolution deals with the problems of becoming as above defined. And here it becomes necessary to distinguish between different ways of formulating and interpreting the idea of evolution. The various modes of conceiving and interpreting the idea of a natural evolution of things depend on the answers given to three principal questions respecting the nature and causes of the process. These are:—I. How far is the process a real objective one? II. What is the nature of that reality which makes the content, so to speak, of the process of evolution? and III. How is the process effected?

I. First of all, very different views may be taken of the reality of the process of becoming, generation, and transfor-

mation. On the one side we have the extreme view of the Eleatics, that there is no such thing as change or individual object, that real being is one and unchangeable, and that what appears like the formation and destruction of things is an illusion of the senses. At the other extreme we have the view that all reality consists in the process of becoming, or self-realization, and that nothing persists save this law of evolution itself. Between these two extremes there lie a number of intermediate conceptions, as that of a varying and progressive activity, of a persistent force, or of a gradual manifestation of an unchanging substance. The reality of the process is viewed in a peculiar light from the stand-point of modern Subjective Idealism, which regards time as nothing but a mental form. It is to be added that the process of cosmic evolution may present different degrees of reality. Thus to the ancient atomists the real part of the process is the combination of atoms. There is no absolute generation or destruction of things. Further, the evolution of the world of sensible qualities (colour, &c.) of things, is illusory, and has only a subjective existence in our sensations. The modern scientific doctrine of evolution carries out this view of its reality, both by its conception of the material world as objectively real only in its forces and movements, and by its doctrine of the conservation of energy, which teaches that amid all change and transformation there is something (though not necessarily a metaphysical thing) which persists.

II. Secondly, the view of evolution will vary according to the conception of that substance or real thing which enters into the process and constitutes its essential content. We have said that the problems of being and becoming (*esse* and *fiere*) are distinct, yet they cannot be discussed in perfect isolation. More particularly our idea of becoming must be determined by our notion of that existing reality which underlies the process.

It follows from our definition of evolution that its main problem is to conceive of material and mental development in their mutual relation. There are various ways of effecting this result. First of all, the material and the mental may be regarded from a dualistic point of view as perfectly distinct kinds of reality. According to this view, physical evolution as taking place in the inorganic world, and mental evolution as unfolded in man's history, are two unconnected processes. Further, the fact of their correlation in organic development must either be left unexplained altogether, or can only be referred to the arbitrary action of some supernatural power.

Opposed to this dualistic conception of reality there are the monistic conceptions, which conceive of all parts of the process of evolution as homogeneous and identical. Of these the first is the materialistic, which assumes but one substance, and regards mind as but a property or particular manifestation of matter. On this view, mental evolution is simply one phase of material, and the whole course of cosmic evolution may be described as a production of mind out of matter.

The next monistic conception is the spiritualistic, which assumes but one substance—mind, and resolves the reality of the material world into a spiritual principle.¹ According to this way of looking at the world-process, material and mental evolution are but two continuous phases of one spiritual movement. From the operation of inanimate nature up to human history it is the same spiritual reality which manifests itself.

Finally, there is the monistic conception in the narrow modern sense, viz., that which views the material and the mental as two sides of one and the same reality. Accord-

¹ Of course, there is a transition from the dualistic theory to the spiritualistic in those doctrines which allow a certain reality to matter, but only as something dead or existing potentially.

ing to this view, physical evolution as manifested in the material world, and mental evolution as seen in human life, may each be regarded as a two-sided process. The first is simply that part of the process in which the material side is most conspicuous; the second, that in which the mental side is so. This monistic conception shows itself in a number of forms,—from the crude semi-mythological conception of a cosmic organism or world-animal, which is at once body and soul, up to the metaphysical doctrine of one substance with two attributes.

III. In the third place, the form of the doctrine of evolution will vary according to the conception of the force or activity which effects the process. This point, though closely related to the last, is not identical with it. It is one thing to understand *what* it is that evolves itself, another thing to comprehend *how* the process is brought about. The latter point is of even greater importance for studying the various theories of evolution than the former.

