ON SOME OF THE CONDITIONS OF MENTAL DEVELOPMENT.[1]

If you will carefully consider what it is that you have done most often during this day, I think you can hardly avoid being drawn to this conclusion: that you have really done nothing else from morning to night but *change your mind*. You began by waking up. Now that act of waking is itself a passage of the mind from an unconscious to a conscious state, which is about the greatest change that the mind can undergo. Your first idea upon waking was probably that you were going to rest for some time longer; but this rapidly passed away, and was changed into a desire for action, which again transformed itself into volition, and produced the physical act of getting up. From this arose a series of new sensations; that is to say, a change of mind from the state of not perceiving or feeling these things to the state of feeling them. And so afterwards. Did you perform any deliberate action? There was the change of mind from indecision to decision, from decided desire to volition, from volition to act. Did you perform an impulsive action? Here there is the more sudden and conspicuous change marked by the

[1] Discourse delivered at the Royal Institution, March 6, 1868.

word *impulsive*; as if your mind were a shuttlecock, which has its entire state of motion suddenly changed by the *impulse* of the battledore: conceive the shuttlecock descending quite regularly with a gentle corkscrew motion—the battledore intervenes—instantaneously the shuttlecock flies off in a totally unexpected direction, having apparently no relation to its previous motion; and you will see how very apt and expressive a simile you use when you speak of certain people as having an *impulsive temperament*. Have you felt happy or miserable? It was a change in your way of looking at things in general; a transition, as Spinoza says, from a lower to a higher state of perfection, or *vice versâ*. In a word, whatever you have done, or felt, or thought, you will find upon reflection that you could not possibly be conscious of anything else than a change of mind.

But then, you will be inclined to say, this change is only a small thing after all. It does not penetrate beyond the surface of the mind, so to speak. Your character, the general attitude which you take up with regard to circumstances outside, remains the same throughout the day: even for great numbers of days. You can distinguish between individual people to such an extent that you have a general idea of how a given person will act when placed in given circumstances. Now for this to be the case, it is clear that each person must have retained his individual character for a considerable period, so as to enable you to take note of his behaviour in different cases, to frame some sort of general rules about it, and from them to calculate what he would do in any supposed given case. But is it true that this character or mark by which you

know one person from another is absolutely fixed and unvarying? Do you not speak of the character of a child growing into that of a man: of a man in new circumstances being quite a different person from what he was before? Is it not regarded as the greatest stroke of art in a novelist that he should be able not merely to draw a character at any given time, but also to sketch the growth of it through the changing circumstances of life? In fact, if you consider a little further, you will see that it is not even true that a character remains the same for a single day: every circumstance, however trivial, that in any way affects the mind, leaves its mark, infinitely small it may be, imperceptible in itself, but yet more indelible than the stone-carved hieroglyphics of Egypt. And the sum of all these marks is precisely what we call the character, which is thus itself a history of the entire previous life of the individual; which is therefore continually being added to, continually growing, continually in a state of change.

Let me illustrate this relation by the example of the motion of a planet. People knew, ages and ages ago, that a planet was a thing constantly moving about from one place to another; and they made continual attempts to discover the *character* of its motion, so that by observing the general way in which it went on, they might be able to tell where it would be at any particular time. And they invented most ingenious and complicated ways of expressing this character:

'Cycle on epicycle, orb on orb,'

till a certain very profane king of Portugal, who was

learning astronomy, said that if *he* had been present at the making of the Solar System, he would have tendered some good advice. But the fact was that they were all wrong, and the real case was by no means so complicated as they supposed it to be. Kepler was the first to discover what was the real character of a planetary orbit; and he did this in the case of the planet Mars. He found that this planet moved in an ellipse or oval curve round the sun which was situated rather askew near the middle. But upon further observation, this was found to be not quite exact; the orbit itself is revolving slowly round the sun, it is getting elongated and then flattened in turns, and even the plane in which the motion takes place sways slowly from side to side of its mean position. Thus you see that although the elliptic character of the motion does represent it with considerable exactness for a long time together, yet this character itself must be regarded as incessantly in a state of gradual change. But the great point of the comparison—to aid in the conception of which, in fact, I have used the comparison at all—is this: that for no two seconds together does any possible ellipse *accurately* represent the orbit. It is impossible for the planet to move a single inch on its way, without the oval having slightly turned round, become slightly elongated or shortened, and swayed slightly out of its plane; so that the oval which accurately represented the motion at one end of the inch would not accurately represent the motion at the other end. The application is obvious. In like manner it is true that the character which will *roughly* represent the law of a man's actions for some considerable time, will not *accurately* represent that

law for two seconds together. No action can take place in accordance with the character without modifying the character itself; just as no motion of a planet could take place along its orbit without a simultaneous change in the orbit itself.

