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THE GROUNDWORK OF SCIENCE

THE GROUNDWORK OF SCIENCE

A STUDY OF EPISTEMOLOGY

BY

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PREFACE

WE have again and again been impressed by the ready disposition of men whose views and opinions are most opposed, to agree in accepting as certain, things which are by no means evident, and in adopting conclusions as proved, which are by no means the only consequences that follow from conceded premisses. Our great object, therefore, in this little volume, is to represent nothing as certain which does not appear to us to be really evident, and yet not to shrink from upholding as true whatever, in our judgment, possesses the highest conceivable evidence.

It has been our constant care to be impartial and, above all, to allow no consideration not purely scientific—no anticipations as to possible consequences—to influence us in the conclusions which our judgment has led us to form. Our appeal throughout has been to the dry light of reason, and to that alone. Not so to act; to allow any kind of prejudice, any non-scientific consideration, to influence us in such a task as an endeavour to investigate the groundwork of science, would be both treason to science and a betrayal of the cause of philosophy.

But it is possible that to some persons the title of this book may prove a rock of offence, namely, persons disposed to doubt whether its object can be by any possibility attainable. "Is there," they may ask, "anything which can really merit the name of a 'groundwork of science'; and, should there be such a thing, can a knowledge of it be really attainable by us ?"

To this question the answer appears to be that some groundwork of science there must be. For no one can deny that science exists, and this is obtrusively evident in our own time, when we are witnessing the closing days of an age which has been conspicuous beyond all others for scientific progress. Now, any science which we may select for consideration will be found to consist of some truths which are the results of other truths antecedently ascertained, whether the latter have served as incentives to more patient and careful observations and experiments, or whether the antecedent truths have served as premisses from which the newer truths have been logically inferred. These primitive and fundamental truths of the science selected, together with the efforts made to ascertain and establish them, must be allowed to form the groundwork of that particular science. And as every science must possess such primitive and fundamental truths, there must be a groundwork of science generally, even if it consists only of a collection of all the fundamental truths of all the several sciences.

But can there be one common groundwork for all the sciences from logic to geology, however diverse may be their several subject-matters ? It might be supposed that such there cannot be, the sciences being so numerous and diverse. Nevertheless, there is one point which is common to them all. However numerous and diverse the sciences may be, they all agree in having been developed by one kind of energy, namely, that of the human mind. And, indeed, after putting on one side all the differences which have arisen from diversities of culture (qualitative and quantitative), of energy, and of industry, there is a general and fundamental unity in human capacity. The sciences therefore being many and diverse, while the nature of the energy applied to their investigation is essentially one, it is evident that the groundwork of science must be sought in the human mind, and in the mind of each individual man who applies himself to its study—the study of Epistemology.[1]

Now the mind of each one of us is, during our waking hours, ceaselessly active, but active in very different ways. We may be vaguely conscious of our existence while listening to some sweet melody which entrances us with its charm. We may be enjoying the freshness of the air and the augmenting brightness of the sun of a summer's day, hardly aware of undefined thoughts passing through our mind. We may be anxiously longing for the arrival of a friend whom we impatiently expect, or dreading the delay in his arrival as foreboding evil. We may be dwelling in fancy over events of days gone by, or looking forward to the future fruition of a hope long entertained. We may be simultaneously applying our senses of sight and touch to ascertain the shape and structure of some material object—a feather, a shell, or a work of art. We may be carrying out a piece of deductive reasoning, or we may be reflecting upon what we are about, and making sure we know, suspect, or doubt what we are actually cognising, suspecting, or doubting. But if we happen to be engaged in the study and pursuit of science, we must be aware of what we are doing, and, at least occasionally, reflect upon our perceptions.

Therefore, once more, the groundwork of science must be sought for in the human mind—in our own mind—when cognising scientific truths; especially those deemed most certain and far-reaching. And such truths cannot be truths obtained by reasoning, and cannot depend for their certainty on any experiments or observations alone. Such is manifestly the case, since whatever truth depends on reasoning cannot be ultimate, but must be posterior to, and depend

[1] *Επιστήμη*, understanding, and *λόγος*, a discourse.

upon, the principles, experiments, or observations which show us that it is indeed true, and upon which its acceptance thus depends; while the reflex certainty of observations and experiments themselves also implies the recognition of fundamental intellectual perceptions. Therefore, the groundwork of science must be composed of facts and of truths which carry with them their own evidence—which are self-evident—together with our own mental activity in reflecting upon and recognising such propositions as being the self-evident truths they are. Amongst such truths (as we shall hereafter see) must be that of our continued existence from day to day, and the certainty that we cannot at the same time continue to exist and yet cease to be, with others of similar nature. Such truths, it will be sought to show, cannot be really doubted without mental paralysis and self-stultification, for complete scepticism, as absolutely and necessarily self-destructive, is impossible for us. This assertion our readers are now asked to accept provisionally for what it may be worth, as full treatment of this and kindred subjects will find its place in the eighth chapter. They cannot be fully treated earlier, because before beginning to consider those fundamental questions, regarded as most essential elements of the groundwork of science, the way must be cleared for their due appreciation by a preliminary consideration of the various intellectual structures (the sciences)—the foundations common to the whole of which it is the purpose of this book to point out.

At the commencement, therefore, it appears incumbent on us, after considering what science is and of what it must consist, to call attention to certain elementary facts and distinctions without which it seems impossible to follow up any intellectual inquiry: such facts, *e. g.*, are (in our opinion) the essential nature both of our ideas and the words we make use of to express them.

Obviously, without an adequate acquaintance with the nature of our ideas no one can hope to succeed in a task an important part of which consists in the analysis of mental conceptions. What factors, therefore, co-operate in their elicitation, and the nature of such factors, the shares they respectively take, and the rank of each in ideation, are preliminary matters which must be noted at the very commencement of this book. Similarly, no one can arrive at even a provisional conclusion with respect to any merely initial problem unless he can be satisfied that there is some criterion of truth and that he can avail himself of it. To these first steps towards an understanding of the groundwork of science, the earlier portion of this book must, it appears to us, be exclusively devoted.

But in order to explore the groundwork of all science, it seems reasonable that the reader's attention should also be called to the different kinds of systematic and organised inquiry—the different sciences about which men's minds have been hitherto occupied—their number, nature, and the various degrees of affinity and relationship existing between them, etc. But before we can take another step forwards we shall find our progress arrested by the idealists. It is true that we hear it said that all the physical sciences can be pursued and taught as well on the idealistic hypothesis, as on that view concerning a real, external, independent world existing on all sides, which is entertained by all men who are not idealists. This we regard as true for one reason only: the reason, namely, that nature is too strong for idealism, and that no man can be always a consistent idealist, least of all students and adepts in physical science, who are continually recognising in thought and speech, and are constantly occupied about, certain bodies acting and interacting upon other bodies, not only quite without regard to their own perceptions (which need not be adverted to as being such), but with an implied perception of substantial existences, underlying and utterly different from any plexuses of feelings. If we shall be compelled to admit that idealism is true, we shall have to admit also that the groundwork of science is indeed mental, in a very different sense from that in which we and most other men have taken it to be. Moreover, for our own part, we should then feel that the authority and certainty of other seemingly self-evident truths were gravely compromised, especially if a truth apparently so self-evident as the existence of our own body (as we and most men understand that body to exist) were but a delusion and self-deception of the mind. But although, even then, the most fundamental truths of all would still, for us, remain evident and unimpaired in their certainty, it nevertheless appears to us to be incumbent on anyone who desires to study Epistemology, to enter upon a serious inquiry as to the truth of idealism.

An inquiry respecting a system which has been adopted, and is maintained, by so many men of eminence, not only in philosophy but in physical science also, can evidently be no light task; yet it must be undertaken and idealism accepted or rejected before further progress is possible. If such an inquiry were neglected the groundwork of science would, we think, have to remain for the student a problem unsolved and (till this has been finally decided one way or the other) insoluble.

The inquirer, having become once convinced of the real existence of an external independent world of "things in themselves" should, we think, have his attention next called to the modes and methods wherewith science deals with the objects it investigates, in order to ascertain, as far as he may, what assumptions and convictions are implied in, and by, and are necessary for, all and any scientific research. This appears to us a desirable, if not an absolutely necessary, preliminary, because assumptions and convictions which are indispensable for the carrying on of science must be more or less closely connected with the groundwork thereof. Such an introductory inquiry, however, should, we think, be made only in order to ascertain what are the necessary implications of science, the question as to the objective truth of such necessary implications finding its place (as before said) later on, namely, towards the climax of our inquiry. These implications cannot but be very nearly related to questions concerning our highest mental faculties. Such must be the case, since science, in the widest sense of that word (including even the science of sciences, or metaphysics), requires for its satisfactory prosecution the employment of our very noblest powers, and it is by them alone that we can hope to attain a knowledge of the most supreme and ultimate truths which our intellectual faculties have the power to apprehend.

On this account, before entering upon our final inquiry as to what it is which constitutes the groundwork of science, we must study the nature and power of what seem to be our highest faculties; but this we cannot usefully proceed to do till we have taken cognisance of our ordinary mental powers, upon the pre-existence and exercise of which the possibility of such higher faculties depends. But, again, it is obvious that our ordinary mental powers, our emotions, our feelings, and the actions which thence result, are absolutely dependent on our bodily capacities, and our bodily powers are not less entirely dependent upon our corporeal structure.

Therefore, in order duly to comprehend our highest intellectual faculties, we needs must begin with a consideration of at least some points in the construction of the human body—especially that of such parts as minister to feeling in general, and to our special senses, such as sight and hearing.

But to appreciate what the human body is, it is necessary, since nothing can be understood by itself, to learn something also about other animals, so that we may know what is the place occupied in nature by that living body of ours which possesses powers and attributes so wonderful. But a mere study of structure—of anatomy—can serve but to supply us with a knowledge of the material elements indispensable to human thought and feeling. We must also, therefore, acquire some knowledge as to how the various parts and organs of the body act during its life, and how that life is maintained, how the body is formed and nourished, and how, if need be, injuries that it may suffer are repaired. The living energy of the body, apart from the feelings and sentiments to which it may give rise, requires to be understood in a certain degree before we advance to the consideration of our feelings and sentiments themselves.

Such an elementary acquaintance with both anatomy and physiology will serve to pave the way for our entrance upon the first stage of our proper subject, namely, the study of the human mind in its ultimate pursuit of science. In the first stage of this psychological inquiry, it will be necessary to consider what our own intellect tells us concerning the various kinds and orders of psychical activity whereof our total mental life is made up. It is evidently desirable to ascertain what, if any, psychical activities besides sensation are most closely connected therewith, what are most allied in nature to our unconscious energies, and whether by the aid of reflection, memory, and inference, we can detect the existence of psychical states of which we were unconscious when they were being actually carried on. Evidently, it will also be desirable to ascertain, if possible, whether in the absence of consciousness we possess any other central and unifying psychical faculty, and, if so, what are its utmost powers and capabilities. Very special attention also needs to be given to the consideration of the phenomena of instinct.

But as idealists appear to bar the way to what, for all but themselves, can alone lead to a satisfactory Epistemology, so a distinguished school of naturalists oppose an analogous, though very different, obstacle to our even entertaining a reasonable hope that we may be able to see and comprehend what are and must be the foundations of science.

What confidence, it has been asked, can we place in the declaration of an ape's mind ? Now we by no means admit that were the human intellect and the highest powers of brutes really of one kind (so that the essential rationality of animals was simply restrained by circumstances from making itself manifest), any valid ground for distrusting truths, which to us are self-evident, would thence arise. On the contrary, instead of giving us good reasons for such distrust, it would but supply us with an amply sufficient motive for an enormously increased regard for what we might certainly then, with reason, call our " poor relations." What seems to us to be clear and indisputably evident in and by itself, and what reason demonstrates absolutely, can be none the less true on account of its cause and origin, or the mode in which it may have become manifest. It is plain that in our own case the truths which are for us most certain must have been gained through the evolution and development of psychical power latent in the mind of an unconscious infant, which once showed no sign whatever of rationality. Why then should we distrust the dictates of a mind evolved from creatures which, though giving no evidence of actual rationality, afford us far more signs of cognitive energy than does the child for some time after its birth ?

Nevertheless, since there are so many persons who do feel a sceptical distrust of their reason on account of the source from whence they believe it to have had its origin, it will, we think, be most advisable to consider carefully the question whether or not there seems to be a difference of kind between the highest psychical energy found present in the brute and the intellect of man. This is simply a question of fact.

Now, since man certainly possesses, besides his intellect, the sensitivity, faculty of sense-association, desires, emotions, instincts, and powers of emotional manifestation with which the higher animals are endowed, it will be incumbent on us to ascertain whether man's lower mental faculties, without the exercise of conscious intellect, will not suffice to explain all the various more or less intelligent actions which mere animals display. Should such turn out to be the case, and should both the positive and negative evidence concerning rationality concur in affirming that there is no need to attribute intellect to animals, then it must be admitted that a difference of kind is thereby demonstrated to exist between them and ourselves. But there is one other question which requires very special care in its examination. It is plain that, as a rule, all men speak while animals are dumb. A special consideration is therefore demanded for language. If it should prove that we have two sets of faculties (higher and lower), have we also two corresponding modes of expression? It is plain that we and animals make signs. It will be necessary, therefore, carefully to inquire and distinguish as to what a sign really is, and, if there are different kinds of signs, what relation they bear to the intellect? It will be further most necessary to examine the relations which exist between gestures and vocal expressions, and, above all, the relations which both of these bear to thought and to the faculty of forming and communicating abstract ideas, and the perception of relations as such. But that we may not, through neglect, underestimate the psychical powers of animals, it will be well to pass in review some of the more striking anecdotes of animal intelligence in both the lower and higher classes of the animal kingdom. Remarkably divergent forms of speech of both infants and savages would likewise seem to require some notice, as also the question as to the origin of speech.

If the result of this somewhat prolonged inquiry should be a conviction that between the highest psychical powers of men and animals there is a difference of kind—a difference absolute and not consisting of degrees of difference—it would then be a question whether such a breach of continuity, such a new departure, stands alone, or whether there are others, analogous sudden interruptions, to be met with in nature ? If we become convinced that it is an unquestionable fact that there are other breaches of continuity—such, for example, as between the inorganic and organic worlds and between insentient and sentient organisms—then *a priori* probability will become thereby established in favour of a breach of continuity between merely sentient animality and the rational animality of man.

All these introductory inquiries (as to the conditions necessary for the existence of science; as to idealism ; as to what science implies ; as to both physical and psychical antecedents of science; and as to the place in nature of the human intellect) having been disposed of, we shall next have to examine into our own highest intellectual powers. In beginning that examination, existing circumstances, and the prevalent prejudices of the day, compel us expressly to consider the bearing upon our estimate as to the rank and value of our own mental powers, of the widely accepted doctrine of "natural selection." If we come to recognise that we are in the possession of self-evident truths which could never have given their possessors an improved chance of survival, then it is clear that our apprehension of such truths could never have been gained by " natural selection," but must be altogether independent thereof.

But it is evidently necessary, in order to decide this question, that we should be acquainted with those of our powers which we might expect to be least dependent on " natural selection," and for this it will be necessary to revert (once more, and more fully) to the questions of certainty and of what must be, if anything can be, its criterion. This, again, will necessarily lead us to examine more carefully the possible self-evidence of propositions, the knowledge of our own existence, and the trustworthiness of memory as vouching for such existence in the past.

Then, also, if we conclude it to be true that we can know objects of knowledge as they exist objectively (or in themselves) the problem of the special relation which must, in that case, exist between " subject " and " object," will have to be investigated. The decision of this question will naturally lead us to a further investigation of first principles underlying all our reasoning, what they are, and whether we can attain to an evident and logical adjustment of truths. Amongst the most important of such principles, and one about which the most vigorous disputations have taken place, is the principle of causation. The truth and validity of this principle, if it can once be established, have evidently most important consequences bearing upon the cause and origin of our own intuitions, and upon the existence, qualities, and powers of the entire cosmos. Here the theory of " natural selection " again courts our notice ; and its bearing on the living world will have to be considered in the light derived from that far larger and more enduring world, which is inorganic and lifeless. The question concerning the significance of human faculty as a part of the universe will come next, and bring to a conclusion all but the main question to be dealt with.

When, in our final chapter, we have to apply ourselves directly to that main question, in the light derived from the various preceding investigations, the groundwork of science will, we are persuaded, be found to consist of three divisions: the labourers who work, the tools they must employ, and that which constitutes the field of their labour. Taking the last first, it will, we think, appear that the matter of science is partly physical and partly psychical. In relation with the former, questions concerning the various physical energies, matter, motion, space, and time must be noted, and an inquiry made as to the value of a mechanical theory of the universe, and the reasons why it is so commonly acceptable. Next must come some reference to the tools which must be made use of, namely, those first principles and universal, necessary, self-evident truths which lie, so frequently unnoticed, within the human intellect, and which are absolutely indispensable for valid reasoning. Finally, the nature of the workers themselves must also be noticed, as necessarily affecting the value of their work; and, last of all, a few words must be devoted to the question whether there is any, and, if any, what, foundation underlying the whole groundwork of science, and giving support and validity to that entire conception of the universe which an impartial study of the phenomena it exhibits may have led us to regard as alone consonant with the dictates of reason.

ST. G. M.

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CHAPTER I

INTRODUCTORY

THE century now so near its close has been distinguished from all preceding centuries by the rapid, varied, and continuous progress in science that it has witnessed. An interest in, and a real love for, science have by degrees ceased to be confined to a limited society of experts, and have happily become diffused far and wide amongst all classes of society.

The scientific spirit is, above all, an inquiring spirit. It can never rest satisfied with what has become known, but must ever press on in all directions into fields of truth yet unexplored, and even seek to ascend into regions commonly deemed inaccessible to human research. But the results of these praiseworthy endeavours, however successful they may be, cannot by themselves fully satisfy the scientific mind. It is not only the phenomena surrounding us which demand exploration. Reason cannot be satisfied until it has probed, to the utmost of its power, the depths of science itself, and either ascertained what is and must be its ultimate foundations, or assured itself that such fundamental knowledge is beyond the scope and power of human endeavour.

It is not enough for the true man of science to be acquainted with many sciences, and to reflect on the knowledge he so possesses. The rational mind sooner or later seeks to know what is the basis of his own knowledge and the ultimate groundwork of all science. It thus calls for a science of science, and cannot rest satisfied without a pursuit of Epistemology, or the study of the grounds of all the learning the mind of man can acquire.

It is an attempt to satisfy this rational desire to which the present volume is devoted. Such an attempt appears to us greatly needed at the present time when every branch of science is rapidly becoming more and more subdivided. For the fact of that very subdivision makes a comprehensive contemplation of science and of nature, as one whole, both more and more difficult, and also more and more requisite for the satisfaction of the intellect.

Epistemology is a product of mental maturity, individual and racial; but, sooner or later, a demand for it is inevitable, while the attainment of a satisfactory response to that demand is not only a thing to be pursued for its own sake, but will be found an aid to the study of every separate science and an introduction to them all. This science of the grounds and groundwork of science is one to the study of which gifted minds are spontaneously impelled, as ordinary minds are impelled to acquire at least the rudiments of ordinary scientific truth. For all men (not congenitally defective) are, in fact, forced by a natural and spontaneous impulse to seek and to acquire some knowledge. To most, knowledge is pleasurable, while many pursue it with passion, and find in its possession a perennial source of happiness.

Amongst the latter are to be found men of the noblest minds; for though right action, rather than right thinking, constitutes the highest human activity, yet the will cannot act with good effect unless the intellect be first sufficiently informed.

The earliest known ages of man's existence have afforded us pictorial evidence of some endeavour after knowledge, while the relics of Egypt, Babylon, and China speak plainly of its deliberate and systematic pursuit.

But an ordered, systematic pursuit of knowledge is "science"; for "science" is but the careful and exact application of ordinary reason and good sense to the examination of any object we seek, as best we may, to understand. The endeavour thus to obtain the most complete knowledge possible about any subject of investigation, whatever it may be, constitutes the highest form of science, for it necessitates the study of Epistemology.

When we first deliberately and reflectively survey the world about us, we may well be appalled by the immense variety of objects and activities which on every side seem to solicit our attention. Striking differences, however, between many of these become at once obvious, and, little by little, they are found to arrange themselves in groups according to their apparent degrees of likeness and unlikeness. Such groups roughly correspond with those various branches of human inquiry which have grown into distinct yet connected systems of ordered knowledge, familiarly known as so many different sciences. Among them are the sciences which deal with the celestial bodies; with the earth, its structure and formation; with the multitudinous tribes of living creatures which people its surface, and with the human race.

Ordered and systematic knowledge considers such subjects from various points of view and along different lines of thought. But two questions commonly suggest themselves with respect to each new object or event which comes within the sphere of our experience. Having recognised its existence, or "*that* it is," the first of these questions asks, "*What* is it?"; the second makes the inquiry, "*Why* is it?" Whence does it arise? How does it come to be?

Demands which thus rise to the lips even of the child must assuredly be included amongst the problems which systematic knowledge investigates. They constitute indeed the most searching inquiries which science can carry on with respect to whatsoever objects may become the subject of its labours. To classify each object or event with its congeners is one great end of scientific inquiry, and such an end was attained in each case when the fundamental similarity became understood between the fall of any object to the earth's surface and the moon's motions; between the electric spark and the lightning's flash; and between that hugest of the ocean's inhabitants, the whale, and the little bat which flits through the summer air at twilight. These may serve as familiar examples of approximate answers to the question, "What is it?" The origin of the solar system, the explanation of reflex and sensori-motor actions,[1] and the genesis of new species of animals and plants, are instances of most interesting scientific inquiries as to the "how" and "why" of matters of scientific or of ordinary experience.

Knowledge is initiated in the individual by the actions of surrounding objects upon his organs of sense, which objects the child becomes gradually able to perceive more or less distinctly. Self-knowledge is of later origin, and much acquaintance with the external world is acquired before the attention of anyone becomes directed to his own mental processes and his internal experiences.

[1] Movements which take place independent of the will on the occurrence of some sensation, as the movements of swallowing take place when a morsel is felt at the back part of the mouth.

So it is with the lower races of mankind and the least cultivated members of civilised communities. Physical phenomena attract their attention almost exclusively, and usually they attend but slightly, or hardly at all, to matters psychical. All men also, however cultivated, are continually impelled and compelled to notice what they regard as surrounding objects, to the apprehension of which the mind applies itself with extreme facility. But they are by no means so often impelled to notice their own mental states.

Now, as we all know, " practice makes perfect," and new or unfamiliar modes of activity are generally at first unwelcome and performed with comparative difficulty. It is small wonder, then, that to most men the study of their own minds and mental processes is at first both repugnant and difficult.

But a moment's reflection will suffice to make clear to the reader that if he would become acquainted with the groundwork of science, he must also carefully inform himself respecting the means and conditions indispensable for that inquiry. No language can be fully understood without a knowledge of its grammar, and no art can be successfully pursued by anyone who is ignorant as to the nature and use of the tools needed for its exercise. Obviously the study of objects and actions around us, as they are commonly apprehended, and also as the results of the most careful examination, lies at the base of every science, and is therefore closely connected with the study of the groundwork of science. But none of the objects of any science, however simply physical, can be comprehended by us without the employment of certain mental tools of different kinds, which must be used in the right manner. No science can be properly cultivated without a certain amount of hard work, and in order to lay bare and see clearly the foundations of all science, such work is especially needed. It is on this account we have chosen for our title *The Groundwork of Science*, it being our desire to point out not only what those foundations are, but also the tools to be used and the kind of work requisite for their discovery and correct apprehension. The study of psychical states being thus indispensable, it is fortunate that the difficulty anyone may find in turning the mind inwards upon itself can soon be overcome; for the faculties of introspection and retrospection, like our other faculties, can be strengthened by exercise, and all that is ordinarily needed to perfect it is patient perseverance.

Perceptions of external and internal facts are primary elements of science. But neither physical facts alone, nor mental facts alone, will suffice for even the commencement of science. For that, conceptions, which are the result of both, are needed. The facts our senses make known to us are the existences and actions of what we regard as individual objects, while mental facts are individual states of what is known as "the mind": states in which we act or are acted on. All that we thus know are real individual (or concrete) existences and activities. But with such materials only the intellect could do no work at all. Thoughts, of which words are the external signs, relate not to what concerns external or internal individual things, but each thought relates to many things of the same kind, *i. e.*, to "universals." Almost always thoughts, and the words which express them, refer to and denote what is abstract instead of concrete, and what is universal instead of individual. The thought symbolised by the word "triangle" does not refer to any individual, concrete triangle, nor even to a definite kind of triangle (*e. g.*, to an equilateral or non-equilateral one), but refers to "triangle-in-general"—to a triangle considered as abstract and universal, and to all triangles as members of one class of figures. It is the same with every noun-substantive which is not a proper name, with every adjective, and with every verb. The words "apple," "red," "fallen," are equally applicable to every kind of apple, to whatever object is of a red tint, and to everything which has fallen from a higher to a lower level.

It is impossible intelligently to utter the simplest sentence —no savage could even say "Spear broken!" without making use of highly abstract ideas. Indeed, the highest and most abstract of all ideas, that of "being" or "existence," is necessarily implied in every statement we make and every question we ask. Again, no progress in science is possible without apprehending degrees of likeness and unlikeness, perceptions as to which constitute the basis of all classification. But neither "likeness" nor "unlikeness" can, of course, exist by itself in the concrete, and no single object taken by itself can be either one or the other. But as with likeness, so with every relation in which one object or action can possibly stand to another object or action, we can only apprehend it by means of an abstract idea, and as all science consists of a study and comprehension of "relations," so all science is essentially abstract, although derived from, and accurately applicable to, real concrete states of real concrete things.

"Thoughts" in one sense are concrete, individual mental (or psychical) realities, as truly as a heap of stones are concrete physical realities. But the meaning of a thought and its oral expression—*e. g.*, "triangle" or "apple"—is (as just said) abstract. Nevertheless, it is not purely mental, but refers to real things which constitute the "class" to which the abstract term refers—the class of triangles and the class of apples—each real concrete member of each such class possessing the real concrete characters referred to by the abstract term. Thus these "thoughts" so considered are not simply mental any more than simply physical.

They are ideas which have their roots in the real concrete character of real concrete things. Therefore what we mainly make use of are these activities of a mixed nature—in essence psychical and in reference, generally, physical. It is thus we apprehend the relations between the various existences known to us. And the work of science may be said to consist (1) in the accurate classification of perceived objects, and the relations which exist between them, both simultaneous and successive—which are often called "the co-existences and sequences of phenomena"—and (2) in estimating the possibility, probability, necessity, or impossibility of their recurrence. Thus are formulated what are commonly called "laws of nature." Some of these so-called "laws" are termed "empirical," because they merely express co-existences and sequences which have been observed to exist as facts, apart from any knowledge of the causes which produce them. Necessary laws, on the other hand, are such as we can perceive to be the inevitable result of known causes, or such as possess other evidence of their universal truth. Some scientific truths must be directly evident (in and through perception) or science could make no beginning; but we must also be able to attain to truths which are indirectly evident (in and through reasoning or inference), otherwise we could make no progress, and so science would remain a mere mass of empirically ascertained data.

Now, amongst the laws of nature are the laws which, so to speak, regulate the mode in which mental processes should be carried on in order to secure valid and satisfactory results and to avoid mistakes and fallacies in our judgments and inferences. Therefore, since science depends, and must depend, largely on reasoning, it imperatively requires not only the greatest care with respect to the observation of facts, but also the greatest care that, in our inferences, those laws of thought the violation of which induces error, should in no case be disobeyed.