There are two strongly contrasted modes of viewing all action or change. The first is drawn from the region of physical events, and views the change as conditioned by antecedents or efficient causes. This way of looking at change gives the mechanical view of evolution. The second is drawn from the region of our conscious volitions regarded as themselves undetermined by antecedent causes, and conceives of change as related to and determined by some end or purpose. This gives the teleological view of evolution. Although there is a natural affinity between the mechanical and the materialistic conception of evolution on the one side, and between the teleological and the spiritualistic on the other, they are not exactly co-extensive. The teleological view does no doubt imply the acceptance of a spiritual or quasi-spiritual principle; it refers the form and order of the world to the action of an intelligence (conscious or unconscious) which combines particular events as means to some comprehensive end. The mechanical view, on the other hand, does not necessarily imply the acceptance of a material principle as the one reality. It is applicable to mind as well as to body. Thus, on the determinist theory, mental development is as much a mechanical process as physical development.

Adopting this distinction between the mechanical and teleological conception of evolution as the essential one, we may roughly classify the various systems of evolution under the three heads:—(a), those in which the mechanical view predominates; (b), those in which the teleological view predominates; and (c), those in which the two views are combined in some larger conception.

(a) The mechanical interpretation may first of all be combined with a dualistic theory. Such would be Descartes's doctrine of evolution if it had been fully worked out on its mental side. It has been observed, however, that the mechanical view is naturally allied to the materialistic theory. Systems of evolution which arise out of this combination seek to resolve all appearance of order and purpose in the physical world into the combined effect of elementary forces or actions. They adopt a mechanical conception of organic bodies and their processes. Finally, they regard mental life and its evolution as a process of combination exactly analogous to that of physical evolution and closely correlated with a certain mode of this process. In this way they lead to a materialistic conception of man's origin and development as conditioned by physical circumstances and organic changes.

This thorough-going materialistic way of viewing the origin and formation of the world finds its greatest obstacle in the genesis of conscious life. Hence it has from the earliest been modified in one or two ways so as to provide a primordial source of sensation and thought, without, however, abandoning a strictly mechan-

cal view of the process. The first and crude form in which this modification presents itself is that of an original, thin, quasi-material substance (as ether), which may serve as the raw material, so to speak, of individual minds. The formation of these minds, however, is regarded as a strictly mechanical process, and related to that of physical evolution in the narrow sense. This theory of the origin of mental existence clearly approaches one of the forms of the doctrine of emanation already referred to. We have only to conceive of the primordial mental substance as the infinite being, transcending our finite world, and the doctrine becomes one of emanation. The second modification of this view consists in the theory that all parts of matter are endowed with sensibility, but that the sensations are not themselves (as teleological factors) the productive force in the process, but are rather the appendages of the real factors. The world forms itself according to strictly mechanical laws of combination, and the evolution of the various grades of mind in the organic region takes place by a composition of elementary feelings exactly similar to the process of material combination.

Before leaving the systems which are based on the mechanical view, a bare allusion must be made to a recent suggestion that all things consist ultimately of mental substance ("mind-stuff"), which combines itself both in the material world and in the region of conscious mind according to strictly mechanical principles.

(b) The second mode of viewing the process of evolution subordinates the idea of physical cause to that of final cause. The force which effects the continual production and transformation of things is conceived of more or less distinctly after the analogy of a rational impulse towards an end, and the process is regarded as determined or conditioned by this element of purpose.

This teleological view of evolution may be found in a number of systems of nature, which look on the material world as at once bodily and vital or spiritual, though it is often difficult to say whether any particular system should be called dualistic or monistic (in the narrow sense). Thus we have the evolution of the physical world referred to a vital principle which pervades all matter, and of which the essential nature is productivity, to a formative plastic principle which moulds the dead material into various shapes, to an organizing cosmic force, and so on. In all these conceptions, which appear to aim more especially at an explanation of organic forms and life, the element of purpose appears in a nascent shape. Nature is personified as a worker who aims unconsciously and instinctively at some dimly described end, such as the most various production, the progressive manifestation of life, and so on. In some of these systems, notably in the Aristotelian, the genesis of conscious mind is explained along with that of organic life by means of the supposition that mind is but the formative principle of the individual organism.

The idea of purpose becomes more definite, and, at the same time, a further step is taken towards the explanation of mental life as a development out of physical, in those systems which project a distinct spiritual principle into nature. The way in which this is frequently done is by means of the theory of a world-soul which animates the whole of the material world and directs all parts of its evolution. When this spiritual principle is regarded not only as the formative force, but also as the substantial source of conscious mental life, which has eternally coexisted with matter, we have, as already remarked, a pantheistic conception of evolution which, like another and cognate conception already referred to, approximates to one form of the emanation theory.