But I will go even further. Historians are accustomed to say that at any given point of a nation's history there is a certain general type which prevails among the various changes of character which different men undergo. There is some kind of law, they say, which regulates the slow growth of each character from childhood to age; so that if you compared together all the biographies you would find a sort of family likeness suggesting that some common force had acted upon them all to make these changes. This force they call the Spirit of the Age. The spirit, then, which determines all the changes of character that take place, which is, therefore, more persistent than character itself,—is this, at last, a thing absolutely fixed, permanent, free from fluctuations? No: for the entire history of humanity is an account of its continual changes. It tells how there were great waves of change which spread from country to country, and swept over whole continents, and passed away; to be succeeded by similar waves. No history can be philosophical which does not trace the origin and course of these: things far more important than all the kings and rulers and battles and dates which some people imagine to be history.

To recapitulate. The mind is changing so constantly that we only know it by its changes. The law of these changes, which we call character, is also a

thing which is continually changing, though more slowly. And that law of force which governs all the changes of character in a given people at a given time, which we call the Spirit of the Age, this also changes, though more slowly still.

Now it is a belief which, whether true or not, we are all of us constantly acting upon, that these changes have some kind of fixed relation to the surrounding circumstances. In every part of our conduct towards other people we proceed constantly upon the assumption that what they will do is to a certain extent, and in some way or other, dependent upon what we do. If I want a man to treat me with kindness and respect, I have to behave in a certain way towards him. If I want to produce a more special and defined effect, I have recourse to threats or promises. And even if I want to produce a certain change of mind in myself, I proceed upon the same assumption that in some way or other, and to a certain extent, I am dependent on the surrounding circumstances. People tie knots in their handkerchiefs to make themselves remember things; they also read definite books with a view of putting themselves into definite mental states or moods; and attempts are constantly made to produce even a further and more permanent effect, to effect an alteration in character. What else is the meaning of schools, prisons, reformatories, and the like? Some have actually gone further than this: there have not been wanting enterprising and far-seeing statesmen who have attempted to control and direct the Spirit of the Age. Now in all these cases in which we use means to an end, we are clearly proceeding on the assumption that

there is some fixed relation of cause and effect, in virtue of which the means we adopt may be antecedently expected to bring about the end we are in pursuit of. We are all along assuming, in fact, that changes of mind are connected by some fixed laws or relations with surrounding circumstances. Now this being so, since every mind is thus continually changing its character for better or worse, and since the character of a race or nation is subject to the same constant change; since also these changes are connected in some definite manner with surrounding circumstances; the question naturally presents itself, What is that attitude of mind which is likely to change for the better? All the individuals of a race are changing in character, all changing in different directions, with every possible degree of divergence; also the average character itself, the Spirit of the Age, is either changing in some one definite direction, or tending to split into two different characters: an individual, therefore, may be going with the race or dropping out of it; a portion of the race may be going right or wrong. Let us suppose that some portion of the race is going right and improving: the question is, In what way are we to distinguish that individual who is improving with the race, from the others who are either dropping out of the march altogether or going wrong?

Now what I have proposed to myself to do to-night is this, merely to suggest a method by which this question may ultimately be answered. I shall also endeavour afterwards to point out what I conceive to be one or two results of this method: but this part will be of minor importance; the results depend upon my

application of the method, can be only partially true, and may be wholly false; the method itself I believe to be altogether a true one, and one which must ultimately lead to the correct results.

It consists in observing and making use of a certain analogy, namely, the analogy between the mind and the visible forms of organic life. You know that every animal and every plant is constantly going through a series of changes. The flower closes at night and opens in the morning; trees are bare in winter and covered with leaves in summer; while the growth of every organism from birth to maturity cannot fail to strike you as a forcible illustration of the gradual change of character in the human mind. In fact, it is the peculiarity of living things not merely that they change under the influence of surrounding circumstances, but that any change which takes place in them is not lost but retained, and, as it were, built into the organism to serve as the foundation for future actions. If you cause any distortion in the growth of a tree and make it crooked, whatever you may do afterwards to make the tree straight, the mark of your distortion is there; it is absolutely indelible; it has become part of the tree's nature, and will even be transmitted in some small degree to the seeds. Suppose, however, that you take a piece of inanimate matter—a lump of gold, say, which is yellow and quite hard—you melt it, and it becomes liquid and green. Here an enormous change has been produced; but let it cool; it returns to the solid and yellow condition, and looks precisely as before—there is no trace whatever of the actions that have been going on. No one can tell by examining a piece of

gold how often it has been melted and cooled in geologic ages by changes of the earth's crust, or even in the last year by the hand of man. Anyone who cuts down an oak can tell by the rings in its trunk how many times winter has frozen it into widowhood and summer has warmed it into life. A living being must always contain within itself the history not merely of its own existence but of all its ancestors. Seeing then that in its continual changes and in the preservation of the records of those changes every organism resembles the mind, so that to this extent they belong to the same order of phenomena, may we not reasonably suppose that the laws of change are alike, if not identical, in the two cases? This is of course a mere supposition, not deducible from anything which we have yet observed, which requires therefore to be tested by facts. I shall endeavour to show that the supposition is well founded; that such laws of change as have been observed in animals and plants do equally hold good in the case of the mind. I shall then endeavour to find out what we mean by higher and lower in the two cases, and to show, in fact, that we mean much the same thing. Supposing all this to have been done, the question will have been stated in a form which it is possible to answer. I shall then make an attempt to give part of the answer to it.