In every human perception, and therefore of course in every perception wherewith science is concerned, there are two constituents—(1) the mental or "subjective" constituent—the psychical modification of the subject, *i. e.*, of him who perceives—and (2) the external or "objective" constituent—that (of whatever it may consist and whatever be its cause) which is the object cognised or perceived in the psychical act of cognition or perception on the part of the subject. Again, in every act of intellectual cognition or perception, there are also two elements—(1) the sensational and (2) the intellectual.

In the earliest stages of mental life, psychical action—though no doubt partly excited by internal feelings (that is, by feelings due to physical changes in the internal bodily organs)—is mainly roused to activity, as before said, by the action of external bodies upon the infant's organs of sense and, through them, upon its central and supreme nervous organ, its brain. Numerous feelings are thus aroused and subsequently experienced again and again in various combinations of co-existence and sequence of feelings thus excited by external objects. These experiences lay the foundation for subsequent minute brain modifications, the accompaniment of which are what we call "mental images," "imaginations," or "phantasmata." Such mental phenomena are internal feelings, and resemble, more or less closely, the feelings previously excited by external objects.

Without the aid of such mental images, or imaginations, it is impossible for us to think at all, while it is impossible for us to imagine aught save things which our senses have previously experienced, either entire or in their constituent parts. Our sense-impressions can, as it seems to us, alone furnish a basis and support on which the intellect may build and act, and it can build nothing except upon a foundation of sense-impressions, nor can it take a step without the aid of the imagination. Thus sensations and subsequent mental images are both the necessary antecedents and also the indispensable accompaniments of all our ideas, however abstract or refined.

Nevertheless, it would (in our opinion) be the greatest mistake possible to affirm that there is absolutely nothing in the intellect save what previously existed in our sensations. To say this would be to deny the essential distinctness which exists between "ideas" and "feelings," whether the latter are "sensations" or "mental images." As to the signification of the word "idea," our definition would be "an intellectual representation of an object either actually existing or merely possible."

One or two examples may suffice to show how, by the help of sensations, and mental images, the mind rises to the conceptions of ideas beyond the power of mere feeling. Thus we often refer to some past "experience," and the idea is a sufficiently familiar one, yet that idea cannot possibly be a faint reproduction of past feelings, for "experience" is an abstract term, and, therefore, denotes something which never could have been felt at all. By receiving or obtaining over and over again feelings of the same or of different kinds, we may feel them more easily, more pleasurably, or (as is too often the case) more painfully. But to undergo such changes of feeling, and to obtain the idea "experience," are two very different things.

Again, we can all form an idea of the action of our eyes in seeing (our act of sight), yet that act of seeing was never itself felt, nor can the idea be decomposed into mere feelings —it contains much more. We may have certain feelings in our eyeballs while looking, but even if we could feel (which we cannot) every minute action of every part of the eyes and of the brain's complex mechanism, such feelings would be no "idea of the act of seeing." Among the constant experiences of our daily life are our perceptions of different shades of colour, and different feelings have accompanied such perceptions. But of "colour" we have never once had a feeling; yet we have a clear idea of it and often speak of it.

We have certainly another idea which was never felt, and that is our idea of "nothing," or "nonentity." It is very certain that past sensations can never account for *that* conception, which is nevertheless commonly enough employed. How often do we not hear such expressions as "It is worth nothing," or, "There is nothing in it"?

That our powers of mental conception are not tied down to experience is shown by the very fact that we can conceive of its not being so tied down, and also that we conceive of other senses besides those which we possess—such, *e. g.*, as senses which might enable us to feel the chemical composition, or the magnetic currents and condition, of different bodies. We can conceive of possible experiences which are as remote from being actual as would be perceptions of colour gained by most carefully listening with the ear, or musical harmonies detected by specially contrived lenses carefully fitted to our microscopes.

This essential distinction may be further shown by the fact that one and the same intellectual conception can be initiated and supported by a variety of very different sets of feelings, while a single set of feelings may initiate and support a number of divergent intellectual conceptions. Thus the one abstract idea, "motion," may be initiated or supported by our actual experience or mere imagination of (1) the sight of something traversing our field of vision; (2) a feeling of something slipping through the hand; (3) a sound as of falling waters; (4) one like that accompanying the ascent of a rocket; (5) the sight of a bow and arrow, a musket, or a pile of cannon-balls; (6) the name of a well-known race-horse; (7) dance-music from a familiar ballet; (8) the smell of a fox, and so on.

So also with a single set of feelings, such as those we might experience after gazing upon a marble statue of Shakespeare: its aspect, or even our mere recollection of it, might give rise to and support a number of very diverse intellectual conceptions. Thus it might lead us to conceive of (1) the man Shakespeare who once lived; (2) the Elizabethan age; (3) the man's merit as a dramatist; (4) of poetry as an art; (5) plays we have seen acted; (6) theatrical *mise en scène;* (7) the name and merit of the statue's sculptor; (8) the appearance of the marble; (9) the mountains of Carrara; (10) the geographical age of the limestone; (11) the creatures which existed whilst it was being deposited; (12) marble as a substance; (13) the particular piece making the statue; (14) individuality; and lastly (15) the idea of being or existence.

To state this distinction as shortly as possible, it may be pointed out that our sensitive faculty is affected by surrounding objects in various ways, but that it is the intellect alone which can apprehend the *relations* in which they stand to it and to each other, and that such relations do, in fact, exist. But it is plain that to understand the relative position of two objects, we must perceive both of them and turn back the mind (reflect) from the last to the first perceived. Without so doing, their spatial relations, their relations as to position, could not possibly be apprehended.

Again, feelings (both sensations and imaginations) can never reflect on feelings; but thought can reflect on thought. Feeling may be so intense as to annihilate itself and produce insensibility—as light may dazzle and blind; but an idea can never be too bright and clear, and no amount of vividness on the part of the intellect can mar intellectual perception.

The profound and essential distinction which exists between (1) an idea, or intellectual conception, and (2) a feeling—felt or imagined—is particularly conspicuous with respect to our idea of "being" or "existence." That idea is so fundamental that it is simply applicable to everything, while without it nothing can be apprehended. No group of feelings could possibly give us a feeling of "being," because there neither is nor can be one feeling common to all other feelings, and yet a feeling of a distinguishable kind. Nevertheless, though we have no "feeling" of "being," the idea of "being" lies at the root of all our conceptions, and is present (though, of course, it is not reflected on) in the mind of the young child who asks what that "thing" is. It may be well further to contrast our "feelings" and our "intellectual perceptions" from yet another point of view.

In the pursuit of every science we have to make use of both, and the way we should regard them—the relations in which they stand to each other—is supremely important for those who would enter upon the science of the sciences—Epistemology. To determine what is most certain and most fundamental, it is obvious that we need to see clearly what is and must be the nature of our absolute and ultimate criterion of truth in all cases.

There are some persons who would assign the dignity of an ultimate test of reality and truth to our sensitive faculty. But a little careful consideration will be enough to show the investigator that it is the intellect alone which is, and must be, supreme; and this not only in judging about recondite problems, but even in deciding concerning things which we see, hear, feel, etc., and concerning all concrete experiences as they actually occur. Thus, even with those matters which can be submitted to the test of sensation, the last word, in all cases of doubt, rests with the intellect and not with the senses. It might seem that in making experiments with different bodies (as in chemistry), when we directly appeal to our senses for information, those senses must be our ultimate criterion; yet such is not the case. The enormous value and indispensable nature of our sensations is obvious and unquestionable. Observation and experiment are always, of course, to be made use of, when possible, for verifying our inferences. Nevertheless, in the last resource, when we have done experimenting, how do we know, with absolute certainty, that we have obtained such results as we may have obtained? Manifestly by the intellect. How otherwise are we to judge between what may seem to be the conflicting indications of different sense-impressions? Nothing could be more foolish than to undervalue the testimony of the senses, which are both tests and causes of certainty. They are not, however, *the* test of it. Certainty does not pertain to sensation, but to thought alone. Self-conscious, reflective thought, then, is our ultimate and absolute criterion. It is by thought only—by the self-conscious intellect—that we know we have "feelings" at all. Without that we might indeed feel, but we could not have complete certainty as to our feeling and know assuredly that we possessed it. Our ultimate court of appeal and supreme criterion is the intellect and not sense, and our act of intellectual perception which is thus ultimate, which both knows what it knows and knows that it knows it, with absolute certainty, which is above any possibility of proof and is self-evident in and to itself, is called "intellectual intuition."

The matters thus put forward in a simple elementary way in this introductory chapter will be treated of more fully and scientifically when we begin to grapple with the most fundamental questions concerning human knowledge. We have here somewhat anticipated what we shall have to say in our eighth chapter. We have, however, felt ourselves forced so to do, as otherwise we could hardly make clear matters we must deal with almost immediately.

Here, at the outset, we take for granted that a world of material, independent objects, possessing various powers and activities, exists about us; also that we possess a material, extended body, so organised as to produce in us feelings of various kinds which are closely connected with our perceptions and our judgments.

Taking these data provisionally as unquestionable facts, it may, we think, suffice to affirm and point out what will be fully demonstrated later on, that, though in the investigation of science we should make use of all our available powers and faculties—our powers of feeling, imagination, sensuous perception, memory, and inference—yet that our intellect's declaration, as to what is here and now certainly and self-evidently true, is our supreme guide, and the most powerful and effective instrument for our use in every inquiry we make. A provisional assent to this statement and a temporary obedience to the law thus set forth, is all we wish to ask of those who would follow us in our investigation concerning the groundwork of science.

CHAPTER II

AN ENUMERATION OF THE SCIENCES

A BRIEF enumeration of the principal sciences, the groundwork of which it is our business to inquire into, may fitly, we think, precede the inquiry itself.

Various attempts have been made at a classification of the sciences according to the subjects about which they are occupied; some sciences being set down as "abstract," others as "abstract-concrete," and yet others as "concrete" simply.

All such attempts we regard as futile. Every science is a definitely organised system of recognised relations between thoughts and objects, between thoughts and thoughts, and between objects and objects; and no science can be learned save by the aid of language, spoken, written, or both. But all language is highly abstract; nor can the most concrete objects (*e. g.*, a tray of specimens of different minerals) be apprehended and compared save by the aid of very abstract ideas.

On the other hand, not the most abstract of all ideas, that of "being," or "existence," can be made use of without reference to some concrete reality to which that idea truly applies. Even the most extreme of idealists, he who thinks that the whole universe about him is but the creation of his own mind, or he who deems it (his own being and thoughts included) to be but passing phases of some other unknown mind—each such idealist must regard that mind he so conceives of as a concrete reality and the object of thought.

Everything which can be an object of study has multitudinous relations, of most varied orders, to other objects and to the mind which studies it. A sphere of crystal, as being a single object, solid, transparent, spherical, of a definite weight, of a certain chemical composition, of a certain temperature, capable of projection in various directions and at definite velocities, as a manufactured object, made in a certain locality, for a definite purpose, etc., etc., obviously possesses numerous relations, and cannot be fully understood save from many points of view and by the aid of abstract ideas of very different orders.

How difficult, then, must be the task of classifying the sciences according to the degrees of abstraction made use of by them, seeing that every one of them is, in fact, highly abstract. It is true that an effort might be made to classify them on other lines, as, for example, from an historical point of view. This, however, would obviously be most unsatisfactory were we to try and arrange them in the order wherein the objects they treat of become known in the history of the individual mind; and hardly less unsatisfactory would be an endeavour to arrange according to the date of their origin as sciences. Could astrology and alchemy be deemed incipient stages of astronomy and chemistry? The mere fact that such a question can be asked is enough to lead us to abandon the task of attempting an historical classification.

For our part, we shall not try to construct any classification of the sciences at all, but will content ourselves with the humble task of their brief enumeration, endeavouring, at the same time, to indicate some of their logical relations one to another.

Indeed, reason, it seems, does not permit us to concede that any one science has an indefeasible claim to priority, for conflicting, apparently equal, claims point in various directions.

Our own body is the object we most intimately know, and next might be ranked the objects most closely related to us, and with which we are the most familiar. But such things, taken together, do not constitute any distinct science.

There is, however, one property which belongs to them and to everything else we can think of likewise—to every separate object, natural or artificial, to every motion or appearance, and even to every thought we can entertain about any possible object.

To know anything whatever, is to know that it is distinct from something else. Two marbles, alike in colour, size, shape, and weight, are known with perfect certainty to be distinct, though we may not, when apart, be able to tell one from the other. We recognise them as two things of the same kind, and together they form "a pair." If we have elsewhere a group of three marbles exactly like the first two, then these two groups differ in *number*. "Number" is a property possessed by every object, motion, or appearance, and even by every thought.

The one thing which alike pertains to everything we know, terrestrial or celestial, material or mental, is "number." Probably it was this truth which underlay the system of Pythagoras, who, more than two thousand four hundred years ago, taught that "number" was the principle of all things.

But the study of that which is thus common to everything is the study of mathematics. Therefore mathematics, as the science of number, would seem to have a reasonable claim to be regarded as the most fundamental of all the sciences, since it pertains to every other, and no other can be pursued without it.

Nevertheless, another science can advance a claim seemingly as unanswerable in another respect as is the claim of mathematics, as just stated. No science can claim to be absolutely primary which has to depend on another science for explanation and comprehension. Mathematics is a science of "number"; but what is "number"? Moreover, numbers are alike or not unlike, and a perception of "likeness and unlikeness" was declared, in our introductory chapter, to be at the base of all the sciences. What, then, it must be further asked, is "likeness"? May not the science which can solve these riddles justly claim to underlie, and be prior to, the science of mathematics?

The idea of "number" implies comparison, together with a recognition that the things compared are similar, and yet not identical. Things which are quite dissimilar—such as, *e. g.*, "a violet blossom" and "a fall in consols"—cannot be said to be two, unless it be two expressions or two thoughts—in which respects they *are* alike. But the idea of number, inasmuch as it recognises things as similar but not identical, implies many things besides similarity and identity. In every perception of number there are, and must be, latent the ideas of "existence," "distinction," "similarity," "unity," and "truth," as a little reflection will show. Thus, to say "there are two sheep," implies that they are not merely imaginary, but that they actually *exist;* that they are not seen double by some optical delusion, but are really *distinct;* that they are certainly both sheep and not one of them a goat—*i. e.*, that they are *similar*, and that they have that *unity* of nature which we have just seen to be necessary in order that they should be susceptible of numeration, and finally the assertion implies that the thought of the assertion corresponds with objective reality, that is, it implies *truth.*

It may be replied that mathematics deals with abstractions and considers numerical relations of things apart from the things themselves. The assertion is most true, but from that very fact it must be applicable to all things and would be mere nonsense apart from the implication that there really are things, be it only thoughts, to which the idea of number can be really and truly applicable. And if thoughts are to be capable of enumeration they must have existence, distinction, similarity, unity, and truth, just as a pair of sheep (as above pointed out) must possess those attributes. But this degree of similarity between things so essentially dissimilar as "thoughts" and "sheep," suggests the further question, "What is likeness?"

Now a moment's reflection must make it evident to any thinker that not everything can be defined or explained. If there were not some things capable of being understood without definition and explanation, then nothing whatever could ever be understood at all; for in that case the processes of definition and explanation would have to be carried on forever. Now "likeness," like "number," can be clearly seen to imply ideas of existence, distinction, unity, and truth; but that, of course, is no explanation of it. It is one of those primary, ultimate, fundamental ideas which (like the idea of "existence" or "being") is incapable of definition or explanation just because it *is* so simple. For to say that two things are "alike" when they are identical in some respect, or respects, does not deserve to be called an explanation. For to recognise that two objects are identical in certain respects we must be aware that their other respects are alike in not being identical. Anyone who thinks he cannot understand what he means when he says two things are "alike," or when he declares, "there is a 'likeness' between them," may as well give up the attempt to understand any branch of science and, *a fortiori*, its groundwork. But the science of mathematics enables us to prove a vast quantity of truths which would be inaccessible to the human mind without its aid. By its help truths, applicable to all existing things, can be deduced from other truths by means of various processes of inference. But can mathematics, which thus makes use of "proofs," dispense with the aid of that science upon which it thus leans: which tells us in what proof consists, and lays down the laws by obedience to which alone valid inference can be carried on and truth attained? Now, such a science is logic. Surely, then, logic may advance a strong claim to be the most fundamental, and, therefore, to head our list of the sciences.

But to comprehend logic, speech is necessary, and though, as we shall hereafter see, there are strong grounds for concluding that speech was posterior to thought, nevertheless here and now, the use of, and a considerable knowledge about, speech is long anterior to our comprehension of, or even to the very first application of our minds to, logic. Therefore, the science which treats of human speech could also advance a claim to priority.

But, as before said, logic is essentially the science of the art of proof, and all proof must repose upon certain data. Therefore, such data must, in the first place, be either perceptions which we have concerning our own mental states and operations, or perceptions concerning external things, or conceptions of, and reflections about, one or the other, or both of these.

But all these are forms of psychical activity, or are the direct results of different forms of psychical activity. Now these psychical activities must be anterior to any processes of reasoning, and form the data whence all reasonings proceed. But the elucidation of these data is the business of psychology. Surely, then, the science which deals with the initiation and performance of psychical phenomena (phenomena which constitute the data and basis of logic) may claim priority over, and to be more fundamental than, logic itself.

But the science of reasoning cannot, for another reason, validly lay claim to be primary and fundamental, since it requires other data than those given it by psychology. Now in order to prove anything by reasoning, we must show that it necessarily follows, as a consequence, from other truths, on the truth of which its own truth depends. Such other truths must therefore be deemed more indispensable than the thing they are called on to prove. Evidently we cannot prove everything. However long may be our arguments, we shall at last come to statements which must be taken for granted as ultimate. One such statement is that which affirms the validity of reasoning. If we had to prove the validity of the reasoning process, then either we must argue in a circle, or our process of proof must go on forever without ever coming to a conclusion. In other words, there could be no such thing as proof at all. There must, then, if any human knowledge is trustworthy, be some truths which require no proof, but are evident in and by themselves. Once more, then, that science, whatever it may be, which thus deals with the basis of all reasoning, and therefore of all psychology, of all logic, and also of all mathematics, would seem to have, if anything has, a valid claim to be the most primary and fundamental of all sciences. But the science which does this is metaphysics!

Metaphysics, however, though it thus deals with what is so primary and fundamental, is a science which has also to do with the human mind, with our views concerning an external world, and with whatever constitutes the subject-matter of every other science. For of what does the science of metaphysics treat ?

In the first place, it may be said to be "the science of the supersensuous considered objectively."

It is also divisible into two great sections; the first of these (*a*) may be distinguished as " general," occupied as it is about " being," its properties and categories—about " reality " in the sense we give to that term. For us " reality " is composed of " whatever actually does or possibly may exist "; while, similarly, " being " is that which possesses either form of " reality."

" Reality " cannot be anything else but *possible* or *actual*, for there evidently can be nothing intermediate between the two. Abstract " being " cannot, of course, exist as conceived by the mind; but nevertheless it is not absolute nothing (*nihilum*), because, though incapable of existence in itself, the conception is nevertheless realised in things which do exist, while pure nonentity (*nihilum*) is the absolute negative, and cannot possibly exist in any mode. As to what is " actual," that term needs, and can have, no definition, since it must be implied in every attempt to define it.

The second great conception (*b*) of metaphysics may be called " special," since it concerns itself with definite inquiries about cosmology, the world as it appears to the human intellect, the origin and nature of the latter, with consequences which appear evidently to follow therefrom in all directions.

It would, then, be manifestly absurd to place it first upon our list. It should come, as its name implies, after the study of all that concerns the external world, and the study of man as a living and thinking organic being. But not only must metaphysics, though the most abstract of sciences, be denied the first place in our list; something may even be said for the sciences usually deemed the most concrete. In fact, a knowledge of the physical precedes that of the psychical (as was before asserted), and if concrete sciences need, for their comprehension, abstract ideas, the most abstract sciences have need of the concrete. Thus psychology cannot be fully investigated and understood without some comprehension of our organic frame and its multitudinous activities. But our body is the subject of anatomy (including histology) and its activities, or physiology, while neither human anatomy nor physiology can be adequately comprehended if dealt with alone. For such adequate comprehension the aid of comparative anatomy (or morphology) and comparative physiology—which contrast man's form and functions with those of animals and plants—are needed, and these cannot be made use of without some acquaintance with zoölogy and botany. But, again, the creatures about which the last-named two sciences are concerned, must be studied with respect to extinct as well as existing species (palæontology), and to know that requires a knowledge of the world's past history (geology), and this cannot be fully understood without regard to the earth as a member of the solar system and of the sidereal universe, and so we are led to astronomy.

We have hitherto passed over (simply because everything cannot be mentioned at the same time) the study of mechanics and of the physical energies—gravitation, heat, light, sound, chemical change, electricity, and magnetism; but every one of these sciences is intimately connected with what concerns the inorganic as well as the whole organic world. Nor can that study which relates to the origin and evolution of the world (the only theatre actually known to us of all the sciences) be said to have no claim to be itself primary and fundamental. But the whole universe has been revealed to us by human study alone, and human activity is the cause of the existence of all our sciences, on which account anthropology, the science of man, must be allowed in its turn some claim to be considered fundamental. Now if a separate science (physiology) be devoted to the consideration of the activities of animals and plants, surely the story of human actions has yet more claim on our careful investigation, and the most important results of human activity are recorded in history, which tells us of the first beginnings and systematisation of mathematics, psychology, and logic. And here must also follow on the study of man's pursuit of his ideals of beauty, truth, and goodness—the history of art, of science, of philosophy, of ethics, and of religion. All questions of religion, however, will be very carefully excluded from the present work, all the arguments in which claim to repose on and appeal to nothing but the pure dry light of human reason.

But the fact that different religions have existed has been too often made most painfully evident, and therefore the recognition of the existence of religions and systems of theology as facts, cannot possibly be excluded from the sphere of the sciences any more than the external manifestations of the inner nature of each such system. Now theology professes to occupy itself with man's relations to a God or to gods, and to other superhuman beings, if such there are, and to his fellow-men, and so may be called (on the assumption that the only really intelligent animals are men) "the sociology of intelligences." But this form of sociology demands the aid of philosophy, psychology, and history and ethics. But ethics, like metaphysics, may be divided into (*a*) general and (*b*) special. The former regards the existence and first principles of ethical distinctions; the latter the special application of those principles to society, the family, and the individual.

But for the due application of those principles to individuals and groups of men we must call in physiology to our aid, and therefore anatomy, while physiology brings with it the study of the physical energies (statics, dynamics, thermodynamics, chemistry, optics, acoustics, and the sciences of electricity and magnetism), which again necessitates recourse to mathematics, and once more to logic and psychology.

In a word, all the sciences are connected by such a labyrinth of interrelations that the construction of a really satisfactory classification of them appears to be an insuperable task. Anyhow, it is a task beyond our powers.

But for our special purpose—the explorations of the foundations of science—a systematic classification of the sciences does not appear necessary. We will therefore aim at nothing but to place before our readers a catalogue of the sciences in what seems, to our judgment, a not inconvenient order. It will also, we think, be well here to assume the existence of real, external, independent bodies, as they are commonly supposed to exist, reserving all questions as to the truth of that supposition for our next chapter.

Accepting, then, provisionally, the existence of a world of real and independent external bodies, generally exhibiting some definite shape and figure, with powers of intrinsic motion, of motion due to external causes, and in all cases capable of enumeration, we may thus set down the series.

On account of this last characteristic we will place first on our list the science of *Mathematics*. This, as the reader of course well knows, consists of *Arithmetic*, or the study of definite quantities of things of whatever kind; of *Algebra*, or the use of definite symbols to investigate undefined quantities of undefined things; and of *Geometry*, which studies the properties of figures, the direction of lines, and the conditions of space in its three dimensions (length, breadth, and thickness), including the properties of the sphere, the cone, and the cylinder. Though geometry appears to have arisen through the desire to measure land accurately (for which the properties of triangles and their angles served, and still serve), Greek geometers occupied themselves, in a purely speculative manner, with the different methods in which a circular cone may be cut. The investigation of the various kinds of curves which may be produced by cutting across it in different directions, gave rise to the study we know as *Conic Sections*.

By various other processes the most varied properties of objects have been investigated, including complex reciprocal relations of increase, decrease, and variation. When two quantities vary they may do so equally or in different proportions or ratios. The *Differential calculus* deals with computations concerning the rates of change between quantities. The *Integral calculus* passes from the relation between such rates back to the relations which exist between the changing quantities themselves.

We may next pass to the science of *Mechanics*, with its subdivisions, *Statics*, *Dynamics*, *Hydrostatics*, *Hydrodynamics*, and *Pneumatics*.

"Mathematics" is, as we have seen, concerned with *number*, *space*, and *direction;* "Mechanics" also with *time*, *motion*, and *force*, and especially the action or effects of gravity. Mechanics deals also not only with *solids* but with *fluids*, whether *liquids* or *aëriform* (or gaseous) substances; and these whether apparently *at rest* or in a state of *motion*.

Statics concerns itself with equilibrium, the composition of forces, the lever, the balance, the inclined plane, etc. *Dynamics* considers motion, its velocity, duration, extension, and direction (according to Newton's three laws), its quantity, acceleration, and retardation, and the law of falling bodies due to the action of centrifugal and centripetal forces.

In *Mechanics* it is assumed that solids consist of particles cohering stably in some definite order, but liquids are supposed to consist of particles which possess freedom of motion in all directions, each particle pressing equally on all those which surround it and being equally pressed on by them.

In *Hydrostatics*, therefore, pressure in all directions, and not only the pressure of gravity, is considered, with the well-known consequence that the surface of tranquil liquids is horizontal, and water will always find its own level, and those concerning the sinking and rising and other motions of solid bodies in liquids. *Hydrodynamics*, or *Hydraulics*, deals with the motions of liquids (waves, running water, etc., etc.), which are so complex compared with those of solids, and the various machines—the utilities of which are due to the laws of moving liquids—water-rams, water-wheels, etc.

The science of aëriform fluids, *i. e.*, *Pneumatics*, adopts the hypothesis that such fluids are composed of particles which repel each other, separating as far as they can but pressing equally in all directions. Such fluids are, therefore, both extremely elastic and compressible, but, like solids and liquids, they have their due weight, inertia, momentum, etc., and, like liquids, they have their waves of motion. The weight of the atmosphere is also treated of in its practical applications through the barometer, siphon, pump, etc.

We may place next the sciences which treat of what are called the physical energies of matter, both in their non-manifest or *potential* condition (capable of doing work), and in their active or *kinetic* state (actually doing work). The first of these sciences is that which treats of *Heat*, its powers of expanding bodies, its phenomena of conduction, convection, radiation, absorption, reflection, and refraction, and its relations to other physical energies. The science of *Light* deals in turn with its wonderful velocity of motion, in waves of various lengths, its aberration, reflection, refraction, interference, polarisation, etc., with the laws of *Optics*, and such practical results in the microscope, telescope, spectroscope, and other instruments constructed in accordance with its laws.

Acoustics is the science which concerns itself with sound, its propagation, reflection, and diffusion through aerial waves in all directions, with the laws of musical sounds or notes, the nature of timbre, and various conditions presented by different musical instruments.

The science of *Electricity* is one the amazing consequences of which are familiar to everyone, so that we need but mention its name together with that of *Magnetism*, so intimately connected with it, and pass on to the science of *Chemistry*, which has a distinct, though very indirect, connection with the subject of this work.