The full development of this way of regarding the world and its evolution as the work of a spiritual principle aiming

towards an end is to be found in certain doctrines of Objective Idealism, which resolve all material existence into a mode of mental existence—will and thought. These theories clearly simplify the conception of evolution to the utmost, by the identification both of the substantial reality which enters into all parts of the world-process, and of the rationale of all parts of the process itself. In the systems now referred to, the mechanical idea is wholly taken up into the teleological. Purpose is the highest law of things, and it is one purpose which manifests itself through all stages of the world's evolution,—in the region of inorganic nature, of organic life, and of human history. The first genesis of conscious life is explained as a particular moment in this process. In some spiritualistic systems an attempt is made to combine the mechanical (causal) and teleological ideas under the notion of logical development. Yet as a rule the teleological way of conceiving the process predominates.

(c) The systems which seek to combine the teleological and the mechanical view of evolution are for the most part based on the monistic idea that the material and the mental are two equally real aspects of one thing. It is clear that this conception of reality provides a way of doing justice to both modes of looking at evolution. In this manner the systems now spoken of are able to regard all parts of evolution as identical in nature, being alike links in a chain of purposeful effects.

This way of regarding the world in its process of evolution will vary according to the particular view of the one reality underlying material and mental phenomena. Thus we may have a universalistic conception of evolution as the two-sided activity of one undivided substance. This idea passes easily into a pantheistic view of the world-process as determined by a divine reason which is also the principle of necessity. In the second place, we may have an individualistic conception of this two-sided process, according to which the world arises out of the unceasing activity of an indefinite number of elements endowed with motion and sensation, and so comprehending a mechanical and a teleological factor. It has already been remarked, however, that this conception may be combined with a strictly mechanical view of evolution.

History of the Idea of Evolution.—The doctrine of evolution in its finished and definite form is a modern product. It required for its formation an amount of scientific knowledge which could only be very gradually acquired. It is vain, therefore, to look for clearly defined and systematic presentations of the idea among ancient writers. On the other hand, nearly all systems of philosophy have discussed the problems underlying evolution. Such questions as the origin of the cosmos as a whole, the production of organic beings and of conscious minds, and the meaning of the observable grades of creation, have from the dawn of speculation occupied men's minds; and the answers to these questions often imply a vague recognition of the idea of a gradual evolution of things. Accordingly, in tracing the antecedents of the modern philosophic doctrine we shall have to glance at most of the principal systems of cosmology, ancient and modern. Yet since in these systems the two inquiries into the *esse* and *feri* of the world are rarely distinguished with any precision, it will be necessary to indicate very briefly the general outlines of the system so far as they are necessary for understanding their bearing on the problems of evolution.

Mythological Interpretation.—The problem of the origin of the world was the first to engage man's speculative activity. Nor was this line of inquiry pursued simply as a step in the more practical problem of man's final destiny. The order of ideas observable in children suggests the reflection that man began to discuss the

"whence" of existence before the "whither." At first, as in the case of the child, the problem of the genesis of things was conceived anthropomorphically: the question "How did the world arise?" first shaped itself to the human mind under the form "Who made the world?" As long as the problem was conceived in this simple manner there was, of course, no room for the idea of a necessary self-conditioned evolution. Yet the first indistinct germ of such an idea appears to emerge in combination with that of creation in some of the ancient systems of theogony. (See article COSMOGONY.) Thus, for example, in the myth of the ancient Parsees, the gods Ormuz and Ahriman are said to evolve themselves out of a primordial matter. It may be supposed that these crude fancies embody a dim recognition of the physical forces and objects personified under the forms of deities, and a rude attempt to account for their genesis as a natural process. These first unscientific ideas of a genesis of the permanent objects of nature took as their pattern the process of organic reproduction and development, and this, not only because these objects were regarded as personalities, but also because this particular mode of becoming would most impress these early observers. This same way of looking at the origin of the material world is illustrated in the Egyptian notion of a cosmic egg out of which issues the god (Pha) who creates the world.

Indian Philosophy.—Passing from mythology to speculation properly so called, we find in the early systems of philosophy of India theories of emanation which approach in some respects the idea of evolution. Brahma is conceived as the eternal self-existent being, which on its material side unfolds itself to the world by gradually condensing itself to material objects through the gradations of ether, fire, water, earth, and the elements. At the same time this eternal being is conceived as the all-embracing world-soul from which emanates the hierarchy of individual souls. In the later system of emanation of Sankhya there is a more marked approach to a materialistic doctrine of evolution. If, we are told, we follow the chain of causes far enough back we reach unlimited eternal creative nature or matter. Out of this "principal thing" or "original nature" all material and spiritual existence issues, and into it will return. Yet this primordial creative nature is endowed with volition with regard to its own development. Its first emanation as plastic nature contains the original soul or deity out of which all individual souls issue.

Early Greek Physicists.—Passing by Buddhism, which, though teaching the periodic destruction of our world by fire, &c., does not seek to determine the ultimate origin of the cosmos, we come to those early Greek physical philosophers who distinctly set themselves to eliminate the idea of divine interference with the world by representing its origin and changes as a natural process. The early Ionian physicists, including Thales, Anaximander, and Anaximenes, seek to explain the world as generated out of a primordial matter which is at the same time the universal support of things. This substance is endowed with a generative or transmutative force¹ by virtue of which it passes into a succession of forms. They thus resemble modern evolutionists, since they regard the world with its infinite variety of forms as issuing from a simple mode of matter. More especially the cosmology of Anaximander resembles the modern doctrine of evolution in its conception of the indeterminate (τὸ ἀπειρον) out of which the particular forms of the cosmos are differentiated. Again, Anaximander may be said to prepare the way for more modern conceptions of material evolution by regarding his primordial substance as

¹ According to Ueberweg (who calls their systems Hylozoism), they all conceived of this matter as vital.

eternal, and by looking on all generation as alternating with destruction, each step of the process being of course simply a transformation of the indestructible substance. Once more, the notion that this indeterminate body contains potentially in itself the fundamental contraries—hot, cold, &c.—by the excretion or evolution of which definite substances were generated, is clearly a forecasting of that antithesis of potentiality and actuality which from Aristotle downwards has been made the basis of so many theories of development. In conclusion, it is noteworthy that though resorting to utterly fanciful hypotheses respecting the order of the development of the world, Anaximander agrees with modern evolutionists in conceiving the heavenly bodies as arising out of an aggregation of diffused matter, and in assigning to organic life an origin in the inorganic materials of the primitive earth (pristine mud). The doctrine of Anaximenes, who unites the conceptions of a determinate and indeterminate original substance adopted by Thales and Anaximander in the hypothesis of a primordial and all-generating air, is a clear advance on these theories, inasmuch as it introduces the scientific idea of condensation and rarefaction as the great generating or transforming agencies. For the rest, his theory is chiefly important as emphasizing the vital character of the original substance. The primordial air is conceived as animated. Anaximenes seems to have inclined to a view of cosmic evolution as throughout involving a quasi-spiritual factor. This idea of the air as the original principle and source of life and intelligence is much more clearly expressed by a later writer, Diogenes of Apollonia. Diogenes made this conception of a vital and intelligent air the ground of a teleological view of climatic and atmospheric phenomena. It is noteworthy that he sought to establish the identity of organic and inorganic matter by help of the facts of vegetal and animal nutrition. Diogenes distinctly taught that the world is of finite duration, and will be renewed out of the primitive substance.

Pythagoreans.—We may pass by that curious mode of conceiving the world as a development out of numbers regarded as active principles which was adopted by the Pythagoreans, since it is too remote from modern conceptions of cosmic evolution.²

Eleatics.—The Eleatics, Xenophanes, Parmenides, and Zeno need to be referred to here simply on the ground of their denial of all plurality and individuality in objects and of any real process of change, development, or transformation in the world. It may be added, however, that both Xenophanes and Parmenides have their way of regarding the origin of the cosmos and of animal and human life, though these conjectures are put forward as matters of "opinion," having to do with the illusory impressions of the senses only.

Heraclitus.—The next Greek thinker, Heraclitus, deserves a prominent place in a history of the idea of evolution. This writer distinctly sides with the Ionian physicists, as against the Eleatics, by asserting the reality of motion, change, and generation. He differs from the former, as Grote observes, by regarding the problem of change rather as one of ontology than of physics. Heraclitus conceives of the incessant process of flux in which all things are involved as consisting of two sides or moments—generation and decay—which are regarded as a confluence of opposite streams. In thus making transition or change, viewed as the identity of existence and non-existence the leading idea of his system, Heraclitus anticipated in some measure Hegel's peculiar doctrine of evolu-

² Grote calls attention to an analogue of this notion of number in Oken's *Elements of Physio-Philosophy*. See his *Plato*, i. p. 10, note E.