

III.—PURPOSE AND EVOLUTION.

By ARTHUR LYNCH.

BUFFON declared: *There is only one animal*, thus signifying in the epigrammatic French style the truth which formed the basis of Darwin's work, and for which Herbert Spencer sought to offer the interpretation in his theory of Evolution. Similarly it was said, I believe, by Kirchoff: There is only one science.* And again, in the realm of Psychology the central problem has seemed to me to be that of determining the basic mental operations by combinations of which the whole world of our knowledge may be built. These fundamental operations merge into instincts and automatic processes, so that here again we are brought to the contemplation of one continuous texture of development.

But if in ways thus indicated we gain at length some clear and connected views of the gradual progress of science and of civilisation, there is yet borne in a question deeper and more insistent than all the others which have excited our spirit. That is the question of Purpose, in which is wrapped up that of Ideals. It is related in a biographical note on Darwin that a friend once asked him whether he saw evidence of a mind behind all the phenomena which he had studied. A strange earnest expression came over Darwin's face; the question had evidently recalled intense preoccupations of old,

* Mechanics.

I had this in conversation many years ago in Germany from a friend of Kirchoff. Idealists would protest against the doctrine, but it is they who are more especially committed to it, for "objective" sciences but represent, in their view, the relations of ideas.

but he does not appear either on this occasion or on any other to have given utterance to any decided opinion. I once put the same question to one of the most distinguished of Darwin's disciples, who after reflexion answered: I believe the world to be *necessary*—a remark which contains more than immediately appears.

I have entitled my paper Purpose and Evolution, in order to suggest something of such inquietudes; for many followers of Herbert Spencer and Darwin seem to conclude that, though these great thinkers have not entirely satisfied our minds, yet they have at least exhausted the question as far as we are capable of comprehending it. Issuing, however, from the school of Darwin and Spencer myself I have gradually become more and more critical in regard to their philosophies, and long before beginning the present paper I had freed myself from submission to their mere authority. Some years ago I wrote: "The doctrine of Evolution has come to be accepted among thinking men as one of the commonplaces, as incontestable as the theory of gravitation, or the theory of the circulation of the blood. It will yet be one of the principles invariably assumed even in the diffusion of knowledge amongst common people . . . Spencer will then become a name as Pythagoras, Zeno, Archimedes, Galileo, are names: but his influence, as theirs, will persist; and it will have been his merit to have added to civilisation one of the sources of its perpetual enlightenment."

I am still able to subscribe to these words as applied to the drift of the Synthetic Philosophy, but with regard to what is often called the law of Evolution I will say: It is not a law, it is not even a well enunciated theory; it is at best a principle of classification, and it fails to furnish even a good system of classification. Let us consider the matter more closely. Spencer's own definition reads:

Evolution is an integration of matter and concomitant dissipation of motion; during which the matter passes from an indefinite, incoherent homogeneity to a definite, coherent

heterogeneity; and during which the retained motion undergoes a parallel transformation.*

How did Spencer arrive at this formulation? A question of the sort is always of interest in regard to the works of an author of power and originality, for no matter how closely we may study his theories and test his arguments we will find the veritable clue only when we have come upon the germinating idea from which the work has sprung. In the case of Herbert Spencer it is true that the Synthetic Philosophy, in the whole of its elaborate and frequently overcumbersome structure, becomes illuminated by this light from the source.

Briefly, I conjecture—and a passage in the *Principles of Psychology* seems to confirm the opinion—that Spencer, taking the amoeba as at one end of the animal scale and man at the other, sought to trace out the changes by which the lowest of these organisations might ascend to the highest, and to express the results in terms of the utmost generality. Had the matter been merely represented thus, it is improbable that the principle of Evolution would have received the almost universal acceptance which it has gained; but the argument was thence conducted in application to various provinces of life and of thought, with great bulk of exposition and in prodigious detail. But again for purpose of criticism it is necessary for us to reverse the process, to strip from the exposition of the principle all that occurs adventitiously or even by way of exemplification, and demand the demonstration of some causal operation.

It will, I think, be eventually recognised that no Law is here expressed, for, waiving the point, so important, of the absence of quantitative terms, there does not arise from the principle any method of predetermining, or of predicting, results. That there is no universal onward progress according

* From *First Principles*, II, XVII, §145 (1875). Spencer has several other definitions, corresponding in meaning. He also sought, in various passages, to implicate with Evolution the notion of increasing definiteness with regard to time and space.

to the principles of Evolution has been noted by the Spencerians themselves ; for finding instances in Nature which signify the inverse of Evolution they speak of degeneration. This is vague, but if we had a term more precise we would still be paying ourselves only with words.*

It is not difficult to indicate lines of criticism, each one of which might be profitably pursued in detail. In the first place Spencer seems to have considered the *amœba* a much more rudimentary being than it really is. It was formerly the custom to speak of these creatures as structureless, and various microbes are still so designated. Such words define less the animal's nature than the limits of our own observation. The more the powers of the microscope are increased, and the more these organisations are studied, the higher they seem to rise in the scale of development. Those who devote to them a prolonged and intelligent study are often inclined to attribute to them an active psychic life.†

* I am reminded of a surgeon who, operating for appendicitis and finding the appendix the only healthy organ in sight, recovered from his surprise and entitled the case, *pseudo-appendicitis*.