All the sciences which treat of solids, fluids, and the already mentioned physical energies, plainly exhibit what are commonly termed the laws which govern nature, but had better be called the definite tendencies which are innate in the substances which compose the universe. Yet chemistry is, above all, distinguished by the clear and unanswerable manner in which it demonstrates that these tendencies act in clearly defined directions, and build up by a selective agency certain bodies and none others. Such is the case whatever may be the reduction in number of what are at present considered elementary substances, even if we should ultimately become convinced that the material world is composed only of inconceivably numerous combinations of particles of one elementary substance. Processes of analysis and synthesis demonstrate the definite proportions in which alone different (as yet seemingly distinct) substances can unite and transform themselves into others not less well defined ; while *Crystallography* reveals the extraordinarily definite shapes into which alone definite substances can crystallise, two such substances of different kinds and modes of crystallisation sometimes growing so as to become inextricably mixed, each of them preserving its own individuality and growing according to its own laws. This science is closely allied to, or rather a part of, *Mineralogy*, a knowledge of which leads to, and is a necessary part of, the study of the crust of the earth and the strata which compose it, which are dealt with by *Geology ;* while *Meteorology* concerns itself with the movements which take place in the earth's atmosphere, and all forms of storms, and the varying directions of currents, and all that concerns storms of all kinds. But these, with the flow of rivers and the action of tides, the descent and upheaval of parts of the earth's crust with earthquakes and volcanoes, also come within the purview of *Geography* and *Geology*, which latter is again largely indebted to the science of organic remains (*Palæontology*) for its knowledge of the relations of the superimposed layers of rocks which clothe our globe externally, revealed, as they often are, by the kinds of fossils they contain.

But the phenomena of tides, of dawn and sunset, of the year's seasons, with their shortening and lengthening days, and, above all, of eclipses, force us to pursue the science of the earth's celestial sisters, *Astronomy*, which, in turn, has a distinct bearing on the possibilities of that inexplicable energy with which the sciences which remain to be enumerated are concerned—namely, life.

Our reference to *Palæontology* has, indeed, already borne some reference to that energy, since fossil remains are relics of bodies which once had life.

The two great groups of living things, plants and animals, were long supposed to be so widely separated that each was treated of by a separate science only. Now, however, so many deep resemblances are known to exist between them that we have been forced to treat with them together as one whole, in the science of living things, as *Biology*. Living things being classed in the two great, so-called kingdoms of plants and animals, it is accordingly, as everyone knows, divided into the sciences of *Botany* and *Zoölogy*. But every animal and plant has to be considered according to its form and structure on the one hand, and according to the activities of all its component parts. Those activities are treated of by *Physiology*. Structure may be considered in its larger division as existing in one or many species (*Anatomy*), or in its microscopic division—the structure of the component "tissues" of the organism (*Histology*). The structure of the various kinds may be studied in reference to many or all others, simply as to matters of fact, or with the aim of discovering general laws of structure (*Morphology*). Yet another science investigates the modes in which each species and group of animals or plants is developed from its germs (*Embryology*, *Development*, and *Ontogeny*), and the mode in which it may be conjectured to have been derived from antecedent species (*Phylogeny*). But living creatures have to be considered with respect to the relations they severally bear to space (*Biological Geography*), as also to past time, which brings us once more to palæontology.

A special science, which has been termed *Hexicology*,[1] is, moreover, devoted to a study of the relations which exist between organisms and their environment as regards the nature of the localities they frequent, the temperatures and amounts of light which suit them, and their relations to other organisms as enemies, rivals, or accidental and involuntary benefactors.

Finally, as resuming and uniting all the sciences which deal with the various bodies which compose the universe, comes the science of the material universe considered as one whole—namely, the science of *Cosmology*.

After these sciences, acquaintance with which is necessary for a complete knowledge of man, may follow that science

[1] ἕξις. Habit, state, or condition.

which concerns him specially and directly—namely, *Anthropology*. This science studies the various physical conditions needful for human existence, as the various subdivisions of biology investigate the conditions necessary for the life of other organisms also. Such are the studies of *Human Anatomy* and of the lower activities, *i. e.*, *Human Physiology*. But since man has powers and characteristics which other organisms do not possess, additional sciences are devoted to the study of such additional facts. Thus *Ethnology* occupies itself with the various races into which mankind is divided, while *Philology* examines the languages they speak, and *History* describes their successive appearances and disappearances, their aggregations into tribes and nations, their migrations, wars, and the series of events which have taken place, their form of government, and the actions both of their rulers and of the classes they ruled over. The study of the various conditions which have been, or which now exist, or which might be beneficial or hurtful to the race, is known by the awkward term *Sociology*. The science of *Politics* deals with the various kinds of civil aggregations in which men do or may exist, with the probable or certain benefits and defects of each. Man's conceptions of right and wrong and the relations which thence arise between each individual and other human beings standing to him in a multitude of different relations, constitute the science of *Ethics*, while ethical relations have been supposed to extend to some various real or imagined superhuman intelligences, so constituting *Religion*.

In connection with these latter sciences comes the study of man's lower and higher mental powers, together with the probably psychical powers of lower organisms, namely, the study of *Psychology*, closely connected with which are *Logic* and *Philosophy* or *Metaphysics*, about which enough has, we venture to think, been already said in this chapter.

Finally, and last of all, comes the special subject of this work, namely, the study of the ultimate grounds of all knowledge and of all science of whatsoever kind—the science of *Epistemology*.

CHAPTER III

THE OBJECTS OF SCIENCE

IN our enumeration of the principal sciences, as also in our initial chapter, we have taken for granted that the ordinary and spontaneous judgments of mankind as to the external world are true and valid. But before proceeding any further in our endeavour to apprehend the groundwork of our science, we must carefully consider the question as to its objects. We must endeavour to attain as true a knowledge as possible concerning the nature of those things which science occupies itself about.

The sciences of psychology and logic occupy themselves with the human mind, its powers and processes, its mental images, its feelings and emotions, its thoughts and inferences. But mechanics, astronomy, geology, biology, etc., are commonly thought to busy themselves about things which, though we apprehend them by mental acts, truly exist independent of the mind, and form parts of a really existing external world.

Now, of course, we can know nothing which we do not in some way perceive or indirectly gain information about by eye or ear or some sense organ, and everything we apprehend we apprehend as in various ways related to other things, as well as to our own mind. Every object, therefore, of which science can take cognisance, is only known to us through a variety of mental states which we term feelings, reminiscences, inferences, or apprehensions, and amongst the latter are apprehensions of such object's relations: both its relations to other things and its relations within its own being—its external and internal relations. Every object, therefore, looked at as regards our apprehension of it—*i. e.*, merely *subjectively*—may be said to consist of a plexus of such mental states or "states of consciousness."

It is also true that not only can we know nothing about any object except by means of some mental state of our own being, but that were it possible to preserve such mental states in their entirety while the object they referred to was annihilated, our mind, and therefore our knowledge, might remain unaffected thereby. It is notorious that under abnormal conditions, things may seem to be perceived which do not in fact exist, as also that there may be existences which, to exceptional individuals, remain unperceived—as the odour of the rose to one congenitally devoid of all olfactory power, its red hue to one who is colour-blind, and the cry of the bat to very many persons.

May it not then be that no independent external world really exists at all, and may not the "*esse*" of every seemingly independent thing be "*percipi*"? We know with absolute certainty (with the certainty of reflex consciousness) that we have ideas; may they not be the only real existences?

This, as the reader well knows, is *Idealism*. But idealism has much to say for itself.

Such could not fail to be the case, seeing how many illustrious men of a very high order of intellect have professed and do profess idealism, and it is far indeed from being confined to pure metaphysicians. Many distinguished cultivators and teachers of physical science declare themselves to be idealists.

Its advocates ask:

"What possible ground can anyone have for not being an Idealist? If we examine any object, as for example an apple, what are really its various qualities? Are they not rather ours than the apple's? We think that we look at *it*, but all we see is a definitely shaped patch of colour, and that is a sensation of our own. We take it up and hold it to the nose, when we perceive its apple-odour. But that is only another of our sensations. We may grasp it, feel it, and squeeze it, and these acts will occasion a number of other sensations through our skin, muscles, and the nerves supplying both, and these sensations are merely our own feelings once more, though we refer them to an imagined object and say that it is rounded and rather hard. We may tap it on a table or drop it on the ground, when we shall hear sounds; in other words, we shall experience sensations of another order. Finally, we may bite it, and so have other experiences of resistance overcome and a pleasant flavour; but the taste is certainly not in the apple, but in us. It is but one mental state the more. Do what we may we cannot by examining any so-called material object arrive at anything more than modifications of our own mental states—different feelings. Other feelings we have, indeed, of a less vivid kind. These, however, are nothing but faint revivals of sensations previously experienced, or of feelings of the modes in which such previously experienced feelings have stood one to another. Such 'faint revivals' and 'faint feelings of modes of sensation' we call 'ideas.' These vivid and faint feelings are the only things which can be perceived by us, and the whole of our knowledge consists of nothing else. Therefore, as far as we know, nothing exists or can exist except as something felt and perceived. We cannot even conceive anything otherwise existing, and therefore the very essence of 'existence' must consist in being perceived. Evidently an 'idea' or a 'sensation' can be like nothing but an idea or a sensation. A colour, taste, smell, or sound can be like nothing but a colour, taste, smell, or sound. We can have no experience and no knowledge of anything in any object, *e. g.*, in an apple, which exists underneath (so to speak) its size, solidity, shape, colour, smell, and taste, and which supports these qualities, but which itself can never by any possibility be perceived. What Idealism denies, therefore, is not the existence of that which we really perceive, and which we habitually call 'external things.' It only denies the existence of a something underlying what we call external things, which 'something' is a mere phantom, a creation of the fancy, and cannot be attained to by any of our senses, but is equally out of the reach of them all. If ordinary people when they speak of any object mean to refer to what they actually perceive (and which we cannot any of us know otherwise than as a mere plexus of our feelings), then they are Idealists all the time without knowing it, as Idealism fully accepts and asserts the existence of such things so actually perceived. Idealism does not contest the existence of any one thing which we can feel, perceive, or even imagine—of anything which we can apprehend either by sensation or reflection. That things which we see with our eyes and touch with our hands do really exist and are really known to us, it does not in the least question. It only denies that in these really known and existing things there is an underlying, unknowable and unimaginable 'substance,' which in some mysterious way supports the qualities which our senses perceive. In denying the existence of this unknown and unknowable 'substance,' it deprives men of nothing which they can even imagine, and therefore of nothing they can really miss. If the word 'substance' be taken in the vulgar sense for a collection of all the 'qualities'—quantity, shape, weight, colour, etc., etc., which compose an object as we know it—Idealism can never be accused of taking it away, for, according to Idealism, it is that alone which exists. But if 'substance' be taken in a so-called 'philosophic' sense for something external to and independent of the mind which supports all the 'qualities,' the existence of which the mind recognises, then Idealism may be accused of taking it away, if one may be said to take away a thing which never has been or can be perceived to exist or be even imagined so to do. Far from inculcating any disbelief in the senses or in what the senses tell us, Idealism attaches the very highest value to the senses and to their teaching. It no more doubts the existence of what is seen, heard, or felt, than it doubts the existence of the mind which sees, hears, or feels. Nothing, therefore, can be more absurd than the criticisms of those persons who say that Idealists, to be consistent, ought to run up against lamp-posts, fall into ditches, and commit other similar absurdities. Idealism is not only a thoroughly logical system, but also one quite in harmony with every-day life, its perceptions and its duties. It is obvious that we can never get outside ourselves, or feel the feelings of anyone else. We can only know our own sensations and ideas. The existence of these sensations and ideas is sufficient to explain our whole experience, and we are not idly to suppose that other things exist when such 'other things' are altogether superfluous for explaining any of the phenomena we are or can become acquainted with. As we cannot know anything beyond our own ideas, why should we affirm that there is anything beyond them? It is impossible for us to even imagine anything existing unperceived. We cannot imagine matter existing in the absence of mind, for in the very act of imagining it we are compelled to imagine someone perceiving it. It is, of course, easy enough to imagine trees in a park or books in a library, and nobody by to perceive them. But so to do is only to form in the mind certain ideas which we call books and trees, and at the same time to omit to form the idea of anyone perceiving them. But the person so imagining them must himself be thinking of them all the time. To show, or even to know, that anything was existing independently of the mind, it would be necessary to perceive it while it remained unperceived, or to think of it while at the same time it remained unthought of, which would manifestly be an absurd contradiction and a downright impossibility. Idealism, therefore, does not contradict the assertions of common-sense, or cause any practical inconvenience to him who maintains it, seeing that it only denies what is but a figment of perverse Metaphysicians—a groundless and utterly irrational belief in a necessarily unknown and unimaginable entity, about which no one of our senses can tell us anything whatever."

Such is idealism as put forward and defended by its ingenious and estimable author, Bishop Berkeley, whose piety led him to explain our ideas and perceptions as the result of the direct action of God upon our minds; the whole visible, audible, and tangible universe being the product of the energy of the divine mind so acting upon us.

This explanation, could we accept it, would indeed enable us to know at once what is the groundwork of science. But we by no means see how to reach our goal by so short a journey. We need not even linger over this pious hypothesis, since, so far as we know, no one now adheres to it.

Nor has idealism remained unmodified in other respects. It began with the assertion that we can know nothing but sensations and ideas—the latter being generally interpreted as plexuses of faintly revived sensations. Still it must always be manifest to anyone who would carefully examine his own mental states, that his sensations were very rarely noted or attended to as such, but that his mind was almost always occupied, not about "feelings," but about "things." Even Berkeley himself allowed that we might reasonably speak of "things" and habitually employ our notions of what we so spoke about as if they were what he said they were not, namely, absolute external existences independent of the mind. Things were for him, as they are for modern idealists, stably associated groups of sensuous experiences, and not by any means mere passing feelings of the moment. Berkeley denied, and idealists deny, that we can have any notion of an object save in terms of sense-perception, and this is so far true that, as before pointed out,[1] we can have no conception of anything, however abstract, save by the said mental images or imaginations.

As our readers know, Berkeley's denial of the existence of material substance was followed by Hume's denial of the

[1] See *ante*, p. 9.

existence of any substance of mind, and his representation of our own being as only made up of a succession of fleeting feelings, their mode of succession being modified by custom. According to Fichte, all that exists is the self, or subjective Ego, the thoughts of which constitute the universe (the system of Solipsism). According to others there is an objective Ego, of which our own existence is but a thought. For modern transcendental idealists, a "thinking subject" is the source of relations and of the world they constitute; for, as we before said, nothing exists unrelated.

It would be beside the purpose of this book to enter upon a description of the different forms of idealism. What concerns us is not their various affirmations, but the denial in which they all agree—the denial, namely, that we do, or can, know and perceive an independent external world, consisting of objects known to us as things in themselves, and possessing a number of objective qualities which are revealed to us through our subjective sensations.

Many of our readers may think idealism so unreasonable as to feel unwilling to pursue any further the question of its truth or possible validity. If, however, they are really interested in the inquiry to which this volume is devoted, they can hardly rest satisfied without coming to some decision as to whether the groundwork of science has to do with "thoughts" only, or whether it has necessarily also to do with "things."

It is easy to laugh at idealism, but unless it contained some important truth, it would never have spread as it has done, and captivated so many men exceptionally gifted.

Its propagation, moreover, is a remarkable and interesting example of the vitality and influence of the English mind. For the whole of the philosophy of Germany and Holland, from Spinoza to Hartmann, has been a result of the mental seed first sown in men's minds by Berkeley, who explicitly produced what was implicitly contained in Locke. When we call to mind that Berkeley begot his parricidal child, Hume; that Hume set going the partially antagonistic, yet largely similar, system of Kant; that Kant begot Fichte, and Fichte produced Schelling and Hegel, and these again, by a revulsion, Schopenhauer and Hartmann—it seems impossible to deny that English thought, from Locke through Berkeley, has been far more influential than aught else in the domain of philosophy, save the Greek mind as manifested in Aristotle.

It is easy also to be unjust to idealism in the following way: Because idealists affirm that perceptions consist of plexuses of feelings of various kinds—actual feelings and grouped images of past feelings—it may be represented that they (idealists) occupy themselves exclusively about their own feelings, and thus treat as the *objects* of perception what are merely the *means* of perception. But idealists no more especially observe their own sensations and feelings than other people do; they are, like other people, occupied about "things perceived." The difference is that we, and most men, affirm that *through* our feelings the mind becomes aware that material objects consist of extended corporeal substance, though of that substance *in itself* we have no direct knowledge, but only apprehend it through its objective qualities, the existence of which is made known to us through our sensations.

Idealists, on the other hand, deny the reality of this uncognisable substance, and deny also that we can know it to be really and objectively extended, existing apart from the mind, and they further deny the reality of anything apart from mind, usually seeming to mean a human mind, though many, when pressed by argument, will postulate an objective non-human mind and often a divine mind, as the necessary and indispensable cause of the existence of anything whatever.

Now, as before said, we have no intention of entering upon any question touching religion in this work, but merely of treating of such questions as seem to us necessary for any investigation of Epistemology.

We have, therefore, no intention of denying that the existence of a divine mind is a necessary condition for the existence of anything else, and we have just as little intention of affirming it. But we are perfectly convinced that objects and substances can, because they do, exist apart from our own mind and apart from any mind we can have any direct knowledge of, or even imagine, as existing. Certainly we have no direct perception, no intuition, of the existence of a God; nor do we believe that such an intuition exists in the minds of other men, while we (our individual selves) have a direct perception, an intuition, of the existence of a real, extended, external world existing independently of our own mind and of any mind, as above stated.

Anyhow, we are convinced that the existence of a God can only be known through a process of inference based upon things and actions perceived; and it appears to us a very illogical proceeding to affirm that objects cannot be perceived save *as related* to a certain entity, which entity itself cannot possibly be known to us except by the help of objects not perceived as being so related.

Nevertheless (as we think), idealism enshrines an important truth, namely, the truth that our apprehension of the world about us is much less perfect and complete than is often supposed. Our perceptive powers are inadequate to supply us with a complete knowledge of nature, which, as it appears to us, may be very different from what it might appear to any intelligences higher than our own.

It is certain—quite apart from any system of idealism—that the material bodies about us (assuming that there *are* such bodies) must possess powers and qualities which our present senses are entirely unable to detect. Had we (as before suggested) an organ of sense fitted to enable us to apprehend "magnetism," as our eyes enable us to apprehend "light," how modified might not the aspect of the world become! We rejoice in the beauty of wild flowers and the gay plumage of birds, some of which delight us with their song; yet, though we are not idealists, we do not hesitate to affirm that their colours and their notes are not by any means just that which they seem to us to be. The most startling and impressive lesson we have had in the present century is that taught us by the Röntgen rays—like light, yet so different from it—with such unexpected powers of penetration that wood is to them, as it were, translucent, as the iron rod of a lightning-conductor is for electricity a tube down which it tumbles.

We may seem to have thus delivered ourselves up to the idealists with our hands bound; yet such is by no means the case. We, however, most willingly acknowledge the merits and the intellectual gifts of its supporters. But those supporters are nevertheless relatively very few in number, in spite of the great temptations and the two special attractions which idealism holds out to inquirers about, and students of, philosophy.

Its first attraction for them consists in the fact that the system is exceedingly easy of comprehension. No difficult and sustained acts of mental introspection are needed to understand it. All that is required is to see clearly the difference between "things" and their "qualities," to recognise that no "things" can become known to us except through their "qualities," and to recollect that all the experience we have of these consists in our own sensations, imaginations, and perceptions.

The second attraction which idealism presents is due to the fact that it seems to carry the novice in philosophy into a region very much above that of ordinary men. For him a wonderful change has taken place. What common persons regard as the most stubborn and solid realities he is enabled to transform into an airy pageant consisting of nothing more substantial than a ceaseless series of feelings and ideas; yet all the time his elevated position causes him no practical inconvenience, because it is the boast of his philosophy that it in no way contradicts the assertions of common-sense, but only denies the existence of what no one ever did or ever can perceive, namely, " material substance."

He may also assert—though, as we shall shortly see, in this he is mistaken—that idealism is not out of harmony with " science " any more than it is irreconcilable with " common-sense "; and he can certainly appeal (as before said) to distinguished men of science who affirm that they are idealists.

Some of our readers, influenced by such representations, may be inclined to say to us: " Why, if these so-called ' facts '—bodies and their activities—can be conveniently dealt with as so many ' bundles of feelings,' and if we may speak of such ' bundles of stably associated feelings ' as ' objects ' and ' things,' why should we not be content so to call them ? Why should we not leave all disputes about the truths of idealism on one side, concern ourselves only with what both parties thus agree to term ' things ' and ' objects,' and to treat them as if they were really independent entities quite external to the mind ? "

Certainly we do not for one moment seek or wish to deny that idealists may be very good scientific men, and do excellent scientific work; nor, for the purposes of physical science, are the conceptions of such scientific idealists unserviceable for the scientific ends to which they are directed, though (as will be shortly urged) their *scientific* conceptions are not really idealistic, but are like those of ordinary persons.

Nevertheless, as we have before observed, for our present purpose (namely, the exploration of the groundwork of science) it is necessary to determine whether the foundation of science is entirely mental or partly mental and partly material; and there is a yet graver consideration which forbids us to rest contented with a philosophical concordat, and compels us to do our best to arrive at a satisfying solution as to the system of idealism.

This yet graver consideration refers to the nature of our intellectual faculties. No man can get behind human reason, and no rational man will make any attempt so to do. A belief in a real, external, and independent world of things in themselves appears to most men to be an absolutely certain and self-evident truth. But if idealism is true, then "absolutely certain self-evidence" can be no sufficient guarantee of the truth of that for which it vouches. We should thus be reduced to a state of uncertainty and scepticism, casting a shade of doubt over every proposition whatever. But in such a state of mind it would indeed be a hopeless task to seek to investigate the groundwork of science. The question as to idealism must therefore be examined to the extent of our ability as a necessary preliminary for any possible satisfactory conclusion with respect to Epistemology.

We have done our best to present the case of the idealists fairly. What is now to be urged on the other side?

In the first place, as we said before, most men are not idealists. Indeed, the professed adherents of that system constitute but a very small portion of the most educated part of mankind. Secondly, even idealists themselves cannot help entertaining and acting on the notions common to other men. It is not merely that they make use of ordinary phraseology about "perception" and "things perceived," but they habitually—as we shall shortly see—give to the terms they use the ordinary signification, and reserve their idealistic interpretation for the time they are occupied with philosophising. The most distinguishing character of the notion all men have of the reality of an extended, external, independent world, is the absolute inevitableness of that notion, which holds sway over idealists as well as others.

It has been said that the inevitable character of this notion is due to "natural selection." Men who did not promptly make their actions accord with it, would, it is urged, be very quickly eliminated, and only those most ready to act as if an independent external world existed would survive. Thus it is that this notion has become ingrained in survivors.

But, as we shall see later on,[1] our firmest, clearest, most certain and highest perceptions cannot have been due to "natural selection." If, therefore, there is some efficient cause which has, independently of such selection, produced our highest and most certain perceptions, applicable to all ages and every part of the universe, *a fortiori* it could have also independently produced the very minor effect of enabling us to become aware of the present state of the world about us. We shall here contend that such awareness is of an intuitive character, and that we possess a direct intuition of "the extended"—*i. e.*, of the various extended bodies which make up the material world. Nevertheless, all intuitions do not stand on the same level, and, as we have just implied, our intuition about "extension" does not stand on the highest level but on one below that upon which rest those ultimate first principles of knowledge with which Epistemology directly deals, and which will be carefully considered in our last two chapters. Had it this highest degree of certainty, it would be impossible for us even to entertain about it that sort of fictitious doubt which idealists possess, nor could any dispute take place as to whether the inevitable

[1] Chapter ix.

character of our notion about the external world is either an inference or a delusion.

But before proceeding to argue in favour of the reality as well as the inevitableness of our conviction as to an external world, it may be well to state, as clearly as we can, what that reality according to us is. It may be expressed as follows:

"All the different bodies and substances of the universe about us really exist independent of the mind, and with equal reality, whether they be perceived or not. Through our senses our intellect becomes directly aware of their existence, as 'things of themselves,' and of some of their objective qualities. Those qualities, however, are unlike the sensations external bodies excite in us; though our perceptions, aroused by our sensations, do correspond to such objective qualities. External material bodies exist independently of us, and have a substantial reality in addition to that of the qualities we perceive, and our perception of them also does not in any way essentially alter them."

That this position is the true one is, we think, shown (1) by the natural spontaneous judgment of mankind; (2) by the careful examination of the dicta of our own mind, and (3) by what we learn through science.

The first of these three arguments meets with no consideration on the part of idealists, on the ground that to the multitude it has never been given to understand what idealism is. But in the eyes of persons who are not idealists that argument may well, nevertheless, have some value, since it is plain that the spontaneous judgment of mankind accords with what even animals practically learn through their senses. A wide river is an objective obstacle to the progress of a man's dog, as well as to that of the dog's owner; and a rotten fruit on the ground is plainly not only an external reality to the human observer of it, but also to the various insects which gather on its surface. Certainly those who hold that the inevitable nature of our sentiments about a really independent external world has been produced by the action of "natural selection," must allow the validity of our impressions about it, since they suppose it was the action of that very world which eliminated those persons whose impressions did not correspond with sufficient accuracy to fatal objective realities.

But, in the second place, let the inquirer firmly fix his mental gaze upon his own personal experience, as, for example, when playing a game of billiards. Is it possible for him to believe, as he cannons and "goes in off the red," that the balls he perceives are but groups of vivid and faint feelings, and not real, extended, independently existing bodies which really move, and, by striking, impel each other in different directions as ordinary people think they do? Who that hears the pleasant voices of his children as they are playing in the garden, or even when silence succeeds to their audible merriment, can doubt their independent objectivity entirely apart from his own feelings? Should shrill cries break that silence, and the father, rushing out, find that one of his children has met with a serious mischance, not only his feelings and his actions, but his inmost thoughts, however determined an idealist he may be, will be in full accord with those of any other man similarly circumstanced. We are persuaded the more the reader examines into the dictates of his own mind during his actual experiences from day to day, the more profoundly he will be impressed by a conviction that real external bodies—things in themselves—exist and act independently of his feelings, wishes, thoughts, or perceptions, and that he has full and valid ground to be absolutely certain about it. This will be brought home to anyone with special vividness while undergoing a surgical operation without the use of anæsthetics.

But it is physical science which specially vouches for the reality of an external independent world.

The advocates of idealism generally content themselves with explaining, according to their system, some of our simple perceptions—an apple, a landscape, the furniture of a room, trees in a park, books in a library, etc. Such things may plausibly be represented as made up of bundles of feelings, because bundles of feelings are the means by which we perceive them, and because we have but to gaze on and contemplate a quiet scene devoid of conspicuous interactions between its parts. But what we learn through science is something very different: it is a systematic investigation as to what are the causes of different phenomena and their various modes of action on one another. It has, therefore, to do not only with our perceptions themselves, but also with the causes of our perceptions.

Although, as before said, we do not question the eminence or the services of men of science who are idealists, nevertheless we believe idealism to be fundamentally out of harmony with physical science. We strongly suspect that the intellectual nature of idealistic physicists is too much for them; and that, though they may be ever ready to represent the objects of their study and experience as so many complex groups of feelings, they really regard them (in common with other people) as independent objects with special qualities and powers. We think thus because, though (as we have just observed) it is easy enough to translate mere objects perceived into groups of feelings and relations between them, it is much more difficult to investigate and describe the reciprocal actions of objects (as, *e. g.*, of the sun and moon on the tidal wave) as only relations between ideas and not as activities of external, absolutely independent extended things which really affect each other.