In investigating the laws of change of organic beings I shall make use of what is called the Evolution-hypothesis, which, as applied to this subject, is much the same thing as the Darwinian theory, though it is not by any means tied down to the special views of Mr. Darwin. But I shall use this merely as an hypothesis; and the validity of the method of investigation

which I have suggested is entirely independent of the truth of that hypothesis. If you will pardon me for a short time, I should like to illustrate somewhat further what I mean by this.

When Kepler found out what was the form of the orbit described by the planet Mars, he thought that the planet was driven by some force which acted in the direction in which the planet was going. I have known people who learned a certain amount of astronomy for nautical purposes, whose ideas were very similar to those of Kepler. They thought that the sun's rotation was what caused the planets to revolve about him, just as if you spin a teaspoon in the middle of a cup of tea, it makes the bubbles go round and round. But Newton discovered that the real state of the case was far different. If you fasten a ball on to the end of an elastic string, and then swing it round and round, you can make the ball describe an orbit very similar to that of the planet, so that your hand is not quite in the centre of it. Now here the pulling force does not act in the direction in which the ball is going, but always in the direction of your hand, and yet the ball revolves about your hand and never actually comes to it. Newton supposed that the case of the planet was similar to that of the ball; that it was always pulled in the direction of the sun, and that this attraction or pulling of the sun produced the revolution of the planet, in the same way that the traction or pulling of the elastic string produces the revolution of the ball. *What* there is between the sun and the planet that makes each of them pull the other, Newton did not know; nobody knows to this day; and all we are now

able to assert positively is that the known motion of the planet is precisely what would be produced if it were fastened to the sun by an elastic string, having a certain law of elasticity. Now observe the nature of this discovery, the greatest in its consequences that has ever yet been made in physical science:—

I. It begins with an hypothesis, by supposing that there is an analogy between the motion of a planet and the motion of a ball at the end of a string.

II. Science becomes independent of the hypothesis, for we merely use it to investigate the properties of the motion, and do not trouble ourselves further about the cause of it.

I will take another example. It has been supposed for a long time that light consists of waves transmitted through an extremely thin ethereal jelly that pervades all space; it is easy to see the very rapid tremor which spreads through a jelly when you strike it at one point. From this hypothesis we can deduce laws of the propagation of light, and of the way in which different rays interfere with one another, and the laws so deduced are abundantly confirmed by experiment. But here also science kicks down the ladder by which she has risen. In order to explain the phenomena of light it is not necessary to assume anything more than a periodical oscillation between two states at any given point of space. *What* the two states are nobody knows; and the only thing we can assert with any degree of probability is that they are *not* states of merely mechanical displacement like the tremor of a jelly; for the phenomena of fluorescence appear to negative this supposition. Here again, then, the same two remarks may be

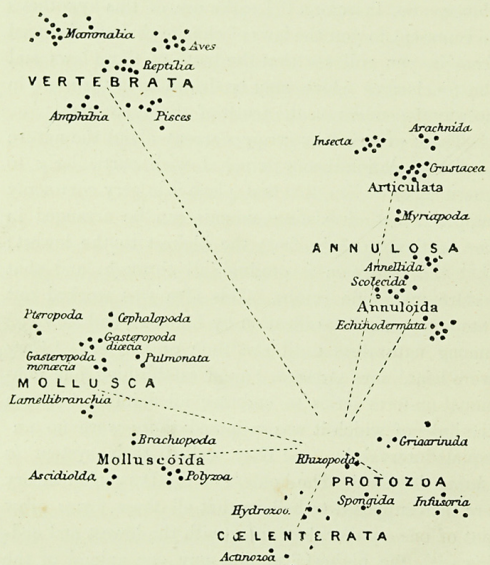
made. The scientific discovery appears first as the hypothesis of an analogy; and science tends to become independent of the hypothesis.

The theory of heat is another example. If you hold one end of a poker in the fire, the other end becomes hot, even though it is not exposed to the rays of the fire. Fourier, in trying to find the laws of this spread of heat from one part of a body to another part, made the hypothesis that heat was a fluid which flowed from the hot end into the cold as water flows through a pipe. From this hypothesis the laws of conduction were deduced; but in the process it was found that the very same laws would flow from other hypotheses. In fact, whatever can be explained by the motion of a fluid can be equally well explained either by the attraction of particles or by the strains of a solid substance; the very same mathematical calculations result from the three distinct hypotheses; and science, though completely independent of all three, may yet choose one of them as serving to link together different trains of physical inquiry.

Now the same two remarks which may be made in all these cases apply equally to the evolution-hypothesis. It is grounded on a supposed analogy between the growth of a species and the growth of an individual. It supposes, for instance, that the race of crabs has gone through much the same sort of changes as every crab goes through now, in the course of its formation in the egg; changes represented by its pristine shape utterly unlike what it afterwards attains, and by its gradual metamorphosis and formation of shell and claws. By this analogy the laws of change are suggested, and these are afterwards checked and corrected by the facts. But as before, science tends to become independent of hypothesis. The laws of change are established for present and finitely distant times; but they give us no positive information about the origin of things. So, therefore, if I make use of this hypothesis to represent to you the laws of change that are deduced from it, you will see that the truth of those laws and the conclusions which may be drawn from them are in no way dependent on the truth of the hypothesis.