† Haeckel established the kingdom of *Protistæ* for organisms, neither animal nor vegetable. It is, however, now agreed that the *Protistæ* possess nuclei with complex structure. When we reach a nucleus we are already dealing with creatures far from simple. Dr. E. A. Minchin at the last meeting of the British Association said that though most biologists considered cytoplasm to represent the true living substance, there were many reasons for believing that the chromatin substance, invariably present in the nucleus, or occurring as grains, chromidia, scattered in the cytoplasm, represented the primary and essential living matter.

Sir Ray Lankester speaks of the complicated structure of diatoms possessing delicate, wonderfully sculptured coats of glass-like silica. Every free living unicell has a complete organisation—mouth, pharynx, renal organ, locomotive organ. G. C. Bourne in his *Herbert Spencer Lecture* (1910) points out that Spencer's assumptions were wrong with respect to the degree of heterogeneity in the germ cell.

Aikin, whose work with Hodge on unicells is admirable, was inclined to credit these with something analogous to rudimentary intelligence. Hering's theory of memory is based also on the supposition of psychic impressions in single cells. Amongst others who have considered the

Life of any degree must imply metabolism ; therefore, the apprehension and the transformation, as by digestion, of food, and the elimination of the waste. There must be movement, whether in regard to the organism as a whole or of its parts as between themselves ; and since these processes correspond to a certain form and ordered activity of organisation there must be response to stimulus ; there must be control of the consequent adjustments ; and, therefore, there must be co-ordination.

We are already far from a homogeneous amœba, and I feel assured that it is only the limitations of our own vision that prevent us from recognising a creature of marvellous complexity.

If we press the problem still more fundamentally we may inquire, for instance, how the change from one geometrical figure to another may be expressed in terms of Evolution. It would only be by some ingenuity of language that a change from one conic section to another, as from a circle to a parabola, or an hyperbola to an ellipse, could be indicated by variations of heterogeneity, co-ordinations, or by more definite relations of space and time. Similarly with regard to the changes of solid figures.

Furthermore the enunciation of the principle of Evolution takes no account of the question of mass ; but when attention has been directed to this factor it will be recognised as always influencing our conception of development.

These are not merely abstract speculations, for all variations

psychic element in unicells may be mentioned Métalnikow (*Archives de zoologie expérimentale*, vol. xlix, p. 373 (1912)) ; Prof. A. J. Stewart (*On the Physics and Physiology of Protoplasmic Straining in Plants*) ; Prof. W. B. Hardy ("The Physical Basis of Life," *Science Progress* (1906)) ; Prof. Gary N. C. Calkins (*Protozoa*, p. 301) ; Dr. G. Bohn (*La Naissance de l'Intelligence*, p. 103) ; Prof. H. S. Jennings (*The Behaviour of Lower Organisms*, p. 8) ; M. F. Washburn (*The Animal Mind*) ; A. Binet (*The Psychological Life of Micro-organisms*, p. 51) ; G. C. Crampton "On Paramœcia" (*Archiv für Protistenkunde*, 27th vol. (1912). Cf. also Prof. F. Darwin's Presidential Address to the British Association, 1908.

of size and shape, and hence all determinations of morphology depend ultimately on variations of mass and of geometric forms as implied in the relative positions of the components.* If then Evolution were a universal principle its operation would be found in these fundamental variations which underlie all visible changes.†

Let us consider a problem at the other end of the scale. We wish to ascertain, according to the principle of Evolution, the relative places in a scale of development of the intellect of John Stuart Mill and of Gram, the discoverer of the stain that bears his name; of Brougham, with his prodigious mental energy, and Dollond, the optician who produced the achromatic

* In fact a conception of this sort lies at the base of Naegeli's theory of development.

† That it is right to apply the test of Evolution at the most fundamental base has been recognised by none better than by Herbert Spencer himself. He says in *First Principles*: "The formation of molecules more and more heterogeneous during terrestrial evolution has been accompanied by increasing heterogeneity in the aggregate compounds of each kind, as well as an increasing number of kinds; and this increasing heterogeneity is exemplified in the compounds, non-nitrogenous and nitrogenous, out of which organisms are built."

It is in accordance with this expression that Mr. Raphael Meldola has written learnedly on the "Evolution of the carbon compounds."

But even here we are not at the lowest accessible level, and if the principle of Evolution were a law of Nature we should discover at the base the principle in operation in such a manner as to enable us to predict phenomena. The whole tendency of modern chemistry from the days of Lavoisier downwards through Dalton, Mendelejeff and Ramsay, has been towards a simplification of the composition of matter. The differences in compounds are eventually functions of the positions of the atoms. So that we are thus reduced to demand the demonstration of a law of Evolution in regard to geometrical figures as expressive of dynamic relations; and the law should be more clearly in evidence than at the juncture of any subsequent complications. Thus, for example, there are two compounds having the same formula, C_4H_{10} . These isomeric paraffins, butane and isobutane, owe their differences to different ways of arranging four carbon atoms. The qualities of the compounds do not change with change of position of the compound as a whole; but we feel we are entering into a secret of Nature when we discover the effect of change of position of the atoms.

microscope; of John Hunter, with his vast erudition and technical skill, and Corti, who defined the structure of the organ of hearing.

In each case the specialist, the man of more limited outlook, accomplished something essential that lay in the direction of the progress of science; but it would be difficult on that ground alone to place his mind higher in the scale of development. It has been seen that we must also take into account the compass and range, or what by analogy we might speak of as the *mass* of a man's work.