There can be no question about the fact that observations and experiments are accepted by scientific men as real *objective* facts and occurrences, and the whole of physical science, understood as men of science themselves understand it, is based upon that way of regarding them. It would be ridiculous to pretend that when astronomers, chemists, and anatomists are tracing the motions of the heavenly bodies, or analysing minerals, or ascertaining the course followed by a nerve or an artery, they remain all the time convinced that they are really investigating the relations borne by groups of past and present feelings to other such groups, and nothing more!

It is very certain that, but for their conviction they were dealing with independent realities and discovering really objective truths, the physical sciences would never have attained their present degree of development. If idealism were true, then the advance of science must simply have been due to a profound mistake, and, the mistake having been once found out, can we believe that scientific advance would continue, or could even maintain itself where it is?

The attempt has been made more than once, and with admirable perseverance, to describe truths of physical science in terms of feeling and no more; and the attempt has always ended (as it must always end) in complete failure.

A few concrete examples may bring home to the reader the intenseness and inevitability with which the notion of external things in themselves, really existing independently of the mind, is forced home upon the intelligence of the man of science by his own pursuits.

Leverrier, by studying the movements of the planet Uranus, came to the conclusion that they were influenced by some external body in such a way as to lead him to believe that Uranus was not, as up to that time supposed, the planet of the solar system which was most distant from the sun, but that there must be another revolving round that luminary at a yet greater distance. After further study he predicted the place in the heavens where that yet more distant orb would be found. The prediction was put to the test, with the result that the planet now known as Neptune was there found. In this instance science did not merely predict that a new body (for idealism "a new group of feelings") would be found if looked for, but it affirmed "*how*" and "*why*" it would be so found. It was a statement as to causation.

Another memorable prediction, in another science, was made by Cuvier. The fossil skeleton of a small beast having been found in the quarries of Montmartre, the great French naturalist, seeing a peculiar conformation in its jaw, foretold that when the lower part of the trunk was laid bare, two peculiar bones—present in but few beasts—would there be found. Friends assembled to see the prediction verified, and it was verified.

The late Sir Richard Owen ventured to affirm that a huge extinct animal of South America (which had been furnished with very powerful limbs and tail) had been in the habit of obtaining its nourishment by uprooting trees and then feeding on their leaves. It was objected to this hypothesis that had animals of that kind really been in the habit of so procuring their nourishment they would now and again have had their heads broken by falling trees. Owen thereupon re-examined the head of the beast which had been the subject of his investigations and conjectures, and found that its head *had* been broken. But he also found that the skull of the animal was so constructed as to enable it to endure such fracture with very little inconvenience.

How can these facts be adequately expressed in terms of idealism ? Is it possible to regard the matters thus perceived as but groups of feelings or ideas in any mind, human or non-human ? If we do not recognise the relation of an actually " falling tree " as a cause of an independently existing " fractured skull," the whole point and meaning of the venerable naturalist's sagacious inference would be lost.

Similarly with respect to the planets Uranus and Neptune. The philosophy of idealism puts before us nothing but groups of feelings—or ideas in the idealistic sense of the word—which co-exist and succeed arbitrarily without any rational order or any evident reason why they should so co-exist or succeed. The idealist cannot say why the group of feelings he calls " the movements of Uranus " should be related to another set of feelings, distinguished as " the influence of an external body," or why the feelings known as " looking through a telescope " should be succeeded by those called " seeing the planet Neptune."

And modern science teaches us not only that real, extended, material bodies interact upon each other apart from anybody perceiving them, but also that they so interacted for untold ages before any human mind existed. It tells us that the world, at first devoid of life, became fitted for it, and ultimately fit for mind. The view which science opens to us concerning the fact may be briefly expressed thus: After an unknown but vast period of time, what we regard as the oldest rocks yet extant were deposited, and after multitudes of lower forms of life had had their day and disappeared, huge reptiles came upon the scene, swam in the ocean, sported in lakes and rivers, browsed in ferny forests, and flitted through the air, all to disappear before the white chalk of our Downs was finally deposited. Then beasts and birds, strangely unlike those which yet live, came into being and passed away unseen by any human eye. Genus succeeded to genus and species to species. Gigantic long-armed apes bounded through the forests of Southern France, and many kinds of monkeys chattered in the woods of what is now Greece. At last the human form walked for the first time on the earth's surface, and then came races destined to dwell for centuries in caves, rudely chipping flints for weapons, but by degrees exhibiting signs of an innate love for art. Race succeeded race, till at last came those whose annals constitute the dawn of history and from whom we proceed. Such is the teaching of science. Such is that process of evolution in our world, which it declares to be certain and indisputable.

But how is it possible to describe such relations and conditions in the language of idealism ?

If idealism were true, evolution would indeed be nothing but a dream, nor could any branch of physical science be considered more substantial.

If nothing exists but feelings and "ideas," and some unperceived cause—theistic, pantheistic, or atheistic—which produces them, then everything must depend upon the action of that agent, and all secondary causes and interactions, such as those by which one body is supposed to act on another, can be nothing but deceitful illusory appearances.

But since physical science largely consists in a search after secondary causes and the laws of the interaction of bodies one on another, a system which can have nothing to say to either must be quite useless to such science.

It is indeed the fact that, while following their special scientific pursuits, idealists must, temporarily, if tacitly, abjure their idealism. As men of science it is impossible for them to be idealists, and this some of them confess, candidly avowing that it would be absurd to try to describe scientific processes and state scientific conclusions in idealist phraseology, while all that science needs is to describe co-existences and successions of appearances and in no way to explain them. But surely such avowals amount to nothing less than a condemnation of the system which makes them necessary.

Physical science requires us to admit the absolute reality of extended bodies which can move or be moved, and which have real objective relations of number and position and really act and react on one another. Newton's discovery is much more than a mere description of appearances, and of the theory of evolution the same may certainly be affirmed. Any system of philosophy, therefore, which denies the objective reality of primary qualities, cannot serve as a groundwork of science. Either physical science has no foundation at all or its groundwork is other than idealistic.

Now, according to received idealism the world is constituted by "relations," the source of which is a "mind" or "thinking subject."

Certainly no object can exist without relations. These are real objective relations of which the mind is not the "source" but the "observer." The immense majority of these objective relations exist in independent objectivity, and would continue so to exist were every mind imaginable by us annihilated. On the other hand, it is surely too absurd to regard the world as made up of relations without objects which are related.

The mind in perceiving these "objective relations"—*i. e.*, the circumstances in which different things stand to each other—cannot, of course, do so without having corresponding subjective mental perceptions, which may be termed "subjective relations"—since they make known to us the corresponding "objective" ones. But the latter exist quite independent of any imaginable mind. Our perceiving or not perceiving them is a mere accident of such relations, and in no way affects them save as regards their being or not being perceived.

A simple illustration or two will, we think, make this clear. Thus, *e. g.*, a definite relation exists between a piece of rock and a volcano in eruption which ejected it, but this relation is substantially similar between a rock and volcano *perceived* and a rock and volcano of the Antarctic Continent which never have been perceived, or between a rock and a volcano on the averted surface of the moon, if such things there exist. Multitudes of relations probably exist between various heavenly bodies, which relations existed long before the formation of our solar system.

But idealists may be asked the following question: If all the truth concerning the universe consists not in the existence of extended things, but in relations essentially "*mental*," how comes it that the outcome has been the production of what idealists must regard as a universal delusion? For the practically universal belief of mankind that external, independent, extended bodies really exist on all sides of us must, in their eyes, be just such a delusion. A philosophy with such a result hardly commends itself to the inquirer after the ultimate tests and grounds of truth.

We therefore do not hesitate to affirm that the existence of the "extended"—that is, of real, independent, external, and extended bodies—is an intuition. It is a revelation concerning the world about us directly apprehended by our intellect through the medium of our sense-perceptions. It is a fact certainly true, and shown so to be by its own evidence. "*Why*" extended things exist and "*how*" they exist we know not, and may never be able to know; but that they *do* exist is a truth intuitively perceived, and this it is which gives to our perception of the external world that character of "inevitableness" which has been recognised as pertaining to it. The possession of this direct intellectual apprehension, together with the need for us of the due action of our organs of sense to call it forth, well explains both our power of directly perceiving what idealists are unable to understand our perceiving, and also the obscurity and confusion into which idealists themselves have fallen.

It is no doubt a wonderful thing that such apparently imperfect means as our organs of sense and general bodily organisation supply, should enable us to know so much concerning the world about us—the extension of bodies and their relations as to size, shape, solidity, motion, and number,—yet it is not more wonderful, essentially, than is the rest of our knowledge and, in fact, the whole of our mental powers. How we get any knowledge at all, how we see objects, how we feel anything is most mysterious, and all our knowledge, deeply considered, is very wonderful. On the occurrence of certain changes in our bodies, induced by surrounding agencies, we experience "sensations." Through such sensations (actual and remembered) sense-perceptions are aroused, and by the aid of mental abstraction ideas are called forth, and we perceive what we know to be "external objects." Through our own activities and by things done to us we recognise our existence, our feelings, and our actions. Nothing can be more wonderful than our faculty of memory, which gives us absolutely certain knowledge of a continuously existing being—our own self—the continuousness of which it is impossible for our senses to perceive, for they can perceive nothing but what is present to them. There is really no more difficulty in our perception of the external world about us than in our experiencing a sensation of azure or of sweetness. The fact is so, and we perceive it to be so; and the act by which we do this is no more really marvellous in one case than in the other; or rather every act of knowledge is alike marvellous. We know things, and we know that we know them. How we know them is a mystery indeed, but one about which it is idle to speculate, as it is absolutely insoluble. The oft-repeated question "How is knowledge possible?" is therefore one of the most idle and futile questions which can be asked.

It is an absurd question, because it leads to a *regressus ad* *infinitum.* To every possible reply to it, giving some explanation of its possibility, it may be rejoined " but how is our knowledge of that explanation possible ? " and so on forever. We cannot (once more) get behind the intellect, and therefore no ultimate explanation of our intellectual power is possible. No intellectual perception can be more than self-evidently true. We are compelled to trust our intellect, as we are compelled to trust that we are not mad; and that we are not altogether mad or deluded is shown us by the fact of our seeing quite clearly that if we were deluded our judgments could not be trustworthy.

The mystery of knowledge runs parallel, as we have just said, to the mystery of sensation. We feel things savoury or odorous or brilliant or melodious, as the case may be; and, with the aid of the scalpel and the microscope, we may investigate the material conditions of such sensations. But how such conditions can give rise to the feelings themselves is a mystery which defies our utmost efforts to penetrate. Yet, because we cannot discover this, we never doubt our sensations or the fact that we feel them; and we have as little reason to doubt our intellectual intuitions or the facts we know as made evident to our intellect through our feelings.

By our recognition of this direct intellectual intuition of the existence—and, in part, the nature—of things around us, science and its progress can be both understood and advanced without the denial of one single fact for which idealism vouches. Its affirmations are justified while its negations can by such recognition be shown to be unreasonable though explicable, and almost necessary upon that conception of the nature of ideas which idealism adopts, and the insecure basis upon which it builds.

By its affirmations, our feelings are correctly described, but its great fault is its non-appreciation of the profound difference which exists between them and our ideas, and its consequent practical negation of the higher source of all our knowledge. That the affirmations of idealism are justified is unquestionable. Idealists rightly affirm that, as we have before pointed out,[1] we can know nothing without the aid of our sensations, that a plexus of our own feelings accompanies every one of our perceptions, and that not even our most abstract ideas are destitute of such accompaniments. In our first chapter we endeavoured at some length to make clear the profound distinction which exists between "feelings," however complexly associated together, and intellectual conceptions, and a similar distinction exists between (1) the associated plexuses of feelings, vivid and faint, which constitute a "sense-perception" of an object—an act which cannot truly be called intellectual, but seems to be merely a form of sensitivity—and (2) the non-sensuous activity, which is an intellectual perception[2]—an act of "consciousness."

The latter is not the mere apprehension of an object as an individual "thing,"[3] but as a "thing of a certain kind," and the recognition that it is such is the result of our power of abstraction. Idealists are too apt to confound "sensuous universals" with true ones. A sensuous universal is a mere blurred or defective mental image of an object which has been produced by the successive experience of a variety of individual objects of the same kind. Thus the successive sensuous impressions produced by a number of horses, different in size, colour, and somewhat in shape, have, of course, their effect upon the imagination, and reminiscences of these concur with freshly received impressions to aid us in eliciting the perception and idea of a horse by a direct intellectual act. But that the intellectual perception and idea of a "horse" is not a mere amalgam of modified imagina-

[1] See *ante*, p. 9. [2] See *ante*, p. 9. [3] See *ante*, p. 6.

tions, or a mere generalised mental image, is plain from the fact that the imaginations which have helped to call it forth, may persist in the mind side by side with it, which they evidently could never do if the idea was made up of such imaginations.

A true universal—the intellectual conception supported by the sensuous universal—is a single idea called forth by a natural activity of the mind, and is by no means a mere collection or residuum of blurred sensuous impressions. Our power of abstraction instantaneously analyses the thing perceived into its ideal qualities, and also synthesises them as belonging to a really existing concrete object. It apprehends both the object's concrete individuality (that it is "this thing here") and also the kind to which it pertains (that it is a member of a group, which, *as a group*, exists only in the mind).

How different is the intellectual apprehension from the sensuous affection is clear from the fact that changes in such sensuous affections may only render the intellectual apprehension a more complete and perfect unity. Thus, if a solid cube be suspended by a string and then turned round before us, we can never see all its surfaces at once, and its square faces, as we see them in perspective, do not look square but lozenge-shaped. Nevertheless, these incomplete, defective signs not only serve to give us an accurate perception of the cube, but its revolution, though it changes our sensuous impressions, only makes our intellectual conception more complete and stable—while the former changes, the latter remains the same throughout.

Thus every material object whereof our senses can take cognisance, has various qualities—its size, shape, solidity, colour, etc.—and acts upon our senses accordingly.

Its qualities affect us in response to our activities of eye, ear, hand, etc. Our two eyes form two slightly discordant images of it, and our hands and arms may give us numbers of synchronous and successive feelings respecting it. Simultaneously with these sensuous impressions, we have a perception of the object and its qualities. But that perception is by no means correspondingly multiform. The perception is one intellectual cognition resulting from a multitude of sensations and reminiscences. Our attention may, of course, be directed to any one of its qualities, but if so, what we then directly perceive is no longer the thing itself but the quality in question.

As it is with the revolving cube, so also changes produced by our own movements may make our intellectual cognition of what surrounds us more unchanging. When walking in Notre Dame, as we progress, the pillars of the double row of columns on either side of its nave successively change their relative positions in our eyes. Yet they remain in reality unchanging, and by the experiences thus received we gain a clearer intellectual apprehension of their true relative positions than we could do by remaining fixed to one spot.

Some opponents affirm that what is really different between a mere sense-perception and an intellectual perception of an object, is that to the latter a word is applied, and that apart from this word there would be no difference. Such a view is, of course, the teaching of the oft-refuted system known as "Nominalism."

That the essence of intellectual perception and conception does not lie in the word, is shown by the fact that the same idea may be made known by different words, different modes of speech, and even by gesture language.[1] But it is plain that if the intellect had not universal ideas, then general terms, such as "dog," "horse," etc., would be meaningless. It may also be asked how general terms ever came to be, if the mind

[1] See below, Chapter vii.

knew nothing but individual things? Again, even nominalists must profess to understand the meanings of certain words; but since almost all words are universals, it is plain that they could not understand them unless they really possessed universal ideas. If we can perceive the general nature of certain words, why not of other things also? But nominalists agree with idealists in one fundamental error. They confuse the *objects* of cognition with the *means* of cognition, not, as before said, because they pay any exceptional attention to their feelings, but because they regard what are really, for both idealists and non-idealists, "objects perceived" as being mere plexuses of feelings, plexuses, therefore, of what are in truth but "means of perception." Objects are known *directly* by means of our mental affections. It is true that modern idealists describe our experience as made up of "perceptions"; but by "perceptions" they mean congeries of vivid and faint feelings, and not that direct intellectual cognition which exists over and above, and in addition to, "feelings" of whatsoever kind they may be. Thus our perception of material, external, independent objects they declare to be not a direct intuition but an inference.

The term "inference" means, as we all know, the perception by our mind of the fact that one truth is implicitly contained in other truths antecedently known. Now it is quite true that an inference, though if it exists it must be conscious, may excite our attention but very slightly and be rapidly forgotten. Can our perceptions of objects, then, be due to such hasty, little adverted-to, and speedily forgotten inferences? Now inferences, even of that kind, can be recognised by reflection to have occurred if they have done so. Thus, if we have on a dark evening mistaken a stranger for a friend, we can recognise afterwards the circumstances which occasioned our mistake, and made us hastily conclude from insufficient evidence that the fact was otherwise than in truth it was. But it is impossible to recognise the presence of any act of inference in our ordinary perceptions of objects, however much we may look back and analyse such perceptions. When, for example, after having perceived an apple, we look back on our various sensations thus derived, we do not find that they have constituted the premises of any conclusion, but, on the contrary, we see that they have directly revealed the apple—they have *made it present* to our intellect. It is thus with the immense majority of our perceptions. Why, then, should we deem them to be inferences, when they exhibit to us no signs of having been produced by an inferential process? Is it one bit more wonderful or mysterious that we should perceive "objects" than that we should perceive "inferences"? An "inference"—a perception that one thing must be true because its truth is implicitly contained in other things—is surely a much more complex and involved mental process than is the direct perception of an object. For this reason, then, if for no other, we should not conclude that we have made use of a process of "inference" when nothing in our minds assures us that we have really done so.

What probably has caused some persons to mistake "perception" for "inference" is the fact that every perception is the result of a number of psychical processes—sensations and imaginations associated in complex groups and a variety of unconscious [1] affections also. This process of complex sensuous association it is which seems to have been denoted under the self-contradictory term, "unconscious inference."

Yet if our perceptions of objects were "inferences," then, since no inference can exist without data, the data of such perceptions must be the feelings which objects occasion in us. But if that were the case, then such feelings must be

[1] As to this, see below, Chapter vi.

primarily observed, or else no consequence could be deduced from them. In that case it would be quite true to charge idealists with mistaking the *means* for the *objects* of perception, and in spite of all their denials, we should have to affirm that they do direct their attention upon their sensations and feelings in an exceptional and most misleading manner.

But that " perception " is not " inference " is very plainly shown by the fact that we can and do obtain a reflective assurance of the truth of our perceptions when we clearly do not employ inference to obtain it.

No one can deny that there is a plain distinction between " attention " and " inference," and we may gain an increased certainty for our perceptions by acts of attention alone. The reader will, we think, readily admit that he sometimes perceives an object consciously, but without paying particular attention to it; and that when his attention to it is by some circumstance aroused, he has then a far clearer consciousness of it and of its nature than before. He can, indeed, thus " make sure " by merely, as it were, tightening his sensuous grasp of the object and carefully focussing his sense-perceptions regarding it.

Thus perception is no process of inference from known signs to a before unknown notion of an object, but is a spontaneous interpretation of signs (which themselves are by no means expressly adverted to) by a natural power the mind possesses, and which is rapidly perfected by exercise. By it we gain an immediate assurance (and, by attention, can gain an augmented assurance) that a perception is certain and needs no proof.

But there remains one supremely important point to consider. If our perceptions were " inferences," our intellect would necessarily be thereby altogether stultified. For no " inference " can be certain which does not repose on perceptions previously acquired and known to be true. If, therefore, every perception were an inference, we should get a *regressus ad infinitum*, and be incapable of ever acquiring a perception of any truth whatever. Anterior to all possible truth, we must know truths which are not inferences, which require no proofs but are evident in themselves.

The fact that we have a direct and immediate knowledge of objects which are made present to the mind through our sensations, is a fact fatal to idealism. It alike justifies the spontaneous and reflective declarations of our own minds, when once we have clearly understood the great difference which exists between (1) intellectual conceptions and perceptions, and (2) their merely sensuous accompaniments.

The conviction, then, that science is really concerned not alone with thoughts but also with external, independent, and extended realities, is so far justified.

It only now remains for us to consider the various objections which have been brought against the validity of this conviction.

The stock objection is based on the supposed constant and inevitable delusion we are led into by our sensations of colour, sound, smell, and taste—the secondary qualities of bodies—as contrasted with their primary qualities of extension, size, shape, number, motion, etc. It is then further argued that if we are entirely deceived as regards the secondary qualities, the primary qualities can be in no better case, each of them being, to our experience, but a plexus of our own feelings, vivid and faint.

And we freely concede that in this idealists are so far right that if we could not directly know things in themselves, but only the impressions they make on us, then the said primary qualities might be no more than combinations of certain of those groups of muscular feelings and feelings of effort and resistance which have been made use of by us in acquiring such ideas. Nevertheless, there is a great difference in our notions of these two sets (primary and secondary) of qualities. For, in the first place, colours and sounds are each perceived by one sense only; but in examining the solidity, extension, figure, number, and motion of any object we perceive, we can bring various modes of feeling to confirm the evidence of vision. We find also that doubt as to primary qualities carries with it very different results from a disbelief in the objective validity of our impressions as to secondary ones. If we became convinced that nothing in the remotest degree like the secondary qualities we know of existed in the perceived objects themselves, the world would lose very much of its charm for us. Flowers would have lost their tints as well as their fragrance, and the melody of birds, no less than their brilliance of plumage, would have disappeared; but otherwise things would remain substantially as they were. But with the disappearance of primary qualities the solid earth itself would vanish, and we should even lose the companionship of that most faithful ally—our own body! If we hold three marbles in our hand and we are told they are not truly of the tint we suppose, or that they really have an odour of garlic which escapes our notice, we are not greatly disturbed thereby. If, however, it were asserted to us that they were not three and not solid objects at all, that we could not touch distinct parts of the surface of any one of them, or that they were not spherical in shape, or that when we dropped them from one hand to the other there was no real motion in them apart from our feelings of touch, effort, and movement,—then, if we were not idealists, we should consider the assertor, if serious, to be irrational, or that he regarded our own rationality as dubious.

The colour of any object, as we all know, is said to be nothing but a result of the undulation of certain waves of light reflected from its surface to us, and we are asked how there can possibly be any real resemblance between that condition of any object, which causes it to reflect such waves, and our sensations of colour? How also, it is further asked, can there be any possible likeness between the real condition of a body thrown into rapid vibration and the sounds those rapid vibrations occasion in us? As well, they exclaim, might a wound be like the knife which inflicted it —thus tacitly asserting the necessary adequacy of a cause for its effect!

Now, of course, as we have before said, no subjective feeling can be like an objective quality belonging to an external object. The simplest rustic, with his senses about him, knows as much philosophy as that. But he also knows that there are in external things real qualities which give rise to the feelings he experiences. This can be easily ascertained (as we have ascertained it) by questioning such rustics in language they can understand. The conviction they really entertain is the spontaneous and universal conviction of mankind, from a Sussex cowherd to the greatest philosopher of Greece; and a spontaneous and universal human conviction should be accepted and acquiesced in unless there are valid reasons against our so doing.

We must here revert to a point before noticed. In our perception of any object it is made present to our mind by feelings to which we do not advert. Its presence is a presence in the mind's perception and not in the feelings (vivid and faint) which accompany such perception. Moreover, though "subjective *feelings*" cannot be like "objective *qualities*," there may nevertheless be a true correspondence between our subjective *perception* of an object and its objective *mode of existence*. For, as we have before pointed out,[1] we can know things which never were and never could be

[1] See *ante*, pp. 10, 11.

felt or imagined, and there is the greatest possible difference between " feelings " and " ideas."

Now let the reader examine what his own mind tells him, and we are confident he will see that in perceiving any body to be *one* body, or to be *solid* or to be *extended* or to be *moving*, he has, in each separate case, one single and simple idea and not an amalgam of feelings of " touch," " pressure," " effort," and " sight," however indispensable such feelings may have been in order to call forth perceptions and ideas of unity, solidity, extension, and motion.

Moreover, the idea of extension may exist apart from visual feelings, for the blind have it, and apart from tactual feelings, for it is given by sight alone—especially with the twofold grasp of objects our two eyes simultaneously afford us. That an idea can persist unchanged amidst changing sensuous experiences and remain single though revealed to us by sensuous experiences of many and such diverse kinds, we have already seen.[1] That feelings of different kinds are required to arouse our idea of extension, does not show that the idea is a plexus of feelings any more than that " coal " is " digging " because we may have to dig in order to obtain it. The *nature* of an idea and the *modes* of its elicitation or acquisition are two very different things.

Our idea of " force " again becomes known to us by means of our sense of effort, of resistance, and of resistance overcome, and such sensations form the occasion through and by which our intellect comes to perceive that surrounding bodies have powers corresponding to our own. Some persons pretend that we thus commit the absurd mistake of attributing to inanimate bodies around us activities absolutely like our own. But, in fact, we only attribute to such bodies powers which have a certain analogy with our own. If we try to pull a man up from the ground and fail because

[1] See *ante*, pp. 59, 60.

he is stronger than we are, and if we try to raise a piece of rock and fail because it is too heavy, we can indeed perceive a certain analogy between the effect on us of the man and the rock, but the difference between the two cases is also plainly evident to the intellect, however alike may be our sensations in the two cases. Similarly with respect to our ideas of "number," "extension," etc. By means of our sensations, and the relations between them, we arrive at something fundamentally different from either—namely, an apprehension of external, objective conditions of real, independent bodies. But, as we have said before, these conditions are utterly unlike the sensations and relations between sensations which serve to make such objective conditions known to us. In considering these things we must never fail to recollect[1] that it is not "sense" but "intellect," not our "feelings" but our "perceptions," which are our ultimate criteria of certainty and truth.

And our intellect surely tells us that by means of our sensations we attain to a certain degree of truth with respect even to the secondary qualities of bodies, and certainly even the common belief on the subject is nearer the truth than its negation can be.

We are sometimes told that were there no eyes or ears darkness and silence would be universal. Now our notion of light is quite inadequate to make its essential nature known to us as it might be known by some intelligence of a higher order than our own. But, nevertheless, if light as we know it, and sound as we know it, are imperfect cognitions because thus subjective, the very same objection applies to our notions of "darkness" and "silence." They are as much subjective as our sensations of colour or melody. A world without eyes or ears would be neither light nor dark, neither sonorous nor silent, but in a condition abso-

[1] See *ante*, pp. 13, 14.

lutely unimaginable by us. Yet that world would be far more like the brilliant one we know than it would resemble one plunged in darkness. For since we suppose the physical forces, sun, moon, and stars, meteors, volcanoes, and phosphorescent organisms to exist in it as they do now, all the objective conditions of light, save sense-organs, would, by the hypothesis, be present, while the objective conditions of what, to our senses, is darkness, would not be present. Though all sensations of eye and ear would, of course, vanish from such a world, yet the objective qualities those sensations reveal to us would continue to exist. Other persons, again, think that they get nearer to the absolute truth of things by considering colours and sounds to be really "modes of motion"—different orders and different degrees of "vibrations." But, as we have seen, the very same cavils may be brought against the validity of our perceptions of primary qualities as against our perceptions of secondary ones. In that case "vibrations" would be nothing but associated, vivid and faint, muscular and tactual feelings, and such must at least be as unlike the objective causes of light, colour, and sound as are the conceptions of ordinary persons with respect to the latter.