There are certain errors current about the nature of the evolution-theory which I wish particularly to guard against. In the first place it is very commonly supposed that all existing animals can be arranged in one continuous chain, from the highest to the lowest; that the transition is gradual all through, and that nature makes no jumps. This idea was worked out into a system of classification by Linnæus, and survived among naturalists until the time of Cuvier. 'They were bent,' says Agassiz, 'upon establishing one continual uniform series to embrace all animals, between the links of which it was supposed there were no unequal intervals.' . . . 'They called their system *la chaîne des êtres*.' The holders of the Darwinian theory are then supposed to believe that all these forms grew out of one another, beginning with the lowest and ending with the highest; so that any one animal of the series has in the course of its evolution passed through all the lower forms. And as the species is thus supposed to have grown up through the chain, and the lower species to be continually growing into the higher, so it is imagined that every individual creature, in the

course of its production, passes through the lower adult forms; that a chicken, for instance, while it is being formed in the egg, becomes in succession a snail, an insect, a fish, and a reptile, before it becomes a bird. Now that all these ideas are entirely wrong, I need



hardly remind you; and I have mentioned them in order that there may be no mistake about the theory which I am using as an analogy. So far is it from being possible to arrange existing organisms in a single

line or chain, that they cannot be adequately represented even in the manner which is attempted in the preceding diagram taken from Spencer's 'Principles of Biology,' vol. i. p. 303.

In the next place, no existing organism could possibly grow into any other. What is really supposed is this:—that if you went back a million years or so, and made a picture like this one, representing the forms that existed then, no single spot which is covered in one figure would be covered in the other; but the general arrangement would be very similar, except that all the groups would be nearer to the centre or radiant point, and therefore nearer to each other. And if you made a third picture, representing the state of things another million years or so further back, then they would be still nearer together; and at a distance of time too vast to be represented, they would all converge into this radiant point. So the theory is that at that stupendous distance of time all species were alike, mere specks of jelly; that they gradually diverged from each other and got more and more different, till at last they attained the almost infinite variety that we now find. If you will imagine a tree with spreading branches, like an oak; then the outside leaves at any time may be taken to represent all the existing species at a given time. It is quite impossible to arrange them in any serial order. As the tree grows, the outer leaves diverge, and get further from the trunk and from each other; and two extremities that have once diverged never converge and grow together again. But even this simile is insufficient; for species may diverge in a far greater variety of direc-

tions than the branches of a tree. Space has not dimensions enough to represent the true state of the case.

Von Baer's doctrine of development is illustrated by the same figure. If you took embryos of polypes, and snails, and cuttle-fish, and insects, and crabs, and fish, and frogs, and if you could watch their gradual growth into these several animals: at first they would be all absolutely alike and indistinguishable. Then, after a little while, you would find that they might be sorted off into these four great classes. Afterwards these groups might be divided into smaller groups, representing orders; then these into families and genera; last of all would appear those differences which would separate them into species.

The evolution-hypothesis, then, represents a *race* of animals or plants as a thing slowly changing: and it also represents these changes as connected by fixed laws with the action of the surrounding circumstances, or, as it is customary to say, the environment. Now the action of the environment on a race is of two kinds, direct and indirect. That part which is called direct action is very easily understood. There is no difficulty in seeing how changes of climate might produce changes in the colour of the skin, or how new conditions which necessitated the greater use of any organ would lead to the increase of that organ, as we know that muscles may be made to swell with exercise; and changes thus made habitual would in time be inherited. But the indirect action of the environment, which is called natural selection, is still more important. The mode of its operation may be seen from an example. There are

two butterflies in South America, nearly resembling one another in form, but one of which has a very sweet taste and is liked by the birds, while the other is bitter and distasteful to them. Now suppose that, for some reason or other, sweet butterflies were occasionally produced with markings similar to the bitter ones, these, being mistaken by the birds for bitter ones, would run less chance of being eaten, and therefore more chance of surviving and leaving offspring. If this peculiarity of marking is at all inheritable, then the number of sweet butterflies with bitter marks will in the next generation be greater in proportion to the whole number than before; and, as this process goes on, the sweet butterflies which retain their distinguishing marks will be all weeded out by the birds, and the entire species will have copied the markings of the bitter species. This has actually taken place: the one species has mimicked the markings of the other. Here we see the working of Natural Selection. Any variation in an individual which gives him an advantage in the struggle for life is more likely to be transmitted to offspring than any other variation, because the individual is more likely to survive; so that nature gradually weeds out all those forms which are not suited to the environment, and thus tends to produce equilibrium between the species and its surrounding circumstances. Changes, then, are produced in a species by the selection of advantageous changes which happen to be made in individuals. Now there are three kinds of change that are produced in individuals: change of size, or growth; change of structure, that is to say, change in the shape and arrangement of the parts, as when the cartilaginous