I have discussed the matter elsewhere,* and I will not now delay further than to point out that the difficulty arises from the want of determination of the terms of Evolution. Of two bodies that which has the less heterogeneity might have the better co-ordination and functions more readily adaptable to the exigencies of time and place; and there might be numerous intermediate grades produced by suitable variations of these factors.

What even is the definition of specialism? Let us consider a specialised region of a special subject such as the infinitesimal calculus; Boole, devoting himself to the study of differential equations, produces a useful text-book; Sophus Lie, taking a wider range, illuminates the whole subject in more masterly style; Riemann, deriving inspiration from considerations of physical science, covers a vast field of thought, and eventually brings to bear on the theory of numbers, for example, an apparatus quite beyond the power of a narrow specialist in that domain. To test the value of specialism requires a standard comparable to that of "work" in mechanics. In forming an estimation of any form of development it is necessary to refer to results. This may be thought to be implied, even if not expressed, in the principle of Evolution; it is, however, necessary to set it in clear relief.

The question of degeneration must not be lightly cast aside.

* In *Psychology: A New System* (1912).

Suppose, for example, that a philosopher, having observed a vast movement of people Eastward to the City, formulated a law which expressed that condition of things as prevailing throughout London. If then his attention were called to the fact of a vast movement in the contrary direction, he might content himself by saying these represented the inverse of the law. But if there were no means of ascertaining what individuals were likely to obey the law or to run counter to it, nor even what relative proportion existed, nor what cause or system of causes produced either one or the other effect, then the law would not be very helpful. But if, further, the greater proportion of citizens seemed to be moving not directly Eastward nor Westward, but in directions neither definite nor constant, then the value of the "law" would be *nil*, and great care would be necessary in order to derive from the formulation any service whatever.*

What has been said indicates the lines on which we should test the rigour of the demonstrations of Evolution. We find that the doctrine fails, and the reason may be expressed in general terms by saying that it presents us with a system of variables, which are not defined quantitatively, nor expressed in regard to mutual relations, nor determined in regard to the direction of activity. It is no more possible to formulate a law on such a basis than it is to offer the solution of a problem in algebra in which the unknowns are in greater number than the equations.†

* The conception of degeneration must be distinguished from that of simple inversion of the process of Evolution. This has been shown by a distinguished Belgian savant, M. Dollo, in his study of cephalopods. Cf. an article on the subject, "L'irréversibilité de l'Evolution," by Robert Douvillé in a recent number of the *Revue Scientifique*.

† The principle of Evolution has not even in zoology afforded any well-defined system of classification. The main lines of the orthodox classifications were laid down by Cuvier, who was not an evolutionist. Alfred Giard mentions three other important systems: that of Lacaze-Duthiers (based on the morphology of the adult); that of C. Semper (anatomo-embryogenic); that of Huxley (purely objective). He was not

The doctrine of Evolution has been closely associated with the spread of Darwin's ideas, but the connection is not inevitable. The theory of Natural Selection is generally supposed to indicate the causal processes by which organisms are conducted along the path of Evolution, and this theory is held by most biologists to be adequate even in the sense of excluding other factors.

The principles of the struggle for existence, and of the survival of the fittest, are so manifestly in evidence on every side that these phrases have become the common-places of speech. Neither is free from objection. It is a strain of language to speak of as arising from struggle, the power of beauty, the charm of a sweet voice, or the witchery of the feats of genius; and it is the more needful to emphasise this point because a school of writers of the present day have acquired celebrity on this misconception. Keats struck the mark, as so often in the wonderful flashes of his intuition, for example, in the phrase, "Gentlier-mightiest."*

Again with regard to the survival of the fittest; when fitness may depend on cunning, or adaptibility of conscience, or the ability to sleep five in a bed, or base egotism in time of danger; then we reach the conclusion, that often the fittest survive only because the survivors may be deemed the most fit.

In studies of Darwinism two questions seem to loom up with especial importance. An animal's mode of life is determined by its functions and its environment. Thus under certain conditions the ant-eater may flourish. But the possession of a rudimentary organ must generally be of detriment to the animal. Our problem is therefore to trace up, through the ages, the gradual development of an organ

satisfied with any of these and proposed the principle of embryogenic superposition. Giard was a Darwinist who recognised fully, as Darwin himself did, the value of the contributions of Lamarck.

* *Endymion*, Book III, near the beginning.

which step by step must be favoured by the environment, while at the same time conditions within the range of the environment permit the existence of the original type and of innumerable diverse types which have also developed from it. It may be possible to solve this problem, but not I think by the explanations hitherto advanced.

Another point is that which I heard expressed by one of the greatest of living biologists, M. Yves Delage, whose results in experimental parthenogenesis have become famous. He said that variation was like the movement of a ball suspended by innumerable little elastic strings. It is easy to cause a slight change of position, but beyond a certain limit it becomes more and more difficult to increase the deviation.*

Just as we may hold the doctrines of Evolution and of Natural Selection as distinct, so we may regard the phylogenetic theory† as not necessarily bound up with either. The evidence of phylogenetic development derived from a study of the embryo, so far from supporting Natural Selection as a sufficient cause, should prompt us rather to challenge this doctrine to make manifest its veritable service. Natural Selection plays its part here, but it is only a surface gloss over profound, determinate processes of growth and development.