Bearing these facts in mind, let us once more consider some objections made by idealists against those who believe in an independent, external world of real, extended objects possessing real, objective qualities.

The iridescent tints of minutely grooved surfaces do not really deceive any more than the effects of coloured lights or tinted glasses, or than distant mountains which look purple make us suppose that they are actually purple when seen close at hand.

The effects of bodily injuries are often cited as evidence of the untrustworthiness of judgments our sensations induce. Men who have had a leg amputated sometimes feel as if they still had it, and also feel pains in their vanished toes. But no one would surely be so foolish as to pretend that our feelings, or even our perceptions, are independent of our bodily organisation; if, then, that organisation be impaired, the action of our sensitive faculty would be likewise impaired, nor should we be surprised if our perceptions were thereby also occasionally misled. If our normal organisation is so arranged as to guide us right, it should be small wonder to us if it sometimes guided us wrongly when in an abnormal condition! But, after all, even though a man whose leg has been amputated may suffer with pains like those he might feel if he still had his toes, that does not lead him to believe that he has actually still got them!

If objects may appear different in size and shape as we change our place in respect to them, though they in truth do not so change at all, not only are we not thereby deceived, but, as we have seen,[1] our knowledge of their objective qualities may be thereby perfected. A pea held between our crossed first and middle fingers will not feel like one pea, but like two peas. But there is no real deception in this. No one would affirm that the mere touch of a surface can impart knowledge as to the bulk and solidity of the object touched; for this, we must also have some experience of resistance. If, then, with the fore and middle fingers we simultaneously touch two opposite surfaces and find we cannot bring our fingers together, the feeling naturally arises (from long experienced associations of sensations) that an obstacle in the form of a solid body lies between them—an obstacle situated between the adjacent sides of those fingers. But if we cross our fingers, then the pea touches those sides of each finger which do not ordinarily touch the same thing, but two different things, and this makes the single pea naturally feel as if it were two peas.

[1] See *ante*, p. 60.

As everyone knows, various ingenious instruments have been invented to produce optical delusions, but that in no way makes the declaration of our perceptive faculty at all less trustworthy. We are able, indeed, so to arrange things as to invert or distort impressions ordinarily made; what wonder, then, that our sense-perceptions sometimes become inverted or distorted likewise? But it is generally the case that though our sense-perception is changed, our intellectual perception remains perfect all the time, and so enables us to be the better amused by the sense-deception induced.

But, it may be urged, most people even now, and everyone a few centuries ago, have been deceived by their senses with respect to the motions of the sun and the earth, yet the fact is, their senses did not deceive them. They only drew too hasty an inference from what they saw, as a little reflection will, we think, make obvious. Our sight gives us no information at all with respect to motion, save indirectly, *i. e.*, as shown by changes of relative position between objects. Thus, when we are moving, we may, under some circumstances, be quite unconscious of it, save for jolts, jars, the feeling of meeting the air, and other incidents which are no elements of motion, but merely its accidental accompaniments. When travellers in a balloon ascend from the earth, they are said to have no feeling whatever of their movement, save by looking down on an apparently sinking world beneath them. The feelings our senses give us, occasion an intellectual apprehension of motion and of moving things; but that apprehension, we can see by reflection, may take place with or without inference. With regard to the movement of the sun, there really is this relative change of position—a fact about which the senses give us accurate information. Our perception of this relative change of place does certainly awaken in our intellect a perception of motion, but it does not, for it cannot, tell us where the motion is, without processes of observation and inference. The supposed perception of the sun's motion is an instance of an inference, not noticed, perhaps, at the time, but clearly recognisable by reflection. It is impossible for anyone to really see the sun move. If we fix our eyes on it at sunset we shall, indeed, from second to second, see that it has more and more disappeared; but we cannot see it move. As to the movement of the sun, the mass of men never think about its relation to that of the earth. The first observers inferred that it moved, and that the earth stood still, and their inference embedded in language, has so affected us, that to this day everyone speaks of the "rising and setting sun," even though he may know quite well that it neither sets nor rises, but that the revolving earth gradually hides it from view and afterwards lets it be seen once more. What men's senses ever did and do now make known, are "changes of relative position between the earth, on which the observer stands, and the sun," and just such changes do really take place. Thus none of the objections yet considered allow us to say that our senses really deceive us.

And, indeed, with regard to the secondary qualities of bodies, more might yet be urged in defence of the veracity of our faculties respecting them than we have yet advanced. No one has ever shown, or can, we believe, show, that it is impossible for our intellect to obtain, through our sensations of colour, sound, etc., the truest notions it is possible for us to have concerning the objective qualities which give rise to those sensations. The objective cause, whatever it may be, must be admitted to be occult in each case, except as it may be made more or less known to us by the sensations it occasions. Granting, for argument's sake, the absolute truth of the undulatory theory of light, the objective condition of an object which causes it to select certain rays for reflection must be admitted to be as yet quite occult. Therefore, it cannot be denied that there may be such a conformity between objective qualities and the effects they produce on us, that those effects may be the best means possible for giving us the best understanding we can attain to of what those objective qualities really are. Though those effects may be, and probably are, far from telling us the whole truth, though the objective qualities that produce them may be very different from such effects, and though much ignorance about such objective qualities (the *existence* of which we do know) may thus have to be added to our ignorance about various other qualities which probably exist unknown to us—nevertheless, our knowledge, however fragmentary, is in part true, and, therefore, our faculties, though inadequate to reveal to us much we might wish to understand, are nevertheless not mendacious. But some persons, strange to say, have affirmed that incomplete knowledge is error; and that what we know only in part, we therefore know wrongly.

Yet such an affirmation is surely a most irrational one. Is the statement, "The angles at the base of an isosceles triangle are equal," false or erroneous, because it does not also express the facts which follow if its sides be produced? Is it false to say, "A gibbon has extremely long arms," because we do not also say, "No ape except a species of gibbon has a chin"?

It is, of course, most true that no man can possess, with respect to any object whatever, a knowledge of all its relations (real and possible) with the rest of the universe. But the impossibility of our being omniscient does not prevent our having some knowledge which is perfectly accurate, absolutely true, as far as it goes. Our knowledge, for example, of the numerical difference between two groups of marbles (one with three, the other with five) is a perfectly true knowledge, and in no way tainted with error.

The same example may serve to refute another and very common objection to the veracity of our perceptions. Some persons, while professing to know nothing but sensations and sense-impresses, vivid and faint, yet believe—as a sort of faith—in the existence of an independent material world, quite unlike our perceptions, and yet the cause of them. The men of this school do really believe in "*independent* material objects" and "actual physical states," as realities independent of their minds and of everyone else's. But, on their system of knowledge, they can (since they say they can know nothing but states of consciousness) only get this belief of theirs by an act of blind and unreasoning credulity. They also affirm our knowledge to be necessarily untrue, because it corresponds neither with what is internal and subjective, nor with what is external and objective. They regard it as a sort of *tertium quid* which results from the combined activity and interaction of both subject and object, but resembling neither—just as water resembles neither the oxygen nor the hydrogen from the combination of both of which it results. But experience and reflection clearly show us that our intelligence has the power of unconsciously subtracting its own subjective element from the result. Let us concede that every perception is produced by the combination $x + y$; x being the Ego, or self, and y the object. Yet the mind has the power of supplying its own $- x$, and so we get $x + y - x$, or y pure and simple. Unless such were the case, how could we know the real numerical difference between three marbles and two marbles, between a cube and a sphere? Does any reasonable person doubt that, in these matters at least, we attain to absolute objective truth?

It is clear that the mind *can* correct any such supposed delusive tendency of its own, or the above facts could not be known to us as perfectly certain and accurate *objective* truths. Thus the mind unquestionably must possess the power of transmitting to us a knowledge of at least some facts and principles as they really and objectively exist. Why should we distrust its other dictates? Grounding all our assertions on the positive declarations of our consciousness, we can affirm that we really know (though more or less imperfectly) things in themselves, and not a mere amalgam made up of a mixture of the results of objective and subjective influences—results neither resembling ourselves nor the world without us in any one respect.

As to the contention of idealists that the essence of all "existence" is "being perceived," we may freely allow that nothing can exist in absolutely the same condition when perceived as when unperceived, for in the former case it is "a thing perceived," and in the latter case "a thing unperceived," and "a thing unknown" cannot be identical with "a thing known." But this contention is one which is utterly trivial. Of course, things unknown cannot be known while they exist as unknown objects, and of course, again, a thing perceived by us does not exist in a state of "being perceived by us" when we do not perceive it. But our perceiving it or not perceiving it is (as we have more than once urged) a mere accident of its existence, which existence continues on essentially the same, whether perceived or not. Who has perceived the mountains on the other side of the moon; but are they the less real because no one can perceive them? Who perceived for untold ages the many palæozoic fossils which have been in modern times disentombed; but have they been less persistently existent on that account? Does want of being perceived impair the reality of the thousands of fossils which as yet remain undiscovered?

Surely here, as in the former instances we noted,[1] physical science is fatal to idealism.

Before finally concluding this chapter it may be well to consider some special objections made by one of our most esteemed idealists[2] against a non-idealistic conception of the universe as being self-contradictory and replete with illusion.

After the usual objections founded on the divergence between our sensations induced by the secondary qualities of objects and the objective nature of the latter, he endeavours to raise difficulties as to our perception of the extended on the ground that the mode of inherence of its secondary qualities and the relations holding between them[3] ("how the qualities stand to the relations which have to hold between them"), are, on any non-idealistic system, inexplicable.

We have already protested[4] against the question, "How is knowledge possible?" as a necessarily idle one. Our knowledge of the "*how* anything is" must always repose upon a previous knowledge of the fact "*that* it is." To seek to know the "how" and "why" of every "that," is to enter upon an inquiry which it is plain cannot possibly have any end—a necessary *regressus ad infinitum*. All men, even idealists themselves, have, we are convinced, consciously or unconsciously, an intuition of the extended. Nevertheless, when affirming anything thus evidently true, it is specially needful to guard against the appearance of declaring any other things to be evident which really are not evident. Thus many persons assume that "the extended" must possess secondary qualities, and, of course, our uniform sensuous experience renders it impossible for us to *imagine*

[1] See *ante*, pp. 51–53.

[2] Dr. F. H. Bradley in his work entitled *Appearance and Reality*, 1893.

[3] *Ibid.*, pp. 14, 15.

[4] See *ante*, p. 56.

any extended object devoid of such qualities. Yet it really is not evident that it must possess such qualities, though, of course, its possession of them may in fact be necessary for all that.

The " extended " must, of course, have some definite quantity, but it is not evident that " corporeal substance " must be extended, or, so to speak, be quantitatively extended in space. Let us suppose that the earth and the moon were both simultaneously deprived of their extension while remaining individually distinct, the one from the other; they would, though not externally extended, have a definite state of some kind, though we cannot imagine it even so well as we can imagine what Newton said as to the possibility of reducing the earth, without loss of substance, to the size of one cubic inch.

Although merely speculative, it is well to recognise that when Kant argued that the *noumenon* of substance did not evidently demand the *phenomenon* of extension, he was not unreasonable save in denying our intuition of extension as a fact. We have no intuition of the essential nature of material bodies—of corporeal substance in itself—such as would warrant us in drawing the conclusion that it necessarily postulates, short of annihilation, actual extension. But in order to be able to affirm with certainty that the extended —the external world—exists, it is by no means necessary to know its intimate " nature," and the absolute exhaustive truth about all or any of its qualities. " Qualities " and " relations," as such, are, of course, mere abstractions, though every one of them has a foundation in those real things of which they are truly predicated.

The difficulties raised by Dr. Bradley are very largely verbal ones, and result from the impossibility of our imagining what is beyond our sensuous experience, and from his proneness to make use of exceedingly sensuous illustrations.

Appearance, he tells us,[1] must belong and yet cannot belong, to the extended.

But it is not evident that something extended may not exist in our vicinity which our sensitive faculties may be unable to perceive, so that it cannot appear to them; and it is certain that multitudes of extended bodies exist in space (so to speak) which never can appear to any human being. So much for the first alternative. As to the second, "appearance" can and does belong to the extended, in so far as it has objective qualities and powers which our faculties are able to apprehend. The "appearance" is partly objective and partly subjective, or rather it is in one sense the former and in another sense the latter, just as we have seen that colour and sound are both objective and subjective.

That the extended comes to us "only by relation to an organ," and is "perceived through an affection of our body and never without," is another objection. But why should we not apprehend extension through our organs, and what doubt does such a means of apprehending it cast on the truth of our apprehension? Why also should we doubt the truth of the extension of our own body because we can only perceive it by the action of one part of it upon another?

Dr. Bradley says[2]: "That we have no miraculous intuition of our own body as spatial reality is perfectly certain." The word "miraculous" should not have been used by him in this context, as it tends to excite an initial prejudice against the view he opposes. Nobody pretends that we have *such* an intuition, but that our possession of an evident *natural* intuition is certain we do not hesitate to affirm. Of course we cannot think till after we have begun to feel, and our intuition of the body's extension is not gained without experience and without multitudinous antecedent movements between its various parts. But that intuition once

[1] Bradley, *loc. cit.*, p. 15.

[2] *Ibid.*, p. 15.

gained is not on that account a bit less clear and distinct at a very early date.

There is no difficulty in the fact that nothing extended can be perceived except in relation to thought which is unextended. Who would expect that two extended but thoughtless things could perceive each other? What doubt is cast upon our intellectual intuitions from the fact that they cannot do so?

That extended objects may be real in themselves, with various relations to our percipience, is opposed by Dr. Bradley on the ground that, "if a thing is known to have a quality only under a certain condition, there is no process of reasoning from this which will justify the conclusion that the thing, if unconditioned, is still the same."

But here the use of the term "unconditioned" seems quite unwarrantable. Because the conditions which accompany perception may be absent, it by no means follows that all conditions are absent. Indeed, it is clear and manifest that no extended object can exist devoid of all relations to the rest of the universe. The antithesis, therefore, is between the extended under "some" conditions, and the extended under "other" conditions, and, thus corrected, the assertion is plainly erroneous.

We have only known the sun in so far as it is above the horizon. But that does not prevent our being certain that we could, were we supplied with certain helps, also see it on the opposite side of the heavens.

That objection to the reality of qualities only known to us through one sense—one relation—which is grounded on the assertion that to affirm the reality of such qualities apart from that relation is "more than unwarranted"—is itself "more than unwarranted."

For we always have more than one source of information about the qualities of things. We have (1) our sensitive faculty, which informs us of the subjective results of such qualities, and we have (2) the intellect, which assures us that our sensation has, under normal conditions, a real objective cause.

That extension cannot be presented in thought, or thought of except as possessing secondary qualities, we altogether deny, though, as we have already affirmed, it cannot be *imagined* without them.

The former assertion is manifestly false. For though we cannot think of our extended body except by the aid of sensuous images, into which *imaginations* of secondary qualities enter, nevertheless, thus aided, we can *think* of such things as devoid of secondary qualities. If we could not do so we should not be able even to discuss the question whether the extended can or cannot exist without such secondary qualities, nor could we have declared, as we have done, that it is not evident to us either that they can or that they cannot do so, and that an open mind is to be maintained there anent.

Dr. Bradley could not discuss the question either, unless he had the "*miraculous*" faculty of writing about a question concerning which he is utterly unable to think.

"Extension," like quality (whether primary or secondary), is, of course, an abstraction, though with a very solid foundation in extended things.

The reality of extension, once more, is for us a direct perception. It is no inference, but an intellectual intuition acquired through the ministry of sense. It is, of course, most true that we can feel nothing of an object save the subjective effects of its objective qualities: that in a lump of sugar we have no sensitive perception of anything but its whiteness, hardness, roughness, sweetness, etc., together with its shape and its extension; but we none the less know that there *is* more. We have, as we before said, no intuition of the corporeal substance *in itself*, but we have an evident intuition of corporeal substance *in conjunction* with the qualities our senses make known to us. This is the material substance which Bishop Berkeley said he alone denied the existence of, and the absence of which, he declared, would be missed by none. But its absence would, indeed, be missed by all; for the plain man always thinks of a material object as something real in itself over and above its qualities. Such reality is apprehended by every healthy and normal intellect. It is easy to laugh at Dr. Johnson's refutation of idealism by kicking a stone. But that simple act *was* a refutation of it, for it was an energetic manifestation of Johnson's perception that he had an *intuition* of real, extended, independent objects. It was a mute expression of a profound philosophic truth—a truth which underlies all physical science—the truth, namely, that we have an intuition of the extended.

After the most patient consideration it has been in our power to bestow on Dr. Bradley's contention, we remain convinced that he has succeeded neither in showing that primary and secondary qualities stand on a similar footing in the mind, nor that the latter are appearances only, and are not known to us as revealing corresponding objective realities. But if neither primary nor secondary qualities are mere appearances, a fundamental mistake underlies his whole contention, that the world as perceived and understood by the mass of mankind is mere delusion. If, then, we are to rise out of utter scepticism—the irrational nature of which will be later pointed out—we are justified in shaking off the prejudices of idealism.

These prejudices are ultimately due to a non-recognition of the fundamental difference which exists between feelings and ideas, between the impressions of our sensitive faculty and the dictates of the pure intellect. They are therefore due to an utterly inadequate apprehension of the power and dignity of human reason.

But if the system which underlies idealism were true, if we had no means of perception save sensations and sense-impresses (vivid and faint feelings), then we could have no warrant for a belief in an external world, or for a conviction that other minds existed in addition to our own. If we could know nothing but complex associations of our own feelings, what right could we possibly have to affirm that anything else existed? If we could in no way get beyond our own being, the only absolute certainty for us must be our own feelings, and so we become upholders of *Solipsism.* It would be all very well to talk of a divine mind which produced those feelings in our mind; or of a material universe possessing many energies, whereof our own feeling was one; or of an impersonal absolute which became conscious in our consciousness; or of a monistic universe, the absolute unity of which has two sides—one physical, the other psychical—like the one substance of Spinoza with its two attributes, thought and extension. All these for the consistent idealist would be so many pleasant or unpleasant dreams, with no more body or coherence in any one of them than in the mist of the morning. For such an idealist there is but one firm reality—his own sentient being, and of all else he is evidently the creator (since everything he knows is a plexus of feelings which his being has caused to exist), though as to how he created the universe he need neither know nor care to inquire. It is enough for him that he has, in fact, produced it, and that its being depends absolutely on his own. The divine mind, the material world, the absolute, the uncogitable unity of the monists, and the substance of Spinoza, will by him be courteously bowed out or unceremoniously kicked out, according to his idealistic temperament, and he can logically remain, like the Indian sage in peaceful contemplation of the plexus of feelings he calls his own navel, as a symbol of that first cause and immanent upholder, from which all things have proceeded, and in which all things have their only being.

This logical development of idealism finds small favour with existing idealists. Solipsism is looked at askance with evident dread by some, and vain attempts at its refutation have been made by others. But it remains none the less invincible on its rock of "nothing-known-but-feelings." It was, as our readers know, first developed and upheld by Fichte, though he ultimately abandoned it; and thus the logical outcome of the system of idealism has been practically condemned by its own disciples. To the other idealistic extreme, that by Hume, we will sacrifice no space, for, in spite of its author's acuteness and great ability, it does not really admit of logical statement, so utterly incoherent is it, and so confident are we that its ingenious author had no belief in it himself, but was laughing in his sleeve at his inept admirers and disciples.

In opposition to the notion of solipsism—that everything we can perceive or imagine is but a mode of our own personality—may be opposed the contradictory form of idealism, before referred to by us,[1] which would assert that our personality is but a mode of the absolute or of some divine existence. But, as Mr. Arthur Balfour has well remarked, "the very notion of personality excludes the idea of any one person being a 'mode' of any other."

A system which would strongly, and with reason, deny that it was idealist, may conveniently, with apologies to its advocates, be here briefly referred to.

This at present popular system is Monism, which solves the conflict between the advocates of mind and the advocates of matter (as alone the source of all whereof we can

[1] See *ante*, p. 40.

have any knowledge) by denying them both and affirming that nothing exists but a substance utterly unknowable save as regards two of its aspects, one psychical, the other material. According to it, thought is nervous tissue in motion just so far as nervous tissue in motion is thought, both being eternally divergent and antithetical modes of a substance which is neither thought nor matter.

This system affords a seemingly easy way of explaining the ever-recurring puzzle about "matter" and "mind." How can mind (unextended and immaterial) ever possibly act or be acted on by such a thing (extended and material) as matter? This question has tortured many choice minds for more than two centuries, because men sought to obtain an answer to it in impossible terms, namely, in terms of the imagination. But it is utterly impossible for us to imagine the action of mind on matter or of matter on mind, simply because the mind never has been or can be a matter of sensuous experience, and we can never imagine anything of which we have not had such experience.

But our inability to imagine such action does not constitute an argument of the slightest value against the reality of such action (in ways which are beyond our power of imagination), if our intellect shows us good reason for thinking that such action does, in fact, take place, and there is no real evidence that such reciprocal action is impossible.

But because it is felt difficult to imagine the action of mind on matter or of matter on mind, it is a curious method of obtaining relief to assume the unique existence of something more unimaginable (because more unknowable) than either, and take that as a satisfactory explanation!

Matter we know and mind we know, but what is this x underlying both, the only properties of which are the two manifestations of existence (mental and physical) deemed the very metaphysical antipodes of being?

If it is difficult to understand matter and mind as reciprocally active, how can the emergence of entities so antithetical from one absolutely unique and common source be better understood ?

We have an intuition of the extended—the physical. Is it possible that we should have a less perfect intuition of our own consciousness ? Surely our reason tells us that we know them both as evident existences and as existences profoundly different. This is made manifest by the diversity of their activities, and this diversity can be perceived in our own intimate, unique, concrete being.

Suppose we are energetically opposing the entrance of someone into the room we are in, by leaning the whole weight of our body against the door of it. We have a distinct intuition both of our volitional effort and intention and also of our body acting by its mere weight as a corpse or a block of wood might do.

To disregard such positive intuition of two evident entities thus different in action, in favour of an unthinkable entity, with no apparent power of exercising activity in either mode, is, in our humble judgment, little less than a deliberate abandonment of philosophy gained by experience in favour of a mere intellectually groundless fancy.

We hope that enough has here been said to justify the dictates of the human intellect (as recognised by all but idealists and monists) in its declaration that we have the power of cognising an external, independent world of things in themselves, real objects possessing real qualities, apart from any perception of them by any imaginable mind. We have maintained, and do maintain, that the existence of such a world is (in our judgment) an absolutely certain and self-evident fact, of which the intellect, through the ministration of the senses, acquires a direct intuition. Yet we will proffer one more argument for the consideration of those who may still hesitate as to the final rejection of idealism. This argument springs from a recognition of the fact that the contentions and objections put forward by idealists remain as plausible as ever, even upon the hypothesis that an external world exists. Let us assume, for argument's sake, that a real, external, extended world of "things in themselves" exists on all sides of us, we remaining the beings we are. Could we possibly know of the existence of such a world except by some influence it should exercise upon our organs of sense? Could we get at it in any way except by means of our faculties conjoined with its influences? It would, therefore, always be possible for men of a certain turn of mind to declare they had no ground to accept the existence of anything save the "influences" and the "faculties" themselves, and to deny the existence of anything producing the former or anything possessing the latter. Nay, let us suppose ourselves creatures possessing a thousand different kinds of sense-organs, revealing to us a mass of properties possessed by objects now quite unimaginable by us; however great the number of orders of sensitivity or of properties possessed by the external objects, the position must ever remain the same. The external world could never, under any circumstance, be known save through some influence exercised by it on organs capable of in some way responding thereto, and thus nothing could make evident an external world (by our hypothesis supposed to exist independently) to men bent upon regarding the mere means of cognition as the object of cognition itself.

The systems which different idealists have put forward are just those, and nothing more, which men, determined to regard mere signs as everything, and utterly to disregard their signification (a signification evident to the good sense of all who are not blinded by an extraordinary intellectual perversity), are forced to construct.

To those who have so far followed us, then, it will be clear that the *objects of science* are in part mental and in part material.

Its objects are, in part, thoughts and all that concerns our mental nature, but they also, in part, consist of material things, possessing various powers and energies; and all these things (a knowledge of which the human mind can attain to), as well as matters mental, are true and proper objects of science.

But the human mind has never been satisfied with a mere knowledge of facts. Having ascertained the fact *that* any individual thing is (*i. e.*, exists), its next questions are, *what* is it and *why* is it? What is its essential nature? In what relation does that nature stand to the natures of other existences? What are we to think of the whole whereof it is a part, that is, the universe? What is the cause of the individual thing investigated? Has it a purpose, or final cause, as well as an efficient cause? Finally, can anything, and, if so, what, be said as to the nature and causation of the universe itself?

Beyond the knowledge we may be able to acquire about our own minds, and beyond all we can ascertain about the material universe, man has, by a natural, spontaneous impulse, been ever driven to pass beyond all that is physical and seek for metaphysical truth. Physics never have, and probably never will content him. He will ever crave to add thereto the science of metaphysics. That such a science does or can exist many men devoted to this or that special branch of physics energetically deny.

It is neither our business nor our purpose here to consider whether this denial is, or is not, to be justified. All we have to do is to recognise the fact that very many of the highest minds the world has ever known have been devoted to metaphysics, and also the further fact, that if such knowledge can be acquired, since all knowledge is science of some kind, such metaphysical science must be the highest of sciences, and may be called the science of science. The objects of science, then, described in the most general terms, may be said to be threefold: mental, physical, and metaphysical.

CHAPTER IV

THE METHODS OF SCIENCE

THE objects about which science concerns itself are, as we saw in the last chapter, threefold: they are, in the first place, the material bodies, inanimate and animate, which surround us, together with all those of their relations, qualities, and energies, which our senses and our reason combine to inform us about. In the second place, they are the various mental facts and processes which are revealed to us by consciousness and introspection. In the third place, they are problems concerning the essences and causes of whatever can be to us an object of knowledge, including the universe itself, in all its parts and considered as one whole. The method by which science proceeds with its investigations of the objects of its study is essentially the same in all cases, though variously modified according to the kind of matter about which it is for the time occupied.

But it is in no way the object of this work to describe the special methods whereby the various sciences have been brought to their present state of cultivation, nor the several modes in which each of them is now being pursued. Our only purpose is to point out, in the most general terms, certain characteristics, certain necessary conditions, which are common to the study of all, or of a great many of them.

Physical science—the science occupied about the first of the three categories of objects distinguished at the beginning of this chapter—has been said to consist of careful measurements; and there is much truth in the saying, if a sufficiently wide meaning be assigned to the term "measurement." For science has to consider, as everyone knows, not only spatial dimensions—or the extent and directions in which any body is extended, or, in popular phraseology, "occupies space"—but also differences of quality, differences of energy, and of qualities as well as quantities of energy, and differences in respect to all those qualities which the different senses we possess enable us, though in radically diverse ways, to be subjectively affected by, and, through the intervention of the intellect, to perceive the objective existence of.

But for the apprehension of all these matters, measurement is an indispensable and also an efficient aid. Thus, inquiries as to matters seemingly so purely qualitative as different degrees of warmth, are answered by thermometric measurements; differences of velocity are estimated by the aid of the chronometer, and differences in the action of gravity, under various conditions, by the measurement of weight. Our own past history and the history of mankind are to be understood only by measurements of time. Moreover, to know anything, as we said before,[1] is to know that it is distinct from something else, which is to know numerical difference, which is again counting, and that, to a certain degree, is measurement.