skeleton of an infant becomes hardened into bone; and change of function, that is to say, change in the use which is made of any part of the organism. I have one or two remarks to make about the first of these, namely, growth, or change of size. Every organism is continually taking in matter through the external surface to feed the inside. A certain quantity of this is needed to make up for the waste that is continually going on. But let us suppose, to begin with, that an organism has more surface than it absolutely wants to make up for waste, then a certain portion of the assimilated matter, or food, will remain over, and the organism will increase in size. But, you say, if this is all that is meant by growth why does it not go on for ever? The explanation is very simple. I take this cube, which has six sides, each a square inch; let us suppose it to represent an animal, and imagine, to begin with, that two of the sides by themselves are capable of feeding the whole mass, then the nutrition taken in by the other four sides is left over, and the mass must increase in size. Imagine it now grown to twice the linear dimensions, that is to say, to a cube every side of which is two inches. The mass to be fed is now eight times what it was, while the surface is only four times as great; of the twenty-four square inches of surface sixteen are taken up with feeding the mass, while only eight, or one-third, are left to supply the materials for growth. Still there is an overplus, and the organism will grow. Let it now acquire three times its original height and breadth and thickness, the mass is twenty-seven times as great, and the surface only nine times: that is to say, while there are twenty-seven cubic inches to be fed, there are just fifty-four

square inches to feed them. There is no longer any overplus; the organism will stop growing. And it is a general rule that, in any case, when a thing grows its mass increases much faster than its surface. However much, therefore, the feeding power of the surface may be in excess to begin with, the mass must inevitably catch it up, and the growth will stop.

Now the changes of an individual mind may be reduced to the same three types:—

Growth.

Change of structure.

Change of function.

First, then, what is the growth of the mind? It is the acquisition of new knowledge; not merely of that which is required to make up for our wonderful power of forgetting, for oblivion is really a far more marvellous thing than memory; but of a certain overplus which goes to increase the entire mass of our mental experiences. Now I do not know whether there is any race between surface and mass here as in the case of an organism; but it is certainly true that whereas in childhood the amount we forget is very little, and our powers of acquisition preponderate immensely over our powers of oblivion; as we grow up, the powers of oblivion gain rapidly upon the acquisitive ones, and finally catch them up; the growth ceases as soon as this balance is attained. So that in this first law, you see, there is an entire analogy between the two cases.

In the next place, the mind experiences changes of structure; that is to say, changes in the shape and arrangement of its parts. Ideas which were only feebly connected become aggregated into a close and

compact whole. The ideas of several different qualities, for instance, which we never thought of as connected with each other, are brought together by the qualities being found to exist in the same object. In this way we form conceptions of things, which gradually get so compact that we cannot even in thought separate them into their component parts. Portions of our knowledge which we held as distinct are connected together by scientific theories; images which were scattered all about are bound up into living bundles by the artist, and so we find them re-arranged.

Lastly, changes of function take place. Everybody knows how the mental faculties open out and become visible as a child grows up. Men acquire faculties by practice. And without any conscious seeking, you must know how often we wake up as it were and find ourselves gifted with new powers. We have found evidence then of the existence of our three types of change,—growth, structure, and function.

The actions therefore which go on between the environment and the individual may be reduced to the same three types in the case of the mind as in the case of any visible organism. Being somewhat encouraged by this result, let us go back to our original question. What is that attitude of mind which is likely to change for the better? What is the meaning of *better*?

Although it is quite impossible to arrange all existing organisms in a serial chain, yet we certainly have a general notion of higher and lower. A bird we regard as higher than a fish, and a dog is higher than a snake, And if we return to our illustration of the tree, we shall see that at every point, at any given time, there is a

definite direction of development. So that though we might not be able to say which of two co-existing organisms was the higher, yet, by comparing a species with itself at a slightly later time, we might say whether it had degenerated or improved. Now by examining various cases, we shall find that there are six marks of improvement:—

The parts of the organism get more different.

The parts of the organism get more connected.

The organism gets more different from the environment.

The organism gets more connected with the environment.

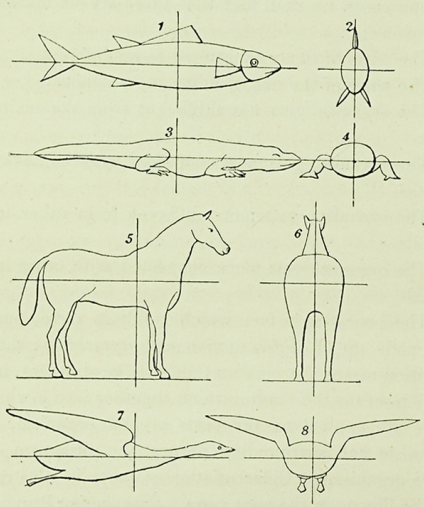
The organism gets more different from other individuals.

The organism gets more connected with other individuals.

The processes in fact which result in development are made up of *differentiation* and *integration*; differentiation means the making things to be different, integration means the binding them together into a whole; these are applied to the parts of the organism, the organism and surrounding nature, the organism and other organisms. Differentiation of parts is illustrated by the figure on the next page. [Spencer's 'Principles of Biology,' vol ii. p. 187.]