Even the word Evolution has been used in senses which are at length synonymous merely with change.‡ So that, although

* It is this weakness of the doctrine of development, as originally conceived, that has given impulse to the theory of mutations. Prof. M. E. Castle (*Science*, 1905) says: "Mutations are permanent, variations transitory." And we find mutationists like Bateson dealing with variations in such a way as to scandalise old Darwinians, such as Poulton. But the mutation theory is not all satisfying.

† That of descent from the same origin.

‡ We have M. Houlléviq's "Evolution of the Sciences," which may be acceptable. But, for example, in regard to chemistry Glaser (1670) wrote: "Chemistry is the art of opening compounds by operations consisting in cutting, bruising, pulverising, alcoholising, scraping, sawing, precipitating, granulating, laminating, melting, liquefying, digesting,

I criticise the principle with rigour, yet I am sufficient of an Evolutionist to desire to save Spencer from his friends. I am also a Lamarckian though I think that Lamarck and Spencer, and nearly all their disciples, have exaggerated beyond measure the relative importance of the Lamarckian factors. I am a Darwinian, though I think that Darwin over-rated the rôle of Natural Selection. I am a Weismannist to the extent of appreciating the control he has exercised on Lamarckism and Darwinism. I am a Hugo de Vriesian in regard to mutation, although I think "spontaneous" mutations absurd.* I am a

infusing, macerating, etc." If we compare this conception with that of modern chemists we will not find a change from homogeneity to heterogeneity.

It is common to speak of the Evolution of Energy: Brunhes writes on the Degradation of Energy; Matout, with ideas not dissimilar, speaks of the Cycle of Evolution. Again, with another meaning, Lord Balcarres has published a book on the Evolution of Italian Sculpture. We even hear of the Evolution of the golf-ball.

* Both Darwinians and Weismannists have asserted with regard to their doctrines that no other explanation can be conceived. This reminds one of the old fallacious argument of the "sufficient reason." The word "Spontaneous" recalls "idiopathic" diseases, that is to say diseases that sprang up of their own accord. Bacteriological investigation is gradually lessening the number of idiopathic diseases; a clear view of the principles of Conservation of Energy and Conservation of Mass will likewise prove the baselessness of spontaneous phenomena. A famous biologist, Dr. Archdall Reid, discoursing on "Methods of Research" has combined both faulty methods indicated in one sentence. "The hypothesis that variations were normally spontaneous was the only relevant hypothesis which was compatible with the law of Evolution through natural selection" (*cf. British Medical Journal*, October 28th, 1912).

We may here also enter a caveat against the habit of some Darwinians claiming in favour of Natural Selection the operation of causes which may be unknown or undeterminable. An instructive example may be found in the history of researches on the sense of vision. Grant Allen in *The Colour Sense, Its Origin and Development*, puts forward the theory that the taste for bright colours has been derived by man from his frugivorous ancestors, who acquired it by exercise of their sense of vision upon bright-coloured food-stuffs. One may argue quite convincingly on these lines if all the uncertain and undetermined factors be conceded to operate in favour of the theory. But in an excellent little book on *Matter and Energy*, Mr. F. Soddy

Mendelian, though I do not believe that the Mendelians have been able in the restricted scope of their observations to cover the whole field of heredity. I think that each of the great men mentioned has lifted a corner of the veil; I do not think that any of them has seen Nature entire and whole.

I will now leave these questions and enter upon a new order of ideas, though with the intention finally of showing the inter-relation of all. Elsewhere in endeavouring to analyse to the fundamental process of the mind, I was led to ask many questions not merely as to the inner meaning of axioms but also as to the importance for geometrical science of certain simple forms, such as the straight line, the right angle, and the Cartesian co-ordinates. These questions brought me at length to a consideration of the conditions of the body and its relation to the physical world.*

Considering the body anatomically we find that it is in great part built up of a series of levers. The bones are the arms of the levers, the muscles supply the motive power. Yet the muscles are comparatively few in number—less than 450†

points out that the greatest sensitiveness to colours corresponds to those parts of the spectrum where the light energy is highest. Upon this fact one might build a theory of development distinct from that of Grant Allen, and even more convincing. Hence we should be circumspect about accepting either.

One of the most delightful chapters in the theory of Natural Selection is that relating to the colour of animals, as for instance when it is explained that Arctic animals are white. These arguments seem less ineluctable in view of the studies of A. Guilliermond and others on the mode of formation of pigments in the carrot, for example. They fail to explain moreover why the fur of a cat shut up in a refrigerator becomes white.

* Kindred speculations form an important part of the work of Ernst Mach, and he has shown the dependence of psychic and emotional states on physiological and chemical conditions. A school of ardent thinkers—the Biochemicals—are prosecuting like studies, and the work of Pawlow and the psychic-analysis of Freud are landmarks, however widely separately, on the same route.

† 446 muscles dissectible and describable according to an old anatomist, Keill.

in all—and the co-ordinations likely to be effected by them for the purposes of life may be subserved by a comparatively small portion of brain. This may be shown by various proofs, but the illustration of the great beasts of prey with their splendidly active life and their small brains may suffice. Mere muscular activity is not the end of life. The athlete is not the flower tip of the world.

The nerves to the muscles are but the lines of communication. The afferent nerves are indicators only, although their impressions have a distinct hedonic element. Even a life of sensation, however, would be meagre if confined to the separate impressions of such nerves. The blood, the glands, and the other tissues subserve the economy of the body. Exploring thus we find that, once provided the essentials of existence, man's chief development must be psychic.