But, though the inquiries of physical science may be generally described as various kinds of measurements, such a phrase is obviously inapplicable to the investigations of mental science. It is true that our own existence does not become known to us save through successive changes in consciousness (successive "states of consciousness"), that is, through "relations" which exist between them, and all

[1] See *ante*, p. 18.

mental facts become known through relations in which they stand to other such facts and to our consciousness. But these are not, in any true sense, "measurements." On the other hand, all the problems solved by careful measurements in physical science are in every case ascertained and solved by the attainment of a correct appreciation of *relations* existing between different objects and activities. And, indeed, metaphysics may also be said to be occupied about metaphysical relations. Thus all science is one vast process of ascertaining, as correctly as possible, relations (*e. g.*, co-existence, succession, and causation) of very different orders of things.

But owing to our organisation, every such inquiry must be carried on, and every conclusion arrived at, through either our sense-perceptions [1] or by the aid of sensuous imaginations, however supersensuous the essential nature of the object of our inquiry may be.

The imaginations we make use of need not, of course, be mental pictures of concrete, extended things; they may be the merest symbols, and such symbols are not only of the greatest utility, but are absolutely necessary for the very simplest kinds of science.

Spoken and written words are such audible and visible symbols, and so are numerals and all algebraic signs. By means of symbols we can work out the most complicated results without any need of thinking, meanwhile, what it is such symbols represent. But in the end, to arrive at any practical or complete result, the symbols must be retranslated into the things they symbolised, and thus the correspondence of processes gone through (simple or complex) may be tested by our direct or our indirect sense-perceptions. Thus, in matters so elementary as the simple addition of numerals, the result may be tested by taking parcels of

[1] See *ante*, p. 9.

things, *e. g.*, marbles, each corresponding in number with one of the (symbols) numbers to be added together, and, having mixed the whole, then counting them, and so seeing that the senses of sight and touch confirm the previous result of the addition of the numerical symbols. It is the same as regards the process of subtraction; its correspondence with the real relations which exist between the substantial things may be similarly tested.

The symbolism of science may be very well exemplified by the simplest facts of algebra, which, as our readers know, is a branch of science replete with the most beautiful, complex, ingenious, and far-reaching processes, whereby alone many calculations are made possible, or the labours of investigation lessened, while the results arrived at have complete accuracy. This is the case even when we find need to employ symbols which express not only unreal, but even impossible, quantities, by means of which we may arrive at otherwise unattainable truths concerning real or possible existences. Such is the case, because they express abstract truths which have real applications, or would have them could the impossible conditions, sometimes supposed, really exist. Thus even the absurd and impossible quantities expressed by the symbol $\sqrt{-x}$ has its relations with reality. It is, of course, really impossible in itself, since there is no quantity which, being multiplied by itself, gives a negative product. Yet it has its relation with reality, inasmuch as it can be used as if it were a real quantity, and all the laws and relations relating to real quantities can be applied to it.

The truths and processes of algebra may be tested by our direct sense-experience (as may those of arithmetic) by making use of definite numbers as representatives of algebraic symbols, and so translating algebra into arithmetic in order to be practically tested. The truths of geometry may be tested by being made evident to the eye and by reasoning.

Making free use of the indispensable aid of symbols, science proceeds to investigate the objects of its study (1) by observation, (2) by reasoning, (3) by putting forward hypotheses, and (4) by testing the hypotheses put forward.

Scientific observation consists in carefully and attentively bringing to bear the senses appropriate to each fact to be investigated, making use of all the artificial means and appliances available for the purpose, with a mind well informed as to what has been done in the same field before, the intellect being also aroused for the detection of likenesses and differences between the objects or actions studied, and other allied objects or actions, and in a state of expectancy as to the possibilities or probabilities of results to be anticipated.

Where it is possible, such observations have to be supplemented by others in which circumstances and conditions have been specially arranged to facilitate discovery. In other words, simple observations have to be supplemented by experiments, and these must evidently be varied according to the nature of the matter under investigation.

In many sciences it is evident that no true experiments are possible, but only different degrees of ingenuity in devising modes of accurate observation. Such must be, of course, the case with the study of astronomy, history, palæontology, etc.

Facts having been sufficiently ascertained, the truths so elicited may be further developed by reasoning according to the laws of logic. Thus it is we gain a distinct and certain perception of truths which were before but imperfectly, only implicitly, apprehended, through the deductive reasoning of the syllogism. By induction, as we all know, we can form judgments more or less probable, and sometimes even certain. Thus, for example, having examined many kinds of pouched animals, and found that they all possess both a peculiar conformation of jaw and also marsupial bones, we judge that if a new species be discovered with one of these characters it will also possess the other.

Such a judgment can never be a certain, but only an empirical,[1] judgment, and it is no wonder that exceptions to the above-mentioned rule of co-existence have been found. But certainty may be attained in some cases. Thus, by the study of different kinds of rocks we easily perceive that they have been deposited at different dates, and that the animals which have left their remains fossilised within them were inhabitants of the earth at different periods.

In endeavouring to reason out the cause (or causes) of any event or fact, we seek it amongst the invariable antecedents or concomitants of that event or fact by five different methods.

There is first the " method of agreement," which endeavours to discover whether, in many cases of the occurrence of the fact we seek to explain, one circumstance is present in every case, and is the only one so invariably present.

Secondly, there is the " method of difference," by which the endeavour is made to find two instances alike in all their circumstances save one, in addition to the difference that in one instance the event, or fact, the cause of which is sought is present, while in the other it is absent. When two such instances are found, then the single circumstance found to co-exist with the event or fact must at least be closely related to its cause.

Thirdly, we have the " joint method of agreement and difference," which may be thus stated:

If in two instances in which y occurs x is also present, while two instances in which y does not occur, have nothing in common save the absence of x, then x is the cause of y.

If we subtract from a given effect all that is due to cer-

[1] See *ante*, p. 8.

tain causes, then the residue is the effect of the rest of the causes. This is the fourth method—" that of residues."

Fifthly, and lastly, if x and y increase, decrease, and vary together, then one is the cause of the other or is closely connected with such cause. This is called " the method of concomitant variations."

Objection has been made to the validity of such reasonings on the ground that the universe is never the same in all particulars save one, at any two successive instants, and that two instances of any event or fact have never occurred with only one circumstance in common. These theoretical objections may also be urged not only against the above " methods," but against all investigations by experiment and observation.

The objection is no doubt formally correct. The celestial bodies are never in the same position for two successive instants, while, on the other hand, their existence persists through whatever series of experiments we carry on.

In all cases also there are, and must be, both a multitude of persistences and a multitude of changes, no one of which we may ever become aware of. But although such theoretical inadequacies must be admitted to exist in every such proof, they can in most cases be sufficiently well allowed for to serve all practical purposes.

The existence of the Pleiades, or even of the mountains in the moon, can be tranquilly ignored while we are trying experiments with respect to the solidification of gases, nor do the gavials of the Ganges interfere with careful investigations into the development of the amphioxus or the apteryx.

There is hardly need to remind any reader of this book that the " method of agreement " is necessarily uncertain, because one effect may have several causes; but this defect does not apply to " the joint method of agreement and difference."

The idea as to what may be the cause of any effect is generally suggested by analogy, or resemblance known, or suspected, to exist between causes and effects thought to be similar to the case investigated; and, of course, a cause will, as a rule, be the more easily discovered the greater the number of instances of the supposed effect we examine.

A suspected cause may be tested by allowing it to operate in circumstances of less complication, to see whether the effect will still be produced. This is, of course, one important instance of carrying on scientific experiments. The process of seeking out analogies and resemblances wisely is perhaps the special characteristic of a sagacious man of science. The process of constructing carefully thought out hypotheses, and then skilfully and accurately submitting them to fitting tests for verification, is the method by which the greatest scientific advances have been made during the last three centuries; although it must be admitted that much time and effort have been wasted by the frequent emission of careless and ill-considered speculations.

The foregoing observations with respect to the methods of science may suffice, because our purpose in referring to, and briefly noting them in the most general terms, has not been for their own sake. We assume that most of our readers already know as much as we could tell them with respect to the methods of science generally, and the details of such methods with respect to those sciences with which they are best acquainted.

Our purpose in devoting this chapter to a general view of the methods of science has had special reference—as every chapter in this book has special reference—to the subject of Epistemology.

Our main object is briefly to call attention to certain ideas, perceptions, and convictions which are present, in at least a latent condition, in every method whereby science is pursued and advanced, and consciously or unconsciously in the minds of those who pursue it.

The question concerning the intellectual justification of these ideas, perceptions, and convictions will be entered upon later.

Now, doubt and scepticism are not only legitimate but necessary in science. They are safeguards against rash assent to propositions inadequately proved. True as this is as regards physical science, it is still more true with regard to problems that are ultraphysical, in studying which it is especially necessary to withhold assent from what does not appear to be clearly and evidently true to our own minds.

Yet it is possible, here as elsewhere, to go from one extreme to another, and to become so possessed by a tendency to doubt as to forget the existence and legitimacy of certainty.

Nevertheless, we all of us possess absolute certainty concerning many things, and this especially applies to those men who cultivate science. We are all certain that science has advanced, and that our physical knowledge is greater in extent and better grounded than it was in the days of Copernicus. Every man of science is also certain that some progress is being made in that department to which he is himself devoted, whatever that may be. But it is obvious that such advance would be impossible if we could not, by means of observations, experiments, and reasoning, become so certain with respect to some facts as to be able to make them the starting-points for fresh observations and inferences as to other facts.

Thus for the astronomer, the earth's annual revolution round the sun, its daily revolution round its own axis and the coinciding of these two revolutions in the case of the moon, are matters of absolute certainty. No geologist entertains the slightest doubt that the earth's crust is largely composed of strata which have been in past ages deposited from water.

No zoölogist can doubt that the transitory stages which most of the higher animals go through in passing from their embryonic to their adult condition, bear a general resemblance to permanent adult conditions of other animals of lower types of organisation. In science, as in matters of every-day life, there are a multitude of facts as to which no man in his senses can entertain any doubt. Though we are for the most part content to act on reasonable probabilities, yet certainty attends us at every turn. If we meet a friend in the street going away from home, we know that we shall not find him if we go straight to his house. If we find on returning to our library that a window, which we had carefully closed before starting, is open, we are quite sure that someone must have opened it. Such certainties about ordinary and scientific matters are quite beyond the reach of reasonable doubt, and it is very necessary, for our purpose here, to recognise that such is the case.

The methods of science clearly imply a conviction on the part of those who follow them that there really is such a thing as legitimate certainty.

If such were not the case, there could be no true science of any kind. Blind disbelief would be as fatal to science as blind belief, and healthy and firm convictions must follow the presence of sufficient evidence, otherwise the progress of science would be fatally arrested. It is necessary, then, distinctly to recognise that there is such a thing as legitimate certainty, not to perceive the force of which is illegitimate doubt. The first conviction, then, to which we desire in this chapter to call attention as being implicit in all pursuit of science, is the conviction that there is such a thing as certainty, and that there are at least some things which we can ascertain to be certainly true. In a later chapter we will consider the justification of this conviction, and the other convictions implied in the pursuit of science.

But what does the assertion that anything can be "certainly *true*" imply?

"Truth" has sometimes been said to be a mere subjective feeling of the mind—truth for each man being just that which each man troweth and no more. But the objectivity of truth is easily shown, since the sceptic who would deny it, in denying it, refutes himself. For if the statement "Truth is merely an individual feeling" were true, then that very statement, as a *fact*, would itself be an *objective* truth, and therefore, *more* than a mere individual feeling. But, as John Stuart Mill long ago pointed out, the recognition of the truth of any judgment is not only an essential part, but the essential part, of it as a judgment. Leave that out, and it remains a mere play of thought in which no judgment is passed. No follower of any branch of physical science can doubt that truth is more than a mere quality of a feeling, or that it has a real relation to things external to his mind. Were not such the case, science, once more, could make no progress. We do not base our scientific inductions and deductions on what we regard as so many individual feelings, but upon what we regard as facts—real relations between real events and things—without a foundation in which our conclusions would be worthless. The truth of physical science consists, and must consist, in the agreement of "thought" with "things," of the world of "perceptions, ideas, and inferences" with the world of "external existences."

In our last chapter we endeavoured to point out how impossible it is to express the facts, processes, and conclusions of physical science in terms of idealism; and we find that the most devoted idealists who also follow some branch of physical science are absolutely forced by their science to use language essentially inconsistent with their philosophy, of which fact it would be as easy as it seems superfluous (and perhaps invidious) to give instances.

But the fact that the pursuit of science cannot be carried on without a real and true apprehension of things objective, and that we possess a special faculty which certainly reveals to us objective truths, are truths contained (however little it may be noticed) in every observation or experiment we may make, and in every conclusion we may draw.

That special faculty of ours, the wonderful office of which it is to reveal to us objectivity with absolute certainty, is our faculty of memory.

Now, as we hardly need say, everything which is objective is external to the self—to the self which is feeling or thinking. Thus all existences, even states of the "self" or the "Ego," which are anterior to the time of any actual thinking are also objective: they are *objects* of thought.

It is memory which enables us to get, intellectually, outside our present selves and our present feelings, in a way the truth of which no sane man can question. For memory informs us with absolute certainty about some events of our past lives. There is probably no one who reads these pages who is not absolutely sure that he was doing some other thing before he began to read them.

And since it is thus actually demonstrated to us through our memory that we can know with absolute certainty things which are objective as regards time, it is the less disputable that our faculties have the power also to inform us as to things which are external to us—spatially objective—and that, as was contended in the last chapter, we have an intuition of real external bodies: an external world as ordinarily understood. The questions as to the validity and the nature of memory will be subsequently considered. They are only here referred to as auxiliary to our apprehension of objectivity.

Thus the second conviction which we desire to point out as existing, at least in a latent condition, in all physical science, and therefore implied in all its methods, is the conviction that an independent, extended, external world really exists, that there are truly objective existences, and that truth is a relation of conformity between the dictates of the mind and other really existing conditions and relations.

We have just referred to our faculty of memory, and that same faculty is intimately connected with the third conviction which must be latent in every pursuit of science. This third conviction is the certainty we have of our own continued personal existence, and along with it the certainty that we do, in fact, know our actions, sensations, reminiscences, emotions, perceptions, conceptions, and inferences.

How would it be possible for any scientific experiments to be carried on if we could not be perfectly certain that it was we ourselves who carried them on: that it was we who had both arranged the test conditions and also noted the results? How, again, could we arrive at any conclusion if we had any doubt about our really having felt, perceived, or reasoned out the results we had felt, perceived, or reasoned out?

Even mere scientific observation would be impossible if we had any doubt that it was we ourselves—one and the same person—who began the observation and carried it through to its end.

To some of our readers these remarks and queries may seem superfluous or even idle. Such, however, is by no means the case, as the same readers will clearly see if they will have patience to peruse this volume to its close. The truths which to them may seem so obvious and undeniable that their enumeration is unnecessary, are truths which have been denied, and are denied by men of very considerable intellectual distinction. For our purpose, that is, to obtain a correct view as to Epistemology, it is extremely necessary to recognise the fact that we cannot follow science if we either, really and truly, doubt the possibility of certainty, or the actual certainty of a greater or less number of facts and principles, the truth of which every science, whatever it may be, necessarily implies.

Provisionally recognising, then, the fact of our continued existence, as vouched for by memory (*i. e.*, till in our eighth chapter the question is more fully discussed), and recognising the fact of the existence of an external world, the components of which stand in various active and causal relations to each other and to us, we have next to consider a matter hardly less momentous. This is the bearing of scientific progress on the question of the validity of the process of inference. The remark hardly need be made that no science has been developed or could be made to progress without it. A direct knowledge of events, facts, and their relations, sufficiently complete to constitute any one of the sciences, would be too vast in extent to be possible for the human mind.

It is conceivable that other beings, endowed with much greater and more far-reaching intellectual powers, might be able to perceive, by direct intuition, all that we are able laboriously to attain to by indirect processes of inference. However that may be, ratiocination is necessary for us (being no better endowed than we are), and every man of science must admit that valid inference is not only a possibility, but a fact. He must admit that inferences which are perfectly valid and certain have been drawn; since, otherwise, there could be no science about the certainty of which we could rest secure. He also knows (as we have already seen) that there is such a thing as scientific certainty, and that to some scientific propositions we can assent without the least fear of error. But this implies that we may, and that we must, place confidence in the principles of deduction —in that perception of the mind which we express by the word "therefore." When we use that word we mean to express by it that there is a truth, the certainty of which is shown through the help of different facts or principles, which themselves are antecedently known to be true. The validity of inference is, then, the fourth of those truths to which we desire here to call attention as being convictions implied in physical science and in all methods by which that science is pursued. Of the process of inference itself, we shall have more to say hereafter; all we desire here to insist upon is that to deny its validity is absolutely to stultify the whole of human science.

But though inferences are necessary for science, our readers will not forget that (as we before pointed out) all reasoning reposes upon a knowledge of facts antecedently known to be true. However long our processes of reasoning may be they must stop somewhere. If we were bound to prove everything, the process would never end, and in this way again we should be reduced to a *regressus ad infinitum*, and no single proposition could ever be proved. It is therefore certain that if any inferences are true and valid they must ultimately repose on facts directly known to us without reasoning; and our fifth conviction, implicitly contained in every method by which science is pursued, is, and must be, the truth that there are some propositions which carry with them their own evidence, which are evident in and by themselves. What is to be said in deprecation or defence of this character of self-evident truthfulness thus attributed to some propositions, we will see later on. What is here to be noted is the fact that science can have neither justification, development, nor even existence, unless it be conceded that not only is the principle of inference valid, but also that underlying true and valid inferences, there are, and must be, in the last resort, certain truths which are made known to us by their own direct evidence, and need no process of proof.

These are intuitive truths, directly apprehended by our power of intellectual intuition.[1] And, indeed, it is perfectly evident that the convictions at which men of science arrive by means of their observations, experiments, and inferences, are not *blind* convictions which they are compelled to arrive at they know not how or why. They are eminently *intelligent* convictions, attained by a conscious and intentional pursuit of truth, and of which those who hold them can give a good account, assigning valid reasons for the scientific faith which is in them.

Amongst the facts and truths thus self-evident are certain evident principles of reasoning. Physical science is emphatically experimental science. But every experiment carefully performed implies a most important latent truth. For when an experiment has shown us that anything is certain, as, for example, that a newt's leg may grow again after amputation, because one actually has so grown again, we shall find that such certainty implies an *a priori* truth. It implies that if the newt has come to have four legs once more, it cannot at the very same time have only three legs. This remark may seem almost absurdly trivial; but it is impossible to make principles of this kind too clear—too plainly certain and inevitable—and there is nothing so useful for bringing home to the mind an important *abstract* truth as the presentation of a plain and indisputable *concrete* example. Anything we are certain about, because it has been proved to us by experiment, is certain only if we know, and because we know that a thing which has been actually proved cannot at the same time remain unproven, and this depends

[1] See *ante*, pp. 14, 47.

again on a still more fundamental truth which our reason recognises—the truth, namely, that "nothing can at the same time both be and not be"—the truth known as the *principle of contradiction*, which we here bring forward as the sixth conviction which must be tacitly, if not expressly, recognised by everyone who cultivates science. It is, at least, latent in every scientific method we employ. Whether or not, in ultimate analysis, the validity of this principle can be sustained, it is at least certain that it is constantly acted on; and this not only in the pursuit of science, but in the judgments and actions of every-day life.

A seventh conviction, which is latent and is acted upon in all the methods of science, is that of the truth of such axioms as "the whole is greater than its part," and that "things which are equal to the same thing are equal to each other." Merely noting this fact, which no one will care to dispute, and reserving what more we may have to say about it for a subsequent chapter, we will pass on to the eighth conviction implied, and at least latent in the methods of science, namely, the principle of causation. However much the validity of this principle may be disputed by philosophers—and such disputes will be considered later—it is impossible to deny that it is practically acted upon by those who prosecute any branch of physical science. It is indisputable that any sudden and unexpected change which may be detected by any scientific observer, is at once put down as due to *some* cause, while he will often do his utmost to detect what that cause may be. That no change can take place, that no new existence can arise, save as the result of causation, is spontaneously acted on by every man of science, and, indeed, by every man of ordinary intelligence, as if it were the most certain and indisputable of axioms. Closely connected with this principle is the ninth conviction, namely, the conviction that the course of nature is uniform.

The uniformity of nature is so evidently necessary an assumption for all who would investigate nature's phenomena and ascertain her laws, that the mere mention of the fact is all that seems necessary at this stage of our progress.

Lastly, since we have seen that the methods of science imply the conviction on our part that some truths are necessary, and that they reveal to us objective necessities in external nature, we must here set down the tenth and last of those convictions to which we desire to call attention. This is the conviction that there really is a condition expressed by the abstract term necessity, a term which would be meaningless without the correlative condition and term contingency.

Reserving, as before said, for a future occasion, an examination into the validity of the fundamental assumptions which must be made by all who pursue physical science, and which are latent in its every method, we may briefly tabulate those assumptions as follows:

(1) It is possible to arrive at certain knowledge about some things, and some absolute scientific certainty has been actually attained.

(2) An external objective world exists and is truly apprehended by some of our intellectual acts, an absolutely certain knowledge of objectivity being afforded us through memory, which reveals to us real existences external to all our present experience.

(3) We can know not only our actions, sensations, imaginations, reminiscences, perceptions, conceptions, and inferences, but also our own substantial and continuous personal existence.

(4) We know that if certain premises be true, then whatever logically follows from them must be true likewise.

(5) Since we thus know certain truths indirectly by inference, we must also know some things directly and see that they are self-evident.
(6) Nothing can at the same time both be and not be.
(7) Some axioms are self-evident.
(8) Every change and every new existence must be due to some cause.
(9) Nature is uniform.
(10) Some things are necessary and others are contingent.

The fact that the above ten propositions are true aud certain is then implied by the methods of science.

Unless we are convinced, and act on the conviction, that the propositions thus implied are true, science is logically impossible, and any scientific man who should deny any one of them would either deceive himself or try to deceive other people. Without their acceptance it is impossible to have any consistent, harmonious, and stable system of ordered knowledge—any true science. More than that, if these ten propositions were really doubted by anyone, he would thereby necessarily fall into a state of mental paralysis and intellectual inanition, in all that relates to scientific knowledge.

Having thus recognised these important convictions, which find a necessary place amongst the implications of science, we may next proceed to consider what are the physical and mental antecedents of all and every science.

A knowledge of such physiological and psychical facts will serve as an introduction to the study of our highest intellectual powers, the dicta of which can alone enable us to judge whether we can attain to a knowledge of the groundwork of science, and, if so, what that groundwork may, or must, be.

CHAPTER V

THE PHYSICAL ANTECEDENTS OF SCIENCE

WE have no experience of knowledge save as consisting of mental states—our own, and those which observation reveals to us as existing in other minds. We have no experience of mental states save as immanent in a living body—our own, and those of other living beings. Without mental states we cannot hope for knowledge, and without organised knowledge there is no science. The groundwork of science, as known to us by experience, may so far, therefore, be said to be twofold: (1) mental and (2) corporeal. Granting, for argument's sake, the essential independence of intellect from all that is material substance, nevertheless we men, here and now, have no experience whatever of it apart from matter, apart from living organised matter, and apart from living matter with a special and definite form of organisation.

If, then, it should be objected that the groundwork of science is, and must be, purely intellectual, we can at least reply that, so far as our actual experience goes, material conditions—a special kind of living organisation—are at least a *sine qua non* for our apprehension of such groundwork.

The groundwork of science must be closely related to the nature of science itself. Now science, as we have seen, is an organised result of knowledge; knowledge is dependent on, and called forth by feelings; and feelings are a result of a normal, vital condition of a physical organisation. To understand fully what is psychical, it is, therefore, generally necessary to have a certain acquaintance with what is physiological and physical. Moreover, as function depends on structure, any sufficient comprehension of the vital activities of our frame necessitates some previous acquaintance with its physical organisation—its anatomy. As we cannot venture to assume that the great majority of our readers are possessed of even a small amount of anatomical and physiological knowledge, we feel it impossible to dispense with some description of the physical antecedents of science (readers, however, who do possess such knowledge, and an elementary knowledge of zoölogy, had better pass over this chapter unread), related as they necessarily are to the groundwork of all science, which it is our ultimate object to study and endeavour to comprehend.

Very little, however, need be said here, except with respect to that substance and those organs of the body which are the necessary means by which alone we are capable of different special feelings and imaginations, or of any feelings at all.

Feeling, knowledge, thought, everyone knows to be carried on by us only in a living body, which ought to be in a sufficiently healthy and normal state. Abnormal conditions may be accompanied by an absence, or paralysis, of one or more of our senses, or by various forms of mental aberration down to complete idiocy. In order, therefore, to have a satisfactory comprehension of our powers of thinking (one indispensable preliminary for investigating the groundwork of science), it is necessary to have some knowledge of those vital functions which are necessary for the exercise of thought; and to understand them, as already intimated, we require to know something of the order and condition of that special mechanism the actions of which so nearly concern us.

To appreciate correctly human thought, it is also necessary to know something of the psychical powers of living creatures which are not human. Some adequate notion as to man's place in nature cannot be dispensed with by anyone who would estimate at their just value the products of human thought. We have already enumerated the sciences which deal with living things,[1] and probably no one will dispute the assertion that man, corporeally considered, is a kind of animal, and that the sciences which relate to animals generally relate, therefore, to him also.

The multitude of species which compose what is called the "animal kingdom" is so vast that it would be impossible to study them otherwise than by classifying them in a number of more and more subordinate groups, each of which is defined by an enumeration of certain structural characters which the creatures included in such group possess in common. It is usual to divide the animal kingdom into two great groups, the lower of which is made up by creatures the whole body of each of which is composed of a single cell, or, at most, a few cells only. Of these creatures, animalcules of various kinds, it is not necessary for our present purpose to say more than a few words. One kind, the *Amœba*, may here be mentioned, as it is so often referred to as closely resembling certain particles (known as the colourless corpuscles) in human blood. It is a microscopic creature, consisting of a minute piece of "protoplasm," with some internal modifications, which protrudes parts of its body in the form of short, blunt projections, and feeds by engulfing what it preys on into its body at various parts of its surface. The bell-animalcule, or *Vorticella*, may also be referred to for the following reason:—its bell-shaped body

[1] See Chapter ii., pp. 24, 32.

is connected with a fixed point of support by means of an elongated stem, traversed by a special fibre. At the slightest shock this fibre contracts, and throwing the filament into curves, draws the body of the creature near to the point of attachment of the filament.

The second division of the animal kingdom consists of creatures the body of each of which is formed by a multitude of cells which are aggregated together into, or give rise to, various kinds of distinct substances, termed " tissues "—such as bone, gristle, muscle, nerve, etc., etc.

The lowest of these many-celled animals are the sponges, and the cells which compose their bodies are arranged in two layers.

Next come the zoöphytes, or plant-like animals (corals, sea-anemones, jelly-fishes, etc.), to which succeed the star-fishes, sea-urchins, and their allies. A multitude of creatures compose at least two large groups of worms, of which the leeches and earth-worms may serve as examples of the higher kinds. We have then an enormous group, *Arthropoda*, which embraces all insects, hundred-legs, scorpions, spiders, mites, crabs, lobsters, and shrimp-like creatures. We have, again, a very much less extensive group of *Mollusca*, which includes all snails, whelks, cuttle-fishes, oysters, mussels, etc. Lastly we have the group of backboned animals (fishes, reptiles, birds, and beasts), to which we ourselves belong. Of beasts, or mammals, there are some dozen different orders, such as opossums, whales, rats, and squirrels, cattle, bats, beasts of prey, apes, etc.