Integration of parts means the connected play of them; so that one being affected the rest are affected. Differentiation from the environment takes place in weight, composition, and temperature. A polype is little else than sea-water, which it inhabits; a fish is several degrees of temperature above it, and made of

quite different materials; till at last a mammal is 70° or 80° above the surrounding matter, and made of still more different materials. Integration with the environment means close correspondence with it; actions of the environment are followed by corresponding actions



of the animal. Differentiation from other organisms means individuality; integration with them sociality.

In a similar way we have a sort of general notion of higher and lower stages of mental development. I will endeavour to show that this general notion resolves itself into a measure of the extent to which the same six processes have gone on, namely:—

Separation of parts,
Connexion of parts,
Separation from the environment,
Closer correspondence with the environment,
Separation from other individuals,
Sociality.

The only conception we can form of a purely unconscious state is one in which all is exactly alike, or rather, in which there is no difference.

> There is not one thing with another,
> But Evil saith to Good: My brother,
> My brother, I am one with thee:
> They shall not strive nor cry for ever:
> No man shall choose between them: never
> Shall this thing end and that thing be.

The first indication of consciousness is a perception of difference. The child's eyes follow the light. Immediately this colourless, homogeneous universe splits up into two parts, the light part and the dark part. A line is drawn across it, it is made heterogeneous, and the first thing that exists is a distinction. Then other lines are drawn; appearance is separated into white, black, blue, red, and so on. This is the first process, the differentiation of the parts of consciousness. But by-and-by a number of these lines of distinction are found to enclose a definite space; they assume relations to one another; the lines white, round, light, capable of being thrown at people, include the conception of a ball; this gains coherence, becomes one, a thing, holding itself together not only separated from the rest of consciousness, but connected in itself into a distinct whole, integrated. Here we have the second process. And throughout

our lives the same two processes go hand in hand ; whatever we perceive is a line of demarcation between two different things ; we can be conscious of nothing but a separation, a change in passing from one thing to another. And these different lines of demarcation are constantly connecting themselves together, marking out portions of our consciousness as complete wholes, and making them cohere. Just as a sculptor clears away from a block of marble now this piece and now that, making every time a separation between what is to be kept and what is to be chipped off, till at last all these chippings manifest the connexion that ran through them, and the finished statue stands out as a complete whole, a positive thing made up of contradictory negations : so is a conception formed in the mind.

And this conception, when it is thus made into a whole, integrated, by an act of the mind, what does it immediately appear to be? Why, something outside of ourselves, a real thing, different from us. This is the third process, the process of *differentiation* from the environment. This is beautifully described by Cuvier, who pictures the first man wandering about in ecstasies at the discovery of so many new parts of himself; till gradually he learns that they are not himself, but things outside. This notion, then, of a thing being real, existing external to ourselves, is due to the active power of the mind which regards it as one, which binds together all its boundaries. And this goes on as long as we live. Constantly we frame to ourselves more complicated combinations of ideas, and by giving them unity make them real. And, at the same time, the

converse process is equally active. While more and more of our ideas are put outside of us and made real, our minds are continually growing more and more into accordance with the nature of external things ; our ideas become truer, more conformable to the facts ; and at the same time they answer more surely and completely to changes in the environment ; a new experience is more rapidly and more completely connected with the sum of previous experiences. But there is more than this. The action of these two laws taken together does in fact amount to the creation of new senses. Men of science, for example, have to deal with extremely abstract and general conceptions. By constant use and familiarity, these, and the relations between them, become just as real and external as the ordinary objects of experience ; and the perception of new relations among them is so rapid, the correspondence of the mind to external circumstances so great, that a real scientific sense is developed, by which things are perceived as immediately and truly as I see you now. Poets and painters and musicians also are so accustomed to put outside of them the idea of beauty, that it becomes a real external existence, a thing which they see with spiritual eyes, and then describe to you, but by no means create, any more than we seem to create these ideas of table and forms and light, which we put together long ago. There is no scientific discoverer, no poet, no painter, no musician, who will not tell you that he found ready-made his discovery or poem or picture—that it came to him from outside, and that he did not consciously create it from within. And there is reason to think that these senses or insights are

things which actually increase among mankind. It is certain, at least, that the scientific sense is immensely more developed now than it was three hundred years ago; and though it may be impossible to find any absolute standard of art, yet it is acknowledged that a number of minds which are subject to artistic training will tend to arrange themselves under certain great groups, and that the members of each group will give an independent yet consentient testimony about artistic questions. And this arrangement into schools, and the definiteness of the conclusions reached in each, are on the increase, so that here, it would seem, are actually two new senses, the scientific and the artistic, which the mind is now in the process of forming for itself. There are two remaining marks of development: differentiation from surrounding minds, which is the growth of individuality; and closer correspondence with them, wider sympathies, more perfect understanding of others. These, you will instantly admit, are precisely the twin characteristics of a man of genius. He is clearly distinct from the people that surround him, that is how you recognize him; but then this very distinction must be such as to bind him still closer to them, extend and intensify his sympathies, make him want their wants, rejoice over their joys, be cast down by their sorrows. Just as the throat is a complicated thing, quite different from the rest of the body, but yet is always ready to cry when any other part is hurt.