The action of the muscles on the bones produces a great part of the visible external life of the man: that is to say, of the varied forms of his locomotion. Yet on the whole man is inferior to many of the beasts in locomotive power. The elephant is larger, the greyhound runs faster, the flea relative to its size is a greater jumper. The completeness of man's muscular equipment hinders its development in the form of simple but powerful locomotion. Therefore even in the muscular system his chief development lies in the variety of co-ordinations. Thus man becomes the tool-using animal. The use of tools brings him into contact with the varied conditions for their best use, and already man by that fact is launched on the road which leads at last to science. He has begun to subdue to his use the forces of Nature.

To burn the stages I will now say—for I have discussed it elsewhere—that the course of civilisation could be illustrated by tracing out those forms of acquisition which in its modern aspect we call positive science. A criterion of man's development is his control over natural forces.

Another domain of thought links on to this. Once on a

time travelling to Marseilles and beholding the beauty of a starlight night I fell to speculating on the distance of the stars.* My senses reeled in that abyss of thought. I turned then to think of the world of the molecules, and again my senses refused their office. I could use symbols, I could conceive neither of these worlds intuitively. Then I asked, why did these distances seem so great, or so small, even beyond the bounds of the conceivable. Humboldt speaks of the narrow limits of the solar system; and on the other hand we employ our microscopes to study the "giant" cells of Betz. Greatness or smallness have only relative† meanings, and that is relative also to the growth of our individual powers. I could imagine myself translated in a thought to the moon. If, as in fabled stories, we could be bodily transported there at once with no sensation intervening, then space would seem in that case to be annihilated.‡

We find arising from the foregoing discussion certain indications of criteria of development in man. We see that it is necessary to consider not merely the type of complexity

* Professor Hinks of Cambridge University found that fewer than twenty stars subtend at the opposite end of the earth's orbit (298,000,000 kilometres) an angle greater than one-eighteen thousandth of a degree.

† Herbert Spencer has an interesting passage on this matter in the *Principles of Psychology*.

‡ From these extreme speculations we may refer to an example which is so striking in our actual time—the flying machine. It seems to me possible to arrive at a development in regard to these machines which will mark as great advances as that of Atlantic steamers compared with the sailing boats with which man first navigated the coasts. We will then regard the world itself differently; we will assert our power over it more freely and more determinedly; our moral nature will in that respect become fortified, our intellectual regard more daring, comprehensive, deeper than now.

The question of the relativity of time opens up interesting speculations in allied domains, as, for example, in the study of physical problems by Lorentz. Some psychologists, notably Czolbe, have suggested that time is a fourth division of space. However, in a luminous article in *Mind*, 1876, "The Origin and Meaning of Geometrical Axioms," Helmholtz argues that it is not possible for us to form a conception of a fourth dimension.

but also the analogues of force and mass, as represented in the energy of the individual at the height of his output. We must not only know the intellectual voltage but also the strength of the current in order to measure the power. We estimate the result in regard to the control over the forces of nature.

This model may be thought to be based too exclusively on science, and it may be asked in what way are, not merely the fine physical excellences,* but also the arts—music, painting, sculpture, poetry, to be appraised? I would explain that here I have been trying to come to the framework of civilisation, the schema of its formation. In this regard the thinkers have been the artisans of our human progress, and greater than those of Kings, Powers, Principalities, and Dominions across the ages come the names of Thales, Pythagoras, Empedocles, Plato, Aristotle, Archimedes, Eratosthenes, Apollonius, Hipparchus; that wonderful pleiade of the Greek philosophers who once in the history of the world gave proof of the highest ethical devotion to truth.

But what of Homer, of Æschylus, Sophocles, Euripides, of Theocritus, and Moschus; of Phidias, Praxiteles, Apelles? These men gave to life its embellishment, its rounded fullness more? Yes something of its inspiration and reward. But the thinkers in their slow explicative toils, their flashes of illumination, were forming the fabric on which is built the progress of man.

Yet something still is wanting to give soul to that conception :

“ At the tip-top
There hangs by unseen film an orbéd drop
Of light ”

That is the Ideal ; that is the guiding star of Purpose.

* Amongst the criteria of development should be included beauty. At the height of physical accomplishment strength and beauty unite. At the summit of mental achievement there is harmony in the movement of thoughts. So profound and vital seems to me this truth, that it may well be the goal of our searching. The problem coalesces with that of Purpose.

Is Purpose to be found in human life? In dealing with a question so fundamental and yet so vital I do not know that the answer may not be given with as much assurance from one of the great inspirational poets—Sophocles, Keats—as from the most comprehensive of savants. But in regard to the poets the language of interpretation is less tangible, and values are more difficult to assess. Why, for instance, do I think especially of Sophocles and Keats?*

Can we take any steps towards demonstrating Purpose? Some of the attempts of theologians have been unfortunate, and the care of Providence in causing the rivers to run through the cities has remained to illustrate this mode of thinking.

I am not, however, afraid to take up anew the argument of design, though without committing myself to adherence to the views of those who have previously used it. Recently I read Bell on *The Hand*, an interesting book wherein one of the greatest of the physiologists endeavours to find evidence of design in the fine adaptation of its anatomical parts.

Possibly still more striking examples might be found—as for instance by Bell himself in comments on Paley—in other regions of anatomy; and one that particularly filled me with delight in my own experience was that of the little pulley in which the obliquus superior works in order to gain the necessary change of direction of its pull. It is as if a problem had been offered to a master artisan to obtain by the use of tensions only the movements of a universal joint, and as if the artisan not relying upon a general plan had pleased himself in this particular in the exercise of ingenuity. The hip joint, and the knee joint—"That wonder of the knee joint," as a distinguished neurologist once said to me—exhibit the problem of obtaining both rigidity and freedom of movement by

* Of Sophocles as the idealist of the wonderful Greeks, that race to whose records I look back with ever-increasing admiration; of Keats, as being in regard to the broad trend of things a great thinker, and the most divinely inspired of the poets of the world.

adjustments of tensions. Bell shows how in the production of the voice various functions separately developed must be co-ordinated. Sir Ray Lankester has explained two quite diverse modes of development of the organ of vision which have terminated in similar results.*

Bergson has pointed out the concordance necessary of two lines of development in the eye, one by which the outer structure is prepared to allow the rays of light to pass, and the other by which a process from the central nervous system is adapted to receive the impressions conveyed.†

* The development of vision in molluscs and vertebrates diverged long before the complete evolution of the eye, yet the process, though by adaptation of different structures, culminated in similar results. Cf. also Saint-Saëns on the snail's eye, which though a rudimentary organ of vision seems to be used in feeling. (Note in *Revue Scientifique*, 1912.)

† This kind of co-ordination has been in operation not only in regard to what one may call the main plan of development in the case cited, but also in regard to successive modifications. Dr. Mott has dealt with the matter in an article in the *Archives of Neurology*: "The Progressive Evolution of the Structure and Functions of the Visual Cortex in Mammalia." In *Felidae* Dr. Mott notes a specialisation of the fore limbs for prehension of their prey which would be less effective for the purpose without stereoscopic vision. In the case of the chameleon, the great Spanish histologist, Ramon y Cajal, has found that in the central area of the retina the cones become more delicate, and each cone is connected with a separate tripolar cell, and this again with a separate ganglion cell giving off an optic fibre. Dr. Wilfrid Harris has pointed out that this development is correlated with a special motor adaptation which is of service in seizing prey. M. Rochin-Duvigneaud, summarising the results of Ramon y Cajal's researches, says that Darwinism is inadequate to their explanation. Dr. Mott and Professor Sherrington, however, meet with no difficulty in solving the problem on Darwinian lines. The reason of these discrepancies is to be found—as has been already shown—in the lack of definition of the principle itself.

Recently (1912) Professor A. C. Geddes, speaking of certain theories of bone formation advanced by Ranvier and Müller and more recently by Retterer and Sir W. Macewen, said: If this idea of the osteoblast ultimately be proved correct it will be necessary for us to revise almost our whole conception of the course of organic evolution, of all histories and cell lineages.

Yet the establishment of some one or other theory, we may be assured, will be accepted with equanimity by Evolutionists, for there has grown up in regard to this a manner comparable to that of the old teleology.

The eyes have been developed in such a manner that the best conditions of vision correspond to the greatest energy of the rays from the sun. No doubt the principle of Natural Selection may operate here, but what is it that has given the impulse to variations in that direction, and what is it that, with this mobility of variation, keeps our spectrum so well defined in its narrow range?

Galen of old said, "Take three eggs, one of an eagle, another of a goose, and a third of a viper The eagle will soar to the highest regions of the air, the goose will betake itself to the marshy pool, and the viper will bury itself in the ground." Evidently then there are factors to be taken into account which are enormously more important in their determination than those of environment.

When various organisms submitted to the influences of the same environment develop each in its characteristic form there is in operation not merely a natural selection of favoured organisms by the environment but also, and more markedly, a purposive selection by the organism from the environment of the favouring forces and material. An oyster and a whale, for example, are placed in the same environment, but there is a wide difference in their adaptation of that environment, as evidenced not only in the greater mobility of the whale but also, curiously, in regard to the means of securing food. The principle is capable of the most extensive application; as wide in fact as that of Natural Selection. Thus a knight, living at a time when his power depended greatly on his ability to use the lance, would find it convenient to protect himself with armour. But if, whether due to the invention of gunpowder or to the establishment of a period of peace, armour became obsolete, the development of the man would become modified in accordance with the modification of his mode of life; but this change would be due not to the reaction of the environment upon him, but on his purposive modification of the environment itself.

Or again a child is born blind. It adapts itself to a certain

environment. Subsequently the child acquires vision. Here there is not merely a change in the child, there is a change in the environment which impresses its life. There are present surrounding us myriad forces of the environment represented by undulations of the ether, or of the air, of which we know nothing. We hang up in space a few vibrating chords, as in the eye or in the ear, and we gain some scanty rustlings which in some way not understood become transformed and "tremble into thought." And when the powers of the organism increase, and the first dim perception of light becomes developed into the keen vision of the eagle, the change has been progressively that of utilising forces that have been offered at every stage.

In considering the action of the environment, therefore, we should avoid the error of supposing that the organism is to the environment as the clay to the hands of the potter. The rôle of the environment, if less mandatory, is more resourceful and diverse. To fix the matter by an image we could say, the environment is not a drill-serjeant but a commissariat officer.

The most rigid upholders of the sufficiency of Natural Selection may agree with all this, and they may well claim that all is in accordance with Darwinism, for since the environment is a universal condition and Natural Selection has been defined only by results, any result whatever may be explained in these terms. I think, however, something may have been gained by pointing out the reciprocal influence of organism on the environment with regard to the availability of its forces.

Consider now the explanations of Natural Selection in the case of immunity from certain diseases: Those most susceptible to diseases succumb and leave us eventually with a stock better fitted to resist. I do not think, however, that this explanation, elaborated as it may be or adorned with statistics, goes to the root of the matter. The study of the mechanism of immunity is only at its beginnings but already highly interesting phenomena have been observed. Diseases are

mainly due to microbes, and one aspect of the process of immunisation, is the production in the blood of substances* which give the phagocytes an advantage in their fight with the microbes.

The ultimate origin of these substances is to be found in certain of the cells of the body. But there are many diseases which seem to be fairly recent in the history of our race, and there are others which are new to some secluded peoples. How is it that the cells have the power of reacting so as to eliminate these diseases which have been foreign to the whole long development of the race? The answer may be obtained from the study of the conditions of life of the simplest cells, and the mode of their incorporation in the human frame; and at the lowest level the principle of Natural Selection will again be found in operation.

Yes, but now to compress the argument, such examples as we have seen of developments long prepared, which would have no meaning or use unless co-ordinated with other developments prepared in quite different modes; conditions of effective life, such as immunity, produced from a deep base in view of contingencies in higher forms of life; and finally, as in the development of the embryo, the determined shaping to a destined end, not submitting to the impress of the environment but drawing with appropriate selection upon its resources; all this seems to me to point to the fulfilment of a determinate scheme of things, and to be fitly summarised by the term—Purpose.

With regard to such processes as the development of the apparatus of vision the advocates of Natural Selection may reply that amongst the variations to which the organism was liable Nature had conserved that which had been so advantageous in enabling the creature to orient itself in the world, and that the sense had been progressively improved. Apply

* As, for example, the opsonins of Sir Almroth Wright.

this style of reasoning to the discovery of the Mont Cenis tunnel by a denizen of the moon. Here we would have the "sport" of two sub-montane hollow processes, which having happened to meet midway were found to be adapted to the laying of rails and the use of rolling stock.

The rejoinder may be that there is no comparison between a local work undertaken by conscient agents and the objective processes of Nature. The actual visible artisan, however, may have no more knowledge of the engineer's plan or of its inspiration than has the cell of the cause that links it to a ganglion.

But the argument should be carried deeper. No process of fabrication is the result of a mechanical inevitable adjustment. Even in the realm of thought each step of reasoning is the outcome of tentative suggestions, followed by the acceptance of those which seem advantageous. Further, at the base of our intellectual life the factors of reasoning, or the elements of which these are composed,* are beyond our control; they arise, I will not say spontaneously, but necessarily, when the conditions are present. Natural Selection here becomes merged into the constitution of the world—its materials and what we call its laws. But this does not prevent us speaking of conscious and deliberate acts. And if, for example, the process of weaving cloth may thus be shown to be ultimately dependent on a selection of tentatives offered by forces whose modes elude us, yet we hold this process as a model of design, and its product as the fulfilment of a purpose.

The development of all organs requires the correspondence of development of separate parts: the harelips, the cleft palates, the colobomas, and various other defects that we meet with, show imperfections of the process which, however, as in these instances, may be not incompatible with life.

The argument from design does not lose even in cases where weakness is shown; as, for instance, in the lack of anastomosis

* I have called these the Fundamental Processes.

of the arterial branches in the brain and kidney; or in regard to the eye itself, of which Helmholtz said that it showed bad workmanship. The problem in animal creation has been broadly: Given certain materials, tissues of all kinds, limited in resistance, to form viable creatures capable of developing in their environment, and capable also of modifying the environment to their advantage. This problem has been solved throughout a wide gamut of existence, and with amazing abundance of illustration.*

Yes, says the Darwinist, but all that is explained by Evolution, and the forces are those arising in the chance play of Nature. Here we come to the pith of the matter. We have seen that there is no law of Evolution, no valid theory even; as to chances of Nature, how did Nature happen to have these chances, and whence came Nature?

All growth, whether determined by purpose or not, is yet brought about by a regular concordance of myriad forces whose operations do not occur by hazard.

If chances permitted these things, whence do the correspondences arise? From selection out of the infinity of chances? No. We are presented with problems that demand the concurrence of infinities of infinities of the regular ordering of things.

The amoeba we find to be a complex creature. Consider it in relation to its ultimate atoms, and their unceasing interplay of influences; it becomes myriadly complex. The chances of development within the environment by accretions and co-ordinations become infinite. How is it that man has developed, even through unlimited ages, to his present form?

* Linnæus estimated the number of species at not more than 4,000. Each generation of savants has multiplied the number. Prof. Pratt (*Science*, 1912) accounts for 522,400 species, and the actual number of animals therefore may well be 1,000 billions. It is a fact of deep significance that three-fourths of these are insects, and only a very small percentage mammals.

By continual determination at every stage of his fitness to the environment. Yes, but out of the numberless possibilities why did he assume his special form? And now that the stability of his type is attained, why do the mere chances sustain him? Why does it happen that after pulling an infinity of winning tickets, as he must, from Nature's lottery, one bad ticket at any step does not arrive to destroy the up-building of countless ages?

The doctrine of chances should be regarded not as the banner of a school of science but as the most helpless of all ineffective hypotheses, the most wretched of the superstitions.

I have shown that our fundamental processes are automatic, instinctive, and that we adopt the favourable happenings. But when we come to ordered chances, selected chances, determined chances, and chances utilised, we arrive at method; and method, if we suppose any meaning whatever in our life, any fundamental reality in existence, so that we may not find

"This world a fretful child's unreal dream,"

—then method implies Purpose.

Yet, even so, the Darwinist replies: Divest all this of the old theological spirit, the teleological bias, reduce it to a mode of progression, and you will then find that we expound the mechanism of the movement. And the sceptical psychologist, still more subtly remarks: Your very laws but imply the limitation of your faculties, they are but the modes by which you seek to catalogue phenomena; the world in itself lies beyond that, vast and void, inscrutable, an eternal sphinx, of which we know only that it smiles and smites:

No. This is not all. Conceiving our world in the most objective manner we find that in our groping towards knowledge we have discovered laws that express objective realities; but when we have discovered the mode of falling of heavy bodies we are not content to regard Nature as a world of bodies falling at hazard. The experiments of Galileo lead us

to the clear conceptions of Kepler, and these receive their explanation in the analysis of Newton; but we still demand to know what is the meaning of this Gravity of which one aspect has been revealed. In the early days of modern electrical science Euler applied his mathematics with the same facility as Evolutionists apply their principle in the biological world; but the greatest discoveries of all were still in reserve, and the researches of Oersted, Ampère, Faraday, Maxwell, and Hertz, have tended both to simplify our conceptions and vastly to widen the scope of their applications. In chemistry the names of Scheele, Lavoisier, Dalton, Mendelejeff, and Ramsay testify to a similar tendency.

And—impressive as Kant's view of the starry Heavens—this principle appears with deepening range more insistent and more inspiring; the discovery of reality is heralded by the feeling of a wondrous harmony of things.*

Here it may be said that in this mood of contemplation, and even in the conception of law itself, the subjective factor enters and throws its enchantment on the sight. That is true, and that is properly true, for we thus attain closer to the essential truth. Science is faulty, for it deprives the world of its meaning, when it restricts itself to its formulæ, its schemes, its diagrams, its forms of things, without recognising that however necessary these be to research and explication, they satisfy no more as the be-all and end-all than the dissection of the larynx gives to us the golden notes of the singer.

I have now led the way to the conclusion. In touching briefly upon the fields of research one cannot do more than indicate lines of thought. And in this manner passing in review the work of Lamarck, of Darwin, of Spencer, of Weismann, of Mendel, of de Vries, it seems to me that each has brought a

* Even in a science so tentative, and at first sight so arid, as Political Economy a philosophic mind may discover entrancing vistas. I have found few descriptions in literature so inspiring as certain inspired passages in Bastiat's *Harmonies*.

valuable contribution to the sum of our knowledge, that no one has offered a satisfactory solution of problems covered by the vague term Evolution. That, adapting the term of biologists, just as some principle of growth presides over ontogeny, so some profound design must explain phylogeny; that the clear recognition of this is already the beginning of a new wisdom; and though in all investigation we must bring a rigorous test to every link of our argument, yet we will find inspiration, and even guidance of method, in the search for wider harmonies, and in the belief of an all-pervading Purpose.

Summary.

Spencer is the only philosopher who has offered a fair tentative definition of Evolution. His definition is faulty in that it refers to the variation of different factors without indicating any method of estimating their relative dependence or importance.

The principle of Evolution apart from the difficulty of expressing it quantitatively lacks essentials necessary for a law. It may be regarded as a principle of classification, but it is imperfect even for that purpose.

Other philosophers have used the word almost at hazard, the only notion in common being that of change. Lamarck, Spencer, Darwin, Weismann, Mendel, de Vries, have all revealed processes of Nature seen from special standpoints; no one has given a clear, comprehensive, and convincing account of the development, physical and psychological, of the animate world.

One reason may be found in the tendency of savants to restrict their view not only to their department of science, but to the schematic forms by which they guide their arguments.

A step towards new paths of science will be found in the recognition, however vague, of a determinate Purpose expressing itself in the various forms of which our "laws of Nature" are partial indications.

Guiding lines are: broader generalisations with ampler

scope of applications, simplification of plan through greater complexities of examples; reconciliation of all wider harmonies of Nature; illumination which infuses with new meanings the position already gained, and shows correlations between remote facts.

The means include: Independence of authority; impatience of the principle of the "sufficient reason"; severe criticism of argument; the play of imagination forerunning the formal establishment of laws; experiment, whenever possible to gain new data or decide between disputed opinions; clear interpretation of the results of experiment.

In a more specialised sense with regard to seeking development and precision of Spencer's principle, due importance must be given to:

(1) The expression of psychic energy, and, though ancillary, of physical energy.

(2) The factors that favour increase of comprehensive intelligence, that is to say, the accord of the psychic energy with physical conditions.

(3) The estimation of these by reference to control over Nature.

(4) The value of "mass" and energy, considered in connection with complexity of type.

(5) The principle of continuous development; that is to say, that the stage attained must admit of the most facile adaptation to a higher.

(6) Beauty as a sign of higher development. This includes the principle of recognition of all harmonies. The basis lies partly in the operation of the fundamental process which I have called the hedonic principle, partly also in the application at a deep level of the principle of economy of means and effort.

(7) The outcome in our actual world, expressible in the form of the development of civilisation on a framework of science.

(8) In all this the intimation of, and the search for, a meaning, a goal, a Purpose.