The structure of man's body closely resembles that of the higher apes, while ape and man agree to differ so much from all other mammals that they may be said to stand, as it were, on a zoölogical island by themselves. Thus man, when only structurally considered, is a species of the order of apes, though widely differing from most of them.

Such being man's place in nature as regards the structure of his body, it remains briefly to pass in review the main facts of that body's organisation.

As everyone knows, the human frame is a very complex structure: a mass of flesh (composed of a great number of muscles of different sizes) embracing a skeleton and clothed with skin—the skeleton consisting of the skull, backbone, ribs, and the bones of the two pairs of limbs. Within the body are the heart, lungs, stomach, intestines, liver, kidneys, etc. The skull and backbone together enclose a mass of soft, white substance—the brain and spinal marrow or spinal cord. Delicate threads of similar substance (nerves) and tubes of various sizes (vessels) traverse the body in all directions.

Conditions essentially similar, but differing greatly in various ways in different groups (thus, *e. g.*, there may be but two pairs of limbs or none), prevail in all beasts, birds, and reptiles.

Organs nearly related to each other form what are termed "systems" of organs. Thus the muscles, each of which is made up of a mass of fibres, and are of different shapes and sizes (muscles of the limbs, trunk, head, jaws, etc.), constitute "the muscular system." Muscles are generally attached by their opposite extremities to different bones. Thus, again, the mouth, stomach, and alimentary canal, with their appendages, form the "alimentary system"; the heart, with all the tubes (arteries, veins, etc.) connected with it, composes the "circulating system"; the windpipe and lungs constitute the "respiratory system"; the organs concerned with reproduction are the "generative system"; and the brain, spinal cord, and all the nerves of the body together make up the "nervous system." These groups of organs are respectively named as above, because they severally minister to vital actions termed "bodily motion," "alimentation," "circulation," "respiration," "generation," and "sensation" (or "feeling").

The functions of alimentation, circulation, respiration, and generation also take place in plants, and are indispensable for organic life. Thus they may be said to exist and prepare the way for development of the higher animal functions of locomotion and sensation. It is with the last-named function alone and the organs which serve it—the nervous system, including its annexed organs of special sense—that we have here to do. Nevertheless, it should be noted that in order to act properly the organs of the nervous system require an adequate supply of blood from the circulating system, which blood must be sufficiently refreshed through the respiratory system and purified by organs of "secretion," while it must also be adequately supplied with sufficient and appropriate nutritious matter by the alimentary system. Through an inadequate supply of blood, or through blood insufficiently nourished, purified, or refreshed, the actions of the nervous system become perverted or paralysed till death ensues.

The entire nervous system is divisible into two main parts: a central and a peripheral portion. The central part consists of the brain and spinal cord, which are directly continuous. Its peripheral part is made of all the nerves of the body. The spinal cord (enclosed within the backbone) is divisible into two lateral halves, and nerves, called spinal nerves, are connected with it symmetrically in pairs (one right and one left), one nerve to each of its lateral halves. Each spinal nerve is connected with the spinal cord by two roots, one anterior in position and the other posterior, and each root is made up of a number of small bundles of nerve fibres. The fibres connected with the hinder and the anterior part of each lateral half of the spinal cord, are mixed and run together into the nerves—or rather compose them

—but those connected with its anterior half go especially to the muscles, while those from its posterior half go especially to the skin.

Within the spinal cord itself is a mass of longitudinal nervous fibres and more or less spherical nervous "cells." The fibres extend upwards and downwards, towards and from the brain, and are closely connected with the spinal nerves.

The brain (which is entirely enclosed within the skull, and is composed of delicate nervous filaments and a multitude of cells) is the expanded summit of the whole nervous axis, and may be said to consist of three noticeable portions: (1) The hindmost under part, or *medulla*, which may be described as the expanded upper part of the spinal cord, so becoming the posterior portion of the base of the brain. (2) The *cerebellum*, a rounder, narrowly grooved prominence, forming the posterior under portion of the brain. (3) The third part, which is by far the largest, is formed in part by the continuance forwards and the divergence of the nervous axis, in part by connection with the cerebellum, and also by a very large quantity of nervous tissue apparently independent of either. This whole mass, called the *cerebrum*, is divided by a deep, median groove into two lateral halves—the *cerebral hemispheres*—which form the whole of the upper surface of the brain, and are marked all over by meandering rounded prominences—the convolutions of the brain. The cerebral hemispheres are deemed to be main agents in occasioning our sensations and imaginations, and it is very noteworthy that as we have two eyes and two ears, so also we have two distinct yet similar cerebral organs which are of such importance. The greater number of the nerves which proceed from the brain have their origin in the medulla. This is notably the case with those which go to the lungs, stomach, and heart. Perhaps the most important, for our purpose, of all the structures which make up our bodily frame, are those organs by the aid of which, in unison with the brain, we are enabled to have sensations of different kinds.

The organ of sight consists essentially of an extremely delicate membrane, the retina, wherein are a multitude of minute bodies called rods and cones placed side by side, and lining the rear of the eyeball. The retina is an expansion of the optic nerve (or nerve of sight), through which it is directly continuous with the substance of the brain itself.

The eyeball is bounded by a tough spherical case, and contains within it three transparent media, of different densities, while it is itself transparent anteriorly. It also contains a mechanism to facilitate vision at different distances, and its transparent media produce a picture (though an inverted picture) of what is opposite the eye, on the posterior part of the internal lining of the eyeball.

As each eye forms an image of what is opposite it, the two pictures simultaneously formed in the two eyes slightly differ from each other. They, of course, must do so, since each looks out on the world from a different point of view.

The essential organ of hearing in man (and also in backboned animals) consists of most delicate nervous fibres, which are distributed over a small, complexly shaped membranous bag containing fluid, and itself surrounded by another fluid, which is enclosed in a cavity (corresponding in shape to the bag it encloses) in the densest bone of the skull, some distance within the opening on the surface of the side of the head, surrounded by that conspicuous projection commonly spoken of as "the ear." The nerve of hearing passes outwards from the brain, traverses a canal through the dense bone just referred to, which canal gives it entrance into the cavity wherein lies the membranous structure before mentioned, and wherein the ultimate filaments of the auditory nerve terminate.

The organ of smell is composed of minute terminal filaments of very delicate nerves (olfactory nerves), which proceed downwards, from two special prolongations of the brain, to the moist membrane which lines the uppermost part of the cavity of the nostrils.

The organ of taste also consists of minute nervous filaments, distributed in the tongue and the hinder portion of the palate, which filaments are derived from two gustatory nerves, by which the gustatory filaments are brought into direct connection with the brain, as in the three sense organs before noticed.

The organ of touch is very widely distributed, consisting as it does of a multitude of nervous filaments that ramify and end in the skin, which is, however, very differently supplied by these nerves in different parts, some parts being much more richly supplied than others. These fibres are connected with some part of the nervous axis, either the brain or the spinal cord.

Having gained an elementary acquaintance with the structure of the human body, and of its component systems of organs, we have next to consider what those organs and systems of organs do, what are their functions, and especially those of the nervous system.

The functions of muscles everyone is in a general way acquainted with, *i. e.*, that their special activity is to produce motion. To do this they contract, becoming shorter and thicker, and thus bringing nearer together the two parts to which the two ends of any muscle may be respectively attached, and it is by these means that all movements of the body are effected. Most muscular movements are voluntary, but others are independent of the will. Such is the case with those of the heart and alimentary canal. Some, like our respiratory movements, ordinarily take place independently of our will, but can be performed voluntarily, and can be voluntarily suspended. Soon, however, the power of voluntarily restraining them ceases, and they take place in spite of all our efforts to the contrary. Movements begun with a voluntary effort may be subsequently carried on automatically, as we see in setting out for a walk. Such movements may be carried on much better automatically than when attended to. Attention often positively impedes the rapidity and accuracy of our movements, as is easily seen if we begin to consider what our movements are as we are running downstairs.

The agents which induce muscular contraction are termed *stimuli.* Such are heat, cold, a puncture, a very acrid or acid substance, electricity, and, normally, the influence of the nerves supplied to muscles, and emotion and volition each may be a stimulus. Stimuli physically equal have a more powerful effect when acting on a muscle through a nerve than when acting directly on the muscle itself.

We have seen that muscular movements may take place in us without any advertence thereto on our part, and, of course, such actions are quite independent of our will. But much more wonderful, when we come to think over it, is the fact that muscular contractions will take place in appropriate groups, resulting in co-ordinated movements and groups of groups of such movements, which not only we do not will, but which we do not even know! How wonderful, when we carefully consider it, is the trivial act of a lad throwing a stone at a mark! How complex must be the co-ordinated movements between different parts of the body in order to produce even such a result! The lad's mind has little to do with it beyond the one impulse to hit the mark. He knows nothing of anatomy, but simply sets going the wonderful mechanism of his body, and this works out the desired effect for him, just as if it were an elaborate machine. In the first place, the various movable parts of his eyes must be so adjusted that he may see the mark distinctly. Then his body must be held in a proper position, the stone be grasped with just the right amount of firmness (that is, certain muscles must be contracted to the proper amount), the arm must be thrown back to the due extent, and its muscles contracted, in co-ordination with the movements of the eyes, and with just that degree of vigour which, as his fingers are relaxed, will carry the stone as he desires it should go. Thus various complex groups of movements may be synthesised without our will and without our knowledge—so as to result in the production of one complex action of the whole body.

Besides these conspicuous movements, a multitude of minute ones are continually taking place in the living body —movements which we not only cannot feel but can in no way perceive in ourselves. They can only be perceived in animals by making use of various devices, including the use of the microscope.

We have mentioned the function of alimentation as that of the system of organs termed alimentary—organs which receive and digest food. But though these organs do in this way minister to that function, nutrition ultimately takes place in parts altogether out of reach of all our powers of observation, consisting as it does in the reception of new elements into the very ultimate substance of the body—the change of the prepared residuum of the food we have eaten into our own living flesh and blood, *i. e.*, assimilation. That this does take place is absolutely certain, but *how* it takes place is an entirely unsolved problem. Moreover, it is to be noted that this function, so absolutely necessary for life, takes place in the intimate substance of the body beyond the terminal filaments of the ramifying nerves.

We have spoken of "the circulation" as the function of the organs which compose the "circulating system." But over and above that great stream of life there is a minute circulation which takes place within each smallest particle of the body's substance (just as it takes place in unicellular animals), for the sake of which multitudinous microscopic streamlets the great sanguineous current may be said to exist.

Respiration consists in the gaseous exchange to which our breathing organs minister. But it is not in that conspicuous respiratory process which is evident to our senses that the process really consists. It is in the minute gaseous interchange which takes place in the ultimate and intimate components of the body's substance.

Similarly, "secretion" is a process of formation, by organs, from the blood of products which did not previously exist as such within it. It is thus analogous to the power by which the various tissues that compose the body are enabled to add to their own substance from the life-stream which bathes them, though their substance does not exist as such in that stream. Thus the process of assimilation in which alimentation culminates is analogous to secretion.

Having thus, in the briefest manner, noticed the most essential facts concerning various bodily functions, we may next turn to our special subject in this chapter—the functions of the nervous system. In the first place, it is by the agency of this system that all the other organic activities of the human body are carried on. Without its aid all nutrition, growth, circulation, respiration, and muscular motion would not exist, just as its activity would be arrested were it not nourished by a sufficient supply of duly constituted blood.

But besides organic activities, this system also ministers to, and is necessary for, sensation, and, therefore, for knowledge, seeing, once more, that the latter is impossible for us except as following upon sensation. The nervous system is thus the special, the only, intermediary between our consciousness and the external world, and the only bridge between the subjective and all that is objective besides itself. It both receives the various effects to which the world about us and our own body can give rise to within it, and which result in sensations; and it also causes all the movements which take place in response to stimuli. But it is necessary to note that it not only acts as an intermediary between each organ and its environment, through the sensations to which it gives rise, but also that it so acts without the intervention of sensations. When acted on by external influences it may, and constantly does, excite corresponding activities in our body without giving rise to any feeling of which we are conscious. The special consideration of sensation itself, its various forms, and their other mental accompaniments and effects, will be considered in our next chapter on the psychical antecedents of science; but sensation in its physiological aspect, in so far as it is related to different portions and diverse conditions of parts of the nervous system, concerns us here and now.

As everyone knows, different parts of the nervous system have different functions, and the special functions of different nerves are partly learned by the study of their distribution, and partly by the simplest observations. Thus an irritation of the nerve which goes to the eye (to the retina) or to the internal ear, does not produce feeling in the ordinary sense of that word, but only certain sensations of light or of sound. The nerves which, as before said, are connected in pairs with the spinal cord, minister either to sensation or to motion, according to their distributions and connections.

If one of these nerves be divided, and the part cut off from the spinal cord be irritated, then motion ceases in the muscles to which such nerve is distributed, but no pain accompanies such irritation. If the part which remains attached to the spinal cord be irritated, then pain is caused but not motion. If the so-called posterior root[1] of a spinal nerve alone be severed, the parts supplied with twigs from such nerve only, lose their power of feeling, but their power of motion remains. If the anterior root of such a nerve alone be divided, then the parts supplied by such nerve are paralysed as to motion, but, nevertheless, retain their sensibility—their power of feeling. If the spinal cord itself be cut or broken through, it is impossible for a man thus injured to feel any irritation which may be applied to those portions of his body which are supplied with nerves which are connected with any part of the spinal cord below the point of injury. Neither can he move such parts by any act of his will, try as he may. Nevertheless, movements of those very parts may be produced by stimuli applied to them, of which he remains entirely unconscious, or which, if by observation he is aware that they are applied, he has none the less no feeling whatever, nor can he possibly withdraw any such part out of reach of the stimulus so being applied. A man so injured, though he may have entirely lost the power of feeling any pricks, cuts, or burns applied to such parts, will none the less execute movements, often in an exaggerated manner, in response to such stimuli, just as if he did feel them. He will withdraw his foot if it be tickled just as if he felt the tickling, which he is incapable of feeling. Such unconscious movement in response to stimuli which are not felt is called *reflex action*, for the following reason: under ordinary circumstances stimulations of the surface of the body convey an influence inwards which produces sensation, and gives rise to an outwardly proceeding influence passing to the muscles, and resulting in definite appropriate motions.

[1] See *ante*, p. 113.

The influence inwards appears to travel upwards through the spinal cord to the brain, and so produces feeling, because the brain is the main organ of sensation. The influence outwards appears to travel downwards from the brain, which is, ordinarily, the main fundamental agent for producing motion, and onwards down the spinal cord, and thence to the muscles, which thus move in response to a surface stimulus which has been felt. But when the spinal cord has been divided it becomes no longer possible for such influences to ascend to the brain (and, therefore, there can be no feeling), or to descend from the brain (and, therefore, there can be no voluntary motion). But the unfelt influence travelling inwards is supposed in that case, on reaching the spinal cord, to be thence automatically reflected outwards. That such is the case appears to be shown by the fact that appropriate movements are made in response, but made without the intervention of the will. Reflex action may also take place when the body is quite uninjured, as during sleep, under the influence of chloroform, etc.

But this kind of action is much more strikingly displayed in some of the lower animals. A frog which has had its head cut off will yet make with its hind legs appropriate movements to remove any irritating object applied to the hinder part of its body. If its skin be touched with some caustic fluid, one leg will be brought forward so that the foot may be applied to the irritated spot; and if that leg be held, then the other leg will be similarly moved forwards. A more striking instance of the same power can be obtained from the same kind of animal at the breeding season. The male frog has the habit of tightly grasping the female, and to enable him the more securely to maintain his hold, a warty prominence becomes developed on the inner side of each of his fore-feet. Now, if such a male frog be taken, and not only decapitated, but the whole hinder part of the body also removed, so that nothing remains but the small portion of its trunk from which the two arms, with their nerves, proceed, and if, under these circumstances, the warty prominences be touched, the two arms will then fly together as if they were moved by a spring, and this remarkable and complex response to a stimulus must take place altogether without the intervention of sensation.

But in all these instances of reflex action, the stimulus applied should be regarded as the occasion, not the cause, of the movements in question. They must, it seems to us, be due to powers and energies latent in the organism, which powers the stimulus serves to make manifest.

Other actions may take place in us which resemble reflex action in so far as they take place independently of the will, and, indeed, in spite of all the voluntary efforts we can make, while yet they differ from reflex action because they occur as consequences of sensations distinctly felt. We have already seen how impossible it is for us to impede our respiratory actions after they have been suspended long enough to give rise to peculiarly distressing feelings. Similarly, if an object, not too large, be placed very far back in the mouth, it must be swallowed, and we cannot help it. But the presence of the object is all the time distinctly felt. Such actions are termed "*sensori-motor*" actions, to distinguish them from reflex ones in which sensations do not intervene.

It cannot be doubted that different regions of the brain are specially connected with our experience of different sensations, imaginations, and sense-perceptions, and it is also certain that different parts of it are organs for originating different motions and combinations of movements. But though very much has been done towards determining these connections, a vast deal more remains quite uncertain, and for our purpose here, such localisations are indifferent, and it is enough to note the fact that there are various central regions which are thus connected with feelings and movements respectively.

What it is especially desirable that the reader should here carefully note, is the fact that nervous activities which are accompanied by definite corresponding feelings, shade off, as it were, into activities which are but occasionally felt, and into activities which are in no way felt, nor can by any possibility be felt.

A delicate network of nerves is distributed to the heart, arteries, intestines, liver, kidneys, etc., which network is generally spoken of as the "sympathetic system." Usually the influences which these nerves exercise do not give rise to sensations, but under some abnormal conditions of any of these internal organs, such influences may be felt and be accompanied by pain.

Another notable fact is that exposure to fresh conditions, it may be the reception of injuries, may result in very remarkable results, which cannot have been brought about without the help of that great co-ordinating system of the body—the nervous system. The thickening of the skin of the hand constantly employed in hard work, and that of the muscles of the blacksmith's arm or the dancer's leg, are instances in point; but most striking of all are the processes of repair which may take place after injury. Very complex structures, appropriately formed and nicely adjusted for the performance of complex functions, may be so developed. Thus a new elbow-joint has been known to be produced in a railway guard who was compelled to have his own cut out as a consequence of an injury he had received. The new joint served his purpose exceedingly well, he having soon acquired the power of swinging himself by it from one carriage to another, while a train was in motion, as easily and securely by means of the newly formed parts as he could do with his other, uninjured arm.

Processes of repair are far more conspicuous and remarkable in certain lower animals than they are in man and the creatures nearly allied to him. The tails of lizards, the legs of newts, and even the eye, lower jaw, and the front part of the head of similar animals can be reproduced after removal.

Processes of repair in ourselves take place in perfect unconsciousness, and our will has no direct control over them; but they are directed to a useful end, and are carried on by vital processes which are practically full of purpose though their end is altogether unforeseen, because quite unknown to the patient who benefits by them.

These facts as to unconscious but appropriately purposive processes of repair naturally lead us to reflect on those wonderfully appropriate, and seemingly purposive processes and metamorphoses whereby the embryo is developed, and the adult condition gradually attained. A description of such processes does not come within the sphere of the present work. Indeed, some of our readers may wonder why we have already said so much respecting merely vital processes which are not accompanied by sensation, and may, therefore, well seem altogether foreign to questions of thought, knowledge, science, and its groundwork.

Nevertheless, they have a distinct reference thereto, as will almost immediately appear when we come to speak of instinctive action. But before entering upon that function a few words must be said concerning our faculty of acquiring habits.

The power of forming habits has a certain analogy with reflex action, since it is the result of a power which our organism possesses to react, within limits, when it is acted on. Let us consider what a habit is. A "habit" is not formed by repeating an action a great number of times, though it may be much confirmed and strengthened thereby. If an act performed only once had not in it some power of generating a habit, then a thousand repetitions of that act would not generate it. Habit is the determination in one direction of a previously vague tendency to action. We possess a natural inclination to activity. Action is not only natural to us, it is a positive want. Our powers and energies also tend to increase with exercise and action (up to a certain limit), while they diminish and finally perish through a too long repose. Thus a power of generating "habit" lies hid in all, and in the very first of those actions which facilitate and increase the general activity and power of our body, and facilitate and increase the exercise of that power in definite modes and directions.

This tendency to bodily and mental activity, which underlies our acquisition of "habits," is closely allied to that special form of action which we have above spoken of as "instinctive action." Instinct, as a feeling, will concern us in the next chapter, but its physiological and physical aspects must be noticed here. Instinctive movements differ from reflex actions in that they are not merely responsive to a stimulus felt, but respond to that stimulus in such a manner as to serve a future unforeseen purpose. Such an action is that of the infant, which, in response to the feeling produced on its lips by contact with the breast, first sucks the nipple and then swallows the thence extracted nutriment with which its mouth becomes filled. It is an action necessary for the nutrition of the infant, and one performed very soon after birth, when there has been no lapse of time wherein it could have learned to perform that action. It is also an action which is definite and precise, and one performed in a similar manner by all infants, though it is effected by a very complex mechanism, and is performed at once, prior to all experience. But not only sucking and deglutition, but also the movements by which the products of excretion are removed from within the body of the infant, are, in our opinion, essentially instinctive. In later life various other instinctive actions minister directly or indirectly to reproduction.

It is an instinct which prompts the female child to seek adornments for her little body, and to fondle a doll, and even press it against her breast, whence, when fully developed, her future baby will draw its nourishment. Later on, when the time for love and courtship has arrived, instinct leads youths and maidens to seek each other's society, and tends naturally to induce affectionate feelings and ultimately caresses, each of which acts as a further stimulus, ultimately leading on towards actions indispensable to the race.

But instinct, as it exists in man, is very feebly and obscurely developed, compared with the manifestations of that faculty which may be met with in various of the lower animals, and especially amongst insects. Chickens will, very soon after they are hatched, peck at small objects, grains, and insects, and but little later will at once perform, when they come in contact with water, the movements for making it flow over their backs and fall off.[1]

Some birds will feign lameness, or some other injury, to draw off attention from their eggs or young. Birds of the first year, when the time of migration arrives, are often the earliest to depart, and duly accomplish their journey, though they can have no knowledge of the route they have to pursue, or the region it is the object of their journey to attain.

Snakes taken out of their mother's body just before their natural birth will even then threaten to strike, and, if rattle-

[1] For an admirable account of such phenomena, see *Habit and Instinct*, by C. Lloyd Morgan, F.G.S.

snakes, to rattle, or at least rapidly vibrate the end of the tail.

Ichneumon flies will lay their eggs within the bodies of caterpillars, that they may find abundant suitable food when they are hatched, but we cannot believe that they foresee the purpose and practical utility of their action.

A kind of wasp, called "sphex," provides for the nutrition of her unhatched young in an analogous but yet more remarkable manner. She will hunt about till she finds a suitable caterpillar, grasshopper, or spider, which she adroitly stings on the spot which induces, or on the several spots which induce, complete paralysis, so as to deprive it of all power of motion, but not to kill it, as to kill it would defeat her purpose. This done, she stores away the helpless victim along with her eggs, in order that when her eggs are hatched the grubs which issue from them may find living animal food ready for them and in a suitable state of helplessness; for were they not in such a state, the grubs would be utterly unable to catch, retain, and prey upon them. The species of sphex which preys on the grasshopper first stings it and then throws it on its back, so as to get at the delicate membrane which unites the pieces of its hard armour at their joints. This it bites through to reach a specially enlarged portion of nervous tissue there concealed, by mutilating which it attains its practical but surely unforeseen end.

But if the adult insect cannot reasonably be supposed to understand the future conditions of its unborn young which it will never see, still less can the poor grub be expected to understand what will be the future conditions of its own life when it is a grub no longer—conditions so utterly different from those of which it has had any experience. Yet many species of caterpillar form cocoons in modes and places most suitable for their protection and for their own easy emergence when they have changed into the adult form. The caterpillars of a moth found in Africa will unite their efforts to form a great, as it were, common cocoon, within which external envelope each caterpillar makes its own special cocoon, but which are so skilfully arranged as to leave passages between them to facilitate their departure when, as moths, the time has come for them to fly away.

The caterpillar of the emperor moth is described as spinning for itself a double cocoon, but leaving an opening fortified with elastic bristles pointing outwards, and so directed that while they readily yield to pressure from within, they firmly resist pressure from without. Thus the caterpillar is at the same time both protected from intrusion from outside, and enabled easily to obtain its own exit when fully developed.

As an example of the blindness which characterises these instinctive actions, we may refer to a kind of wasp which does not enclose living food with her eggs, but from time to time feeds the grubs which thence emerge with fresh food, visiting her nest for that purpose at suitable intervals. She covers her nest so carefully with sand that it is completely hidden, and this covering is replaced with equal care after each of her visits. While it remains thus hidden she, it is said, can always find it; but if an entrance is made ready for her, this, instead of helping her to get to her young, seems to puzzle her completely, and even to prevent her from recognising her own offspring.

But, as everyone knows, moths and butterflies habitually lay their eggs on the leaves of such plants as will form suitable food for the grubs when hatched, although the parents themselves neither feed on such leaves nor make any other use of them than that of serving as a receptacle for their eggs. It may be that the parents are insects which, in the adult condition, do not feed at all, and it is incredible that they foresee the use to their unhatched young of leaves useless to themselves, and the past utility of which to the grubs they once were, they cannot be supposed to remember.

Still more incredible is it, however, that a grub should foresee the shape of the body it is destined later to acquire, especially when this shape is widely different in the two sexes. Yet the grub of the female stag-beetle, when she digs the hole wherein she will undergo her metamorphosis, digs it no bigger than her own body; whereas the grub of the male stag-beetle makes a hole twice as large as his own body, in order to leave room for the enormous jaws (the so-called "horns") which he will have to grow.

One more example of that function of the nervous system which results in instinct must here suffice.

There is a kind of beetle, called "sitaris," which is parasitic on certain bees, while its relation to those insects is very different during the very different stages of existence which make up its life-history.

It is hatched from eggs which the mother sitaris lays in passages in the bees' nest. Instead of being in the form of a grub (as is the case with beetles generally), it comes forth from the egg as an active, six-legged little insect with eyes and two long "feelers," or antennæ. In the spring, as the male bees (drones) pass out for their nuptial flight with the queen, the sitaris attaches itself to one of them, and as soon as the opportunity offers, passes from it to the body of the queen bee. When, afterwards, the queen bee lays her egg in the hive, the sitaris springs upon it, and is unsuspectingly enclosed in a cell with the honey destined to nourish the bee-grub when the queen's egg is hatched. Thus left alone with the egg, the sitaris devours it, and then undergoes a transformation in the empty egg-shell. Having been active in the earliest stage of its life it assumes the helpless form of a fleshy grub, which floats on the honey and gradually consumes it. Afterwards it transforms itself once more, and regaining six legs, emerges as a peaceful beetle, and so with its egg begins again the cycle of this species' strange life-history.

All these various forms of instinctive action consist of movements which take place in response to feelings which have been given rise to, and which are often, in part, feelings of antecedent actions, which are the earlier, or the earliest, stages of the whole instinctive process. An interruption of the normal course of procedure will sometimes greatly impair or render impossible the completion of the entire action —as we saw in the case of the wasp, the carefully concealed entrance to whose nest was laid bare. They thus have a certain analogy with sensori-motor action,[1] which only differs from reflex action because of the intervention of sensation, and so might be called a sensuous-reflex action of an organ, or system of organs, which so react on felt stimuli.