We have thus got a tolerably definite notion of what mental development means. It is a process of simultaneous differentiation and integration which goes on in the parts of consciousness, between the mind and

external things, between the mind and other minds. And the question I want answered is, What attitude of mind tends to further these processes?

I have now done all that it was my business to do, namely, I have stated the question in a form in which it is possible to answer it. There is no doubt that by a careful study of the operations of nature we shall be able to find out what actions of an organism are favourable to its higher development. Having formulated these into a law, we shall be able to interpret this law with reference to the mind.

But now I am going to venture on a partial answer to this question. What I am going to say is mere speculation, and requires to be verified by facts.

The changes which take place in an organism are of two kinds. Some are produced by the direct action of things outside, and these are to a great extent similar to the changes which we observe in inanimate things. When a tree is bent over by the wind and gets ultimately fixed in this position, the change is in no way different from that which takes place when we bend a wire and it does not entirely return to its former straightness. Other changes are produced by the spontaneous action of that store of force which by the process of growth is necessarily accumulated within the organism. Such are all those apparently disconnected motions which make up the great distinction between living things and dead. Now my speculation is, that advantageous permanent changes are always produced by the spontaneous action of the organism, and not by the direct action of the environment. This,

I think, is most clear when we take an extreme case. Let us suppose a race of animals that never had any changes produced by their spontaneous activity. The race must at a certain time have a definite amount of plasticity, that is, a definite power of adapting itself to altered circumstances by changing in accordance with them. Every permanent effect of the environment upon them is a crystallization of some part which before was plastic; for the part must have been plastic for the effect to be produced at all; and as the effect is permanent, the part has to that extent lost in plasticity. As this goes on, the race of animals will bind up in itself more and more of its history, but will in that process lose the capability of change which it once had; at last it will be quite fixed, crystallized, incapable of change. Then it must inevitably die out in time; for the environment must change sooner or later, and then the race, incapable of changing in accordance with it, must be killed off. On the other hand, any addition to the organism which is made by its spontaneous activity is an addition of something which has not yet been acted upon by the environment, which is therefore plastic, capable of indefinite modification, in fact, an increase of power. The bending of a tree by the wind is a positive disadvantage to it if the wind should ever happen to blow from the other side. But when a plant, for no apparent reason, grows long hairs to its seed—the material for which may have been accidentally supplied by the environment, while its use in this way is a spontaneous action of the plant—this is a definite increase of power; for the new organ may be modified in any conceivable way to suit the exigencies of the environment, may

cling to the sides of beasts, and so help the distribution of the seed, or effect the same object by being caught by the wind. Activity, in fact, is the first condition of development. A very good example of this occurs in Professor Huxley's lizards, of which you heard two or three weeks ago.[1] About the time marked by the Primary strata it appears that there was a race of lizards, thirty feet high, that walked on their hind legs, balancing themselves by their long tails, and having three toes like birds. This race diverged in three directions. Some of them yielded to the immediate promptings of the environment, found it convenient to go on all fours and eat fish; they became crocodiles. Others took to exercising their fore-legs violently, developed three long fingers, and became birds. The rest were for a long while undecided whether they would use their arms or their legs most; at length they diverged, and some became pterodactyles and others kangaroos. For Mr. Seeley, of Cambridge, has discovered marsupial bones in pterodactyles; that is to say, bones like those which were supposed peculiar to the order of mammals to which the kangaroo belongs.

Assuming now that this law is true, and that the development of an organism proceeds from its activities rather than its passivities, let us apply it to the mind. What, in fact, are the conditions which must be satisfied by a mind in process of upward development, so far as this law gives them?

They are two; one positive, the other negative.

[1] ['On the animals which are most nearly intermediate between birds and reptiles,' *Roy. Inst. Proc. V.* 1869, p. 278.]

The positive condition is that the mind should act rather than assimilate, that its attitude should be one of creation rather than of acquisition. If scientific, it must not rest in the contemplation of existing theories, or the learning of facts by rote; it must act, create, make fresh powers, discover new facts and laws. And, if the analogy is true, it must create things not immediately useful. I am here putting in a word for those abstruse mathematical researches which are so often abused for having no obvious physical application. The fact is that the most useful parts of science have been investigated for the sake of truth, and not for their usefulness. A new branch of mathematics, which has sprung up in the last twenty years, was denounced by the Astronomer Royal before the University of Cambridge as doomed to be forgotten, on account of its uselessness. Now it turns out that the reason why we cannot go further in our investigations of molecular action is that we do not know enough of this branch of mathematics. If the mind is artistic, it must not sit down in hopeless awe before the monuments of the great masters, as if heights so lofty could have no heaven beyond them. Still less must it tremble before the conventionalism of one age, when its mission may be to form the whole life of the age succeeding. No amount of erudition or technical skill or critical power can absolve the mind from the necessity of creating, if it would grow. And the power of creation is not a matter of static ability, so that one man absolutely can do these things and another man absolutely cannot; it is a matter of habits and desires. The results of things

follow not from their state but from their tendency. The first condition then of mental development is that the attitude of the mind should be creative rather than acquisitive: or, as it has been well said, that intellectual food should go to form mental muscle and not mental fat.

The negative condition is plasticity: the avoidance of all such crystallization as is immediately suggested by the environment. A mind that would grow must let no ideas become permanent except such as lead to action. Towards all others it must maintain an attitude of absolute receptivity; admitting all, being modified by all, but permanently biassed by none. To become crystallized, fixed in opinion and mode of thought, is to lose the great characteristic of life, by which it is distinguished from inanimate nature: the power of adapting itself to circumstances.

This is true even more of the race. There are nations in the East so enslaved by custom that they seem to have lost all power of change except the capability of being destroyed. Propriety, in fact, is the crystallization of a race. And if we consider that a race, in proportion as it is plastic and capable of change, may be regarded as young and vigorous, while a race which is fixed, persistent in form, unable to change, is as surely effete, worn out, in peril of extinction; we shall see, I think, the immense importance to a nation of checking the growth of conventionalities. It is quite possible for conventional rules of action and conventional habits of thought to get such power that progress is impossible, and the nation only fit to be im-

proved away. In the face of such a danger *it is not right to be proper.*

Note.—The following letter, published in the 'Pall Mall Gazette' *of June* 24, 1868, *should be read in connexion with this Discourse.*

Sir,—I ask for a portion of your space to say something about a lecture, 'On some of the Conditions of Mental Development,' which I delivered at the Royal Institution in March last.

In that lecture I attempted to state and partially answer the question, 'What is that attitude of mind which is most likely to change for the better?' I proposed to do this by applying the hypothesis of the variability of species to the present condition of the human race. I put forward also for this purpose a certain biological law, viz., that permanent advantageous changes in an organism are due to its spontaneous activity, and not to the direct action of the environment.

In the short account of the evolution-hypothesis which I prefixed, I followed Mr. Herbert Spencer's 'Principles of Biology,' not knowing, at the time, how much of the theory was due to him personally, but imagining that the greater part of it was the work of previous biologists. On this account I omitted to make such references to my special sources of information as I should otherwise have made. I was also ignorant of the developments and applications of the theory which he has made in his other works, in which a great portion

of my remarks had been anticipated. These omissions I desire now to rectify.

Mr. Spencer's theory is to the ideas which preceded it even more than the theory of gravitation was to the guesses of Hooke and the facts of Kepler.

Finding only a vague notion of progress from lower to higher, he has affixed the specific meaning to the word *higher* of which I gave an account, defining the processes by which this progress is effected. He has, moreover, formed the conception of evolution as the subject of general propositions applicable to all natural processes, a conception which serves as the basis of a complete system of philosophy. In particular, he has applied this theory to the evolution of mind, developing the complete accordance between the laws of mental growth and of the growth of other organic functions. In fact, even if the two points which I put forward as my own—viz., the formal application of the biological method to a certain special problem, and the biological law which serves as a partial solution of it—have not before been explicitly developed (and of this I am not sure), yet they are consequences so immediate of the general theory that in any case the credit of them should entirely belong to the philosopher on whose domains I have unwittingly trespassed. The mistake, of course, affects me only, and could in no way injure the fame of one whose philosophical position is so high and so assured.

I may perhaps be excused for anticipating here what I hope to say more at length at another time,[1] that in

[1] This intention was never carried out, so far as the Editors are aware.

my belief the further deductions to be made from this theory, with reference to modern controversies, will lead to results at once more conservative, and in a certain sense more progressive, than is commonly supposed.

I remain, Sir, yours, &c.,

W. K. CLIFFORD.

ON THEORIES OF THE PHYSICAL FORCES.[1]

[REFERRING to the passage in 'Faust,'

'Geschrieben steht: Im Anfang war das Wort.
Hier stock' ich schon! Wer hilft mir weiter fort?
Ich kann das Wort so hoch unmöglich schätzen,
Ich muss es anders übersetzen,
Wenn ich vom Geiste recht erleuchtet bin.
Geschrieben steht: Im Anfang war der Sinn.
Bedenke wohl die erste Zeile,
Dass deine Feder sich nicht übereile!
Ist es der Sinn, der alles wirkt und schafft?
Es sollte stehn: Im Anfang war die Kraft!
Doch, auch indem ich dieses niederschreibe,
Schon warnt mich was, dass ich dabei nicht bleibe.
Mir hilft der Geist! Auf einmal seh' ich Rath,
Und schreibe getrost: Im Anfang war die That!'

the speaker regarded it as a description of four views or stages of opinion through which a man looking for himself on the face of things is likely to pass; through which also successive generations of the men who look for themselves on the face of things are likely to pass. He considered that by far the larger portion of scientific thought at the present day is in the third stage—that, namely, in which Force is regarded as the great fact

[1] Discourse delivered at the Royal Institution, February 18, 1870. This discourse is reprinted as it stands in the Proceedings of the Royal Institution. The opening paragraphs, being reported in the third person and apparently abridged, are enclosed in square brackets.