But in both insentient and sensuous-reflex action there is a spontaneous response to a stimulus, and a response which is more or less appropriate at the time of its occurrence, but which certainly has no reference to future events, which are to occur long after every trace of the stimulus has disappeared.

The very essence of instinct, however, is that it provides for a more or less distant future, often, as in the case of various instincts of insects hereinbefore noticed, for the wants of a succeeding generation, which will never be known to the creature that performs the instinctive actions without which the new generation could never come into being. Instinct is essentially telic (*i. e.*, is directed to a definite end), and refers to circumstances future and unforeseen at the time the instinctive action takes place. Moreover, the actions which are instinctive, are actions not of this or that organ, but they are rather the reactions of the whole animal

[1] See *ante*, p. 123.

in response to its environment. But though we cannot explain " instinct " by reflex action, insentient or sensuous, there is, as we have said, a certain analogy and, we may add, an affinity between all three. Indeed, all animal life is reflex in the widest sense of that term; for all vital actions result, and are a reaction, from stimuli (internal or external), which are either felt or not felt. The effects of stimuli, moreover, differ according to what it is they stimulate. The ultimate particles of the innermost substance of man's body, like the minute particles which form the whole body of unicellular animals, react upon the stimulus of a certain degree of heat, moisture, or chemical action. The different " tissues " which compose the bodies of multicellular animals and of our own body, react more or less differently under similar circumstances, as the science of the physiology of the tissues shows us. The different organs and systems of organs all react according to the composition of each, and the study of their reactions is physiology as ordinarily understood. Similarly, the entire body of a living creature reacts as one whole in response to influences brought to bear upon it. This we see in the hibernation, or winter sleep, of bats and hedgehogs; in the effects of violent emotions of fear and anger, and in the results of sexual and reproductive influences upon the whole organism. The activities and reactions of the whole body of an animal—including the process of its individual development—form a separate department of the study of animal functions, and may be called " the physiology of organisms considered each as an entire whole."

Now it is a generally admitted principle in biology that structure and function vary together, and the various actions of the several organs of animals depend upon the properties of the parts which act. So also the activities of each animal as one whole, and the sum of the actions it habitually performs

—its habits and instincts—are closely related to its structure. They may thus be said to be sensuous reflex actions not of this or that organ, but of each animal as a whole, and so instinct may be explained as a form of reflex action in the highest and widest sense of that term. But it must not be forgotten that the actions which instinct prompts are not absolutely invariable. They are modifiable to a certain extent by circumstances, through such powers of perception as different animals may possess. The absence of accustomed objects and the presence of others in their place, may lead birds in abnormal conditions to build their nests in unwonted ways. Similarly, many creatures may be led, by the pressure of adverse circumstances, to seek their food in ways different from those which beings of their species usually employ. In this we seem to see the action of a cognitive power of some sort co-operating with and modifying the promptings of instinct. But however much it may now and again be modified, it is clear (from the facts to be noted as to human infancy, the earliest stages of existence in individual beasts and birds, and, above all, from the instinctive activities of insects) that there are courses of continuous action to which animals are prompted by an internal spontaneous impulse, which impulse is blind as to the beneficial consequences of the actions it induces.

Instinct, then, would seem to be a special internal tendency to perform blindly a series of definite and useful actions. It cannot be insentient reflex action, neither can it be what we have termed the sensuous reflex action of an organ or system of organs. It must be more: it must be the sensuous reflex action proper to an individual animal as one whole, or, as we have before said, the highest and most complex kind of all reflex action, "the reflex action of the individual."

The facts and considerations brought forward in the present chapter, not only show us that various material conditions are conditions indispensable for science, because they are conditions indispensable for sensation, but also make it clear what admirable results may proceed from causes seemingly most inadequate.

The different " tissues " of our body are so combined as to form efficient " organs," different sets of which are combined into systems—the activities of the tissues, organs, and systems harmoniously resulting in the performance of those vital functions which characterise and compose the life-history of each kind of animal.

The various vital functions of the body take place in the intimate recesses of our frame quite unperceived, and in a manner in no way directly controllable, by us. Yet these functions are so admirably interrelated that their common result, under normal conditions, is continuous and prolonged life.

Similarly, the intimate processes of repair after injury can neither be perceived nor directly controlled, though their outcome is the practical fulfilment of an indisputably desirable end, and yet more is this evident as regards the processes of embryonic development. In pure reflex action we have a clear example of the close dependence of the actions, and even the practically purposive actions, of animals, on the structure and function of their nervous system; while in sensori-motor action, habit, instinct as fixed, and instinct slightly modifiable by cognition, we meet with a gradual transition from actions in which the will has no sway, and which need not be even matters of cognition, to acts which are results of a cognitive process, and are more or less voluntary in character.

Instinct is a result—a practically purposive and highly intelligent result—of an impulse which is blind and, so to speak, mechanical. But we shall have, in the next chapter, to revert to the question concerning the nature of instinct. So we think no more need be said here upon that subject.

More remarkable still are the results produced by means of those structures we term "organs of sense." Were we pure intelligences devoid of bodies and ignorant of the characteristic psychical endowments of animals, there is nothing in an eye which could lead us to suppose that the inverted picture thrown upon the backs of a pair of them could enable their possessor to see real external objects, and to see them upright and single, and not inverted and double, as they are in each man's pair of eyes. Of course, the mere eyes could not see apart from the brain or apart from the brain's rich supply of duly conditioned blood, etc. Where sight takes place, who knows? The exact nature of the relation of the brain and its parts to actual visual cognition, who can tell? Moreover, as we have seen, the brain is double as well as the organ of sight. But the practical outcome of an organisation so incomprehensible in its innermost nature is none the less satisfactory. That the perception of the eyes is valid, and the cognitions it affords are true, can be shown by comparing small solid objects apprehended by our sight with the same objects as known to us by the use of our hands. Not that we have any ground for considering our physical means of sight less perfect than any other possible physical means—any organ which was not an eye—for obtaining a visual knowledge of objectivity. No such means, which we can in any way imagine, could appear better adapted or less mysterious, because every psychical result of physical antecedents is most absolutely mysterious. But we can hence obtain at least one practical lesson — the lesson, namely, that because we do not know *how* our bodily organisation enables us to obtain a real and true knowledge of what is objective, we can be none the less sure that it does enable us to obtain valid cognition of that kind, and one about which we are certain.

Similarly, our two ears enable us to apprehend the existence of single external bodies possessing energies which translate themselves into sensations of sound, as we say, in our ears, though, for all we can determine, "in our brain" might be an expression more in accordance with reality. For our purpose, however, such distinctions are of no account. What is of account—what relates to considerations which, later on, will concern us much—is the undeniable fact that true and valid cognition are produced by means which, save for familiar experience, we should not, *a priori*, regard as having any capacity, or being at all likely, to produce them.

It also concerns us to note that there is a gradual transition in each of us from vital processes performed altogether beyond the terminations of the nerves, in the most intimate parenchyma of the body, through unfelt nervous activities and nervous activities only sometimes felt, on to acts which are distinctly felt and voluntarily performed. Thus, in addition to our known actions and those corporeal activities which are only occasionally felt, there is an energy operating throughout the body by the intimate activities of which its vitality is ultimately and mainly sustained, and through which entirely unfelt responses are constantly made to received impressions, which never can be perceived, and ever remain beyond the domain of consciousness.

We have in this chapter been mainly occupied about questions of structure, together with the vital energies such structures subserve. We have been compelled to treat somewhat of feelings and cognitions, as forming part of the energies resulting from such structures. But in the next chapter the psychical energies of sensation, imagination, and sense-cognition will be our principal object, though we shall incidentally revert, now and again, to matters of structure and organisation, as we have had here to take some notice, by anticipation, of facts of feeling and cognition.

CHAPTER VI

THE PSYCHICAL ANTECEDENTS OF SCIENCE

THE time has now come to leave behind us, as far as may be, questions of mere physics and physiology, and turn our attention to what concerns the declarations of our own consciousness with respect to our feelings and cognitions.

Our present task, then, is to begin that process of introspection which, in the first chapter of this work,[1] we declared to be indispensable, and though, at first, somewhat repugnant to beginners, yet soon made easy by a little patient perseverance.

Psychical facts can of course be directly known to us only through such introspection—only through consciousness. On this account consciousness itself must be somewhat considered here, although, as one of our higher psychical faculties, its special place is in our next chapter but one. Consciousness is one of those things which can neither be defined nor made known by description. Any being who did not already possess it—if we can conceive of a being who could know other things but not himself—could never be made to comprehend it by any description or definition whatever. Consciousness is, for each of us, both an ultimate fact and an ultimate abstract truth. As an ultimate fact, it is that actual concrete knowledge of ourselves in the act of having some feeling or experience—a knowledge, the

[1] See *ante*, p. 5.

absolute certainty of which is absolutely unquestionable. It is a fact which, being ultimate, is necessarily not only undefinable and indescribable, but also inexplicable. We know, as a fact, that we are conscious, but *how* that fact comes about we know no more than we know the "how" of any other ultimate "that"— *e. g.*, "how" it is that "extended" bodies are extended, or "how" it is that "motion" is a possibility, or "how" it is we can have any knowledge at all.

As an abstract truth, as a universal,[1] consciousness is the ideal perception which the mind gains by abstraction from its experience of concrete conscious states of its own being. Such abstract consciousness, like all other abstractions, is, of course, only an idea, and has no real existence except in that actual living consciousness of an individual conscious being, which is the foundation of the idea.

Consciousness constantly attends our normal waking life, though, of course, it is but rarely that we are expressly conscious of our consciousness. We only become so by turning back the mind and saying, "Now I know that I am conscious." That is *reflex* consciousness. But, like all our other ordinary mental acts, it is accompanied by *direct* consciousness.

Had we not true and valid knowledge in our direct consciousness, without the need of turning back the mind and reflecting thereon, we could never have any knowledge at all; for we should have to go through a *regressus ad infinitum* to obtain it — in other words, we never could obtain it.

When we do turn back the mind and reflect on our experience, we become aware (with special attention to the fact as a fact) expressly of what we may be doing, as when we are playing golf, or engaged in any other amusement or

[1] See *ante*, p. 6.

occupation whatsoever. Thus, consciousness seems to be normally, in its very essence, continuous, and, while existing at each instant, to be aware (directly or reflexly) of its persistence—of its continuity. We each of us know and are conscious, not only that we are actually doing whatever we may be about (as, for example, the reader while reading this passage is aware that he is reading it), but also that before we began to read it we were doing something else. But what still remains to be said about consciousness we shall reserve for a future chapter. Here it is only necessary to recognise the facts: (1) that we know and are conscious of our mental states, and (2) that when we are conscious that we have a thought or feeling, it is absolutely certain that we really have it; (3) that in being thus conscious of our present feeling, we both know it as a feeling, and therefore something so far objective as it is an object of thought; and (4) also that this feeling is something we are actually feeling, and therefore so far subjective. In this act of perception, then, subject and object appear to be identified; but this will be further considered later on. What, then, does this absolutely trustworthy and infallible witness tell us about our own psychical states? Turning our mental eye inwards, and considering our experiences by a process of introspection, what does it tell us concerning the question as to whether any mental states can exist, as it were, beside consciousness—states, the past existence of which, consciousness can by some means become fully aware of as having certainly existed?

It is unquestionable that our consciousness can and does inform us of the existence of very different kinds of psychical experience. Thus it tells us of our very distinct feelings of colour, sound, smell, taste, and touch; or sometimes that we have feelings of exerting force, or undergoing pressure; also that we have feelings which are simultaneous and others which are successive, etc. Besides all these feelings and others allied to them, our consciousness also tells us that we have a multitude of cognitions of very different kinds, some of which are direct perceptions of external objects, others of the force of arguments, or of the evidence of axioms, or the truth of intellectual principles. Now in our visual perception of the world about us, our consciousness informs us that we perceive at any one time a certain small portion of our field of vision with special distinctness, but that around this portion, receding on all sides, are visual perceptions which become more and more indistinct and, as it were, "out of focus." Similarly, in our musical experience, we hear with great distinctness a series of sounds as they succeed each other, as also that they gradually fade as they recede from the present into the past; while, if we are listening to a more or less familiar melody, the notes which are about to be heard become anticipated, so that past, present, and future may be more or less truly present to the mind simultaneously. Similarly, once more, in all that we attend to, there is always some part of what our mind is occupied about which is apprehended with special distinctness, while other matters more or less nearly related thereto are cognised with various inferior degrees of clearness of perception.

Whatever might be the case in this respect with a creature all intellect, and independent of material conditions, such, it would seem, must be the case with beings like ourselves. It must be so, because all our most abstract ideas require to be attended and supported by mental images or phantasmata, which have been derived from the actual experiences our senses have gained from material things. Since also material things, and therefore our imaginations of them, can only be attended to with the greatest keenness piecemeal and in succession, it cannot be otherwise with the intellectual considerations they minister to and support.

The recognition of these facts naturally leads us to the consideration of two other very important facts to which our consciousness gives distinct testimony. These are (1) that past experiences will often rise up in our minds, and (2) that experiences yet to come may also be anticipated. We have both powers of memory and of anticipation. Thus it is we have a power of faintly reviving complex groups of past sensations, and so forming mental images, or imaginations, of persons we have known, scenes we have witnessed, etc.; and we have also the power not only of thus imagining the past, but also what is, or may be, yet to come. We thus also become fully aware that we can (as pointed out in the first chapter) apprehend certain degrees of likeness and of difference, and can cognise "relations."[1] We can also be only too sure we have sometimes feelings of pain as well as of pleasure, which appear to us external in origin, as well as internal pleasurable and painful feelings accompanied with anticipations or recollections—feelings which we distinguish as emotions and desires. Yet other mental states are also clearly known to us which may, or may not, accompany the last-named feelings—*e. g.*, states which we term "volitions."

Thus consciousness, in examining the mind which is conscious, perceives its perceptions, feelings, and activities with differences of intensity and of other qualities. But consciousness, through memory, also shows us—as will shortly be pointed out—that we have had experiences without advertence and vague cognitions of presence, absence, and relations of various kinds, to which consciousness at the time did not attend, so that we were unconscious of parts of our mental affections—not that we were not conscious when we were so affected, but that our attention was otherwise occupied. It is, of course, impossible for us directly to

[1] See *ante*, pp. 8 and 91.

perceive these unconscious psychical processes, because whatever we direct our mental gaze upon becomes thereby in the very focus of consciousness. Nevertheless, by the aid of memory and reasoning, we may plainly perceive that we have passed through such unconscious psychical states.

It is very desirable that we should endeavour to recognise and distinctly draw out, through the assurance of our consciousness, that we must have had certain mental modifications which we did not advert to at the time when our senses were being thus acted upon and were receiving such impressions.

Before proceeding to do so, however, we desire to recall to the reader's mind, yet once more, our representation [1] of the distinction which exists between feelings and ideas, as also that ideas cannot exist for us, unless ministered to and, as it were, supported by mental images, that is, by feelings of the imagination. These two facts may help us to understand how it is that, although we have no ground to regard our mind as other than a perfect unity, it yet has two orders of mental powers. There are two kinds of mental activity: (1) those allied to the sensations which are the means of perception, but which consciousness does not advert to when it perceives an object; (2) those allied to the intellectual perceptions to which such sensations and imaginations minister. A great number of mental facts—mental processes—may be grouped around each of these two kinds of mental affection. Those which are allied to feelings and imaginations constitute our lower mental faculties; while those allied to our intellectual perceptions are our higher ones. No one, probably, will question that a process of conscious reasoning and a perception of the truth of an axiom are higher mental processes than mere feelings of colour, warmth, or sweetness.

This distinction between our higher and lower mental

[1] See *ante*, pp. 10–13.

powers, though it has been so long and so generally neglected, we believe to be one of the most profound and important truths in psychology, and one the recognition of which is absolutely necessary for everyone who would attain to a sound and reasonable philosophy.

But as we are intellectual and conscious beings, we should expect that every lower mental process would, in us, be more or less modified by our higher nature, through the existence of which alone we can (through reflection) ever become aware of the existence of any such lower mental process. As to animals, we can have no psychical experience of any creature's mind but our own. Nevertheless, observation, experiment, and inference, in combination, may suffice to give us a trustworthy assurance that faculties like our lower psychical powers exist in them, and that they are, or are not, sufficient to account for all their actions, however rational such actions may, at first sight, appear to be.

As a familiar illustration of this distinction to which we refer as existing in ourselves, may be mentioned a circumstance which has, perhaps, happened to many of our readers as it has repeatedly happened to ourselves. In walking along a street with consciousness absorbed by some train of thought, it may suddenly strike us that we had passed a house over the shop-window of which there was a remarkable, or a familiar, name, and then, turning back, find that our suspicion was justified. We may thus see that we had experienced sensations, grouped together into a mental image, but which, so far as we can perceive, never rose into consciousness. Again, we may set out to visit a friend at a residence well known to us, and our consciousness, absorbed as in the former case, may not serve to make us recognise the familiar spot we were seeking, and we may only be awakened to the fact that we have passed it by, through a check to our career given by some passing vehicle. But while we have thus been walking in reverie, our senses, though not our intellect, have been awake to all the conditions which were necessary to enable us to walk without accident through peopled streets, with repeated steppings down and up kerbstones, and other similar movements. Each turning, each crossing, may have been accurately effected, and though we had no consciousness of the several objects which passed before our eyes, yet we must have felt them and had an unconscious sensuous cognition of them, or they never could have served to guide us safely along our path.

Once more, let us suppose the case of a young lady playing with perfect facility on the piano a difficult but well-practised piece of music. While she is playing it, she talks to a gentleman she thinks likely to "propose" to her.

Her consciousness is absorbed in attending to his words, his tone, and manner, with mental side-glances as to fortune, temper, and other matters. Yet she need never stumble in her performance, or fail in exactitude as to the force of stroke or prolongation of pressure to be applied to the different keys; indeed, were she to direct her attention thereto, the perfection of her execution might be thereby impaired—just as (once more) running up and down stairs may be impeded by the express direction of attention to the movements necessary to effect it. Most persons who can play melodies on the piano "by heart," know how, when they fail in any familiar passage, the worst thing they can do is to think what the order of the forgotten series of notes should be, and that their best course is to turn their mind away to something else while they try to play it unconsciously and automatically. In other words, the melody is recalled by avoiding the use of the intellect and trusting to the sensuous association which has been formed between successive notes, and which has become, as it were, embodied in the nerves and muscles of the pianist.

And here it seems desirable to point out the differences which exist between our higher and our lower mental faculties as regards "memory."

Memory is sometimes said to be a faculty which revives past feelings and ideas. But any number of feelings or ideas which might be revived and so once more felt or thought, would not constitute true memory unless they were recognised as having existed before, and as relating to the past. Nevertheless, reason shows us that our being must somehow have powers through which past feelings and imaginations can be retained and revived without their appearance in consciousness.

Now two feelings, which have been experienced by us successively or simultaneously, may be so closely associated that on the recurrence of one, the other may recur also. It is natural to us thus to associate feelings and imaginations which have been frequently experienced together. Thus groups, and groups of groups, of such mental states may become associated and will recur as just stated, and this may take place anterior to, or without any intellectual advertence to the ideas such associated feelings may occasion and serve to support. Thus the sound of a dinner-bell, or the sight of an expanded umbrella, may instantly arouse in our minds associated mental images of food or of rain. It is not only that we know, by an intellectual cognition, that the bell is a call to dinner, or that the umbrella has been opened on account of rain. These cognitions of the intellect we may, of course, have, but the associated mental images may be called up before them and persist, sometimes to our annoyance, after them; the notes of a melody familiar in times long past may arouse vivid mental images and keen emotions relating to the days of our youth, and even a mere perfume will sometimes have a similar effect. How true it is that these lower mental states can exist apart from intellectual cognition is proved by the fact that even idiots may sometimes have their emotions similarly aroused.

Such revivals of past feelings, unrecognised as such, cannot, as before said, be properly called memory, but, except for not being recognised, they closely resemble it, and may therefore be distinguished as examples of what may be termed "sensuous memory," or the memory of the imagination. It is this lower power which lies at the base of our true intellectual powers of memory and reminiscence, and it is by its aid, as we believe, that we are able to carry on during those unconscious states of reverie and "absent-mindedness" the actions we have above noted. It is by associated groups, and groups of groups, of feelings and imaginations, that we are enabled so practically to cognise objects in a merely sensuous way that such complex actions can be performed without intellectual advertence.

In our next chapter we shall inquire whether animals, by the use of faculties analogous to our lower mental powers only, may not be enabled to do a variety of seemingly rational actions without consciousness, and therefore without knowing that they do them. We, being intellectual creatures, cannot (as before observed) know that we have these lower faculties save by the intervention of the higher—save by introspection, the interrogation of consciousness, and a consciousness of at least much of our environment. But we can, through observation and memory, be sure that we must occasionally have cognised objects with merely sensuous cognition and without consciousness. And since we can always argue that what has actually happened must be at least a possible thing, we may also be sure that merely sensuous cognition is possible, since we must really have had it. Without such cognitions the actions above noted as taking place during reverie and absence of mind could never be performed.

And the facts we noted in our last chapter ought to make the occurrence of such merely sensuous actions easy of comprehension, because they have much resemblance to those acts of sensuous reflex action and those instinctive actions which were therein described.

But since such complex instinctive actions, and actions resulting from sensuous cognition, are the action of the body as a whole, and as the sensations which give rise to such sensuous cognitions are often feelings produced by very different sense organs—by sights and sounds, feelings of touch, pressure, etc.—they must clearly be referred to, and receive responses from, some common sensorium.

Now in the cases referred to, consciousness is not called into play, but is otherwise occupied, and in consequence we require a term to denote such a faculty and sensorium in ourselves and in animals, at least in such as all would agree have not intellectual consciousness. It has then been suggested to denote that lower psychical faculty, that meeting together of sensuous impulses of the most diverse kinds, by the term *Consentience.*

Sometimes, as both in reverie and a state of absorbed attention to some object, our minds are in a condition in which all the direct consciousness of our being seems to be suspended, and we have but a vague feeling of our existence—a feeling resulting from the unobserved synthesis of all the various sensations and impressions we may then be subject to. Such a blending of feelings is a form of consentience, and it is by this faculty that the unconscious sleep-walker receives and accurately responds to the varied impressions which surrounding objects make on his organs, and by it also the idiot makes such responses, as he may be able to make, to similar impressions. It is to consentience again that the ability to perform many instinctive actions is due.

In many of our rational actions, which consciousness knows and can analyse, we can by attention detect the merely sensuous elements of our cognitions. These elements might be expected to be capable of producing in lower natures—in mere animals—acts apparently intelligent, but which are not really so.

Thus we may recognise the presence of *feelings* of self-activity or passivity accompanying our *perceptions* of those states. When we draw our hand over a foreign body or grasp it, we may detect one such feeling underlying our perceptions, and both at once, when rubbing the hands together or when struggling against a violent wind.

Similarly, a variety of sensations, real and imagined, underlie our perceptions of succession, extension, position, shape, size, number, and motion, and can, with a little care, be easily detected and discriminated. Thus as we feel the series of sensations of contact when the links of a chain are drawn across the hand, we have feelings corresponding with succession and motion. When handling a solid cube we have feelings related to extension, shape, size. Again, in a multitude of actions—for example, in climbing up a bank—we have feelings relating to "relative position," and we may also acquire such by merely drawing our hand from the ankle upwards to the thigh. Of course, we have no feeling of succession itself or of the other abstract ideas above mentioned, but we have feelings which specially correspond with all of those ideas just referred to. Such feelings as serve to guide the footsteps of the unconscious sleep-walker, might well be sufficient to direct the movements of any creatures which were richly endowed with feeling, but denied the power of intellect.

Similarly, we have feelings closely connected with perceptions of agreement or disagreement, and others which accompany surprise or doubt. Let us suppose that we grasp an artificial orange so made as not only to look, but also to feel, like a real orange, and that we cut it, and to our surprise find its interior to be very different from what we expected it to be. Thereupon we have, of course, our intellectual perception of the fact, but we also have a certain feeling of "shock," which accompanies our surprise at making the discovery. Similarly, if the nature of an object seems to us doubtful, we have a feeling of "suspended action" accompanying our state of intellectual doubt. If the object turns out to be what we supposed, as we discover it we have a simultaneous feeling of "smooth and easy transition" along with our perception that our anticipation has been fulfilled. If it should turn out otherwise, then, as we perceive the disagreement, we have a feeling somewhat like that which we get from a suddenly arrested motion.

Thus by the occurrence of different sensations and different combinations with imaginations—by the association of sensations, imaginations, feelings of pain or pleasure with those of activity, passivity, succession, extension, figure, magnitude, unity, multiplicity, motion, and rest—we come to have most varied complex groups of feelings corresponding with states of the world about us and of ourselves. These groups of groups of feelings underlie and accompany our intellectual perceptions, on which account they may be termed "sensuous-cognitions," or "sense-perceptions," since they may produce practical results resembling those of intellectual cognitions and perceptions in any creature capable of feeling them, but devoid of consciousness.

If we reflect on these sensuous cognitions with the associations which may be established between feelings, as evidenced by the effects of merely sensuous memory, we shall see that merely sensuous mental states may bear a notable resemblance, practically, to true inference.

When different groups of feelings have become intimately associated, then, on the occurrence of one group, an imagination of the other group will arise in the mind, and we have an " expectant feeling " of their proximate actual recurrence—as we may have an expectant feeling of orange pulp when cutting the artificial orange.

This expectant imagination of feelings yet to come, has a decided analogy with reasoning and inference, although quite distinct and unlike them essentially. Very noticeable also is that feeling of wondering expectancy which will arise when some strange sound is heard, or some startling movement seen, followed by a feeling of complacency when an innocent cause of either comes in view.

Such feelings are the sensuous accompaniments of an intellectual search for a cause followed by its satisfactory detection.

Strong feelings, and especially strong emotions, tend to manifest themselves externally, not only without our knowledge and intention, but against our utmost efforts, when we become conscious of such manifestations. Thus terror and anger show themselves by external signs, which express feelings, not ideas, and so may be said to constitute a " language of emotion."

Such unintellectual language manifests itself, as we have just said, " by external signs." This is quite true in one sense, yet, without further explanation, the assertion may be misleading, as the word " sign" is used in two very different meanings.

A " sign," in the full sense of that term, is a token or device addressed to eye or ear, depicting by some external manifestation an internal, abstract idea, and made use of with the intention of conveying to another mind the idea or ideas in the mind of the sign-maker.

Yet a sign may be truly such, though quite in another way. Thus the external contortion of the features in terror, or screams or verbal exclamations, are truly signs to onlookers of the feeling of the terror-stricken person. But as the latter has not contorted his features or uttered sounds with the *intention* of making his terror known, it can be nothing but an accidental sign.

Yet, again, a sign may be made with the object of attracting attention so far as to gain sympathy or make known a sympathy felt. Such signs may be an uplifting of the eyes with the hands clasped, or a hand may be smilingly kissed, or articulate words of tender endearment may be uttered, or curses may be shouted with clenched fists, the words in neither case having any further meaning than an indication of the feelings contained. Such signs, of course, are not those of the first category, but only emotional signs.

We have before noticed the remarkable way in which movements may be spontaneously and unconsciously co-ordinated.[1] Such movements are due to feelings which have also unconsciously become associated. The actions performed apart from intellectual advertence show the power we have of co-ordinating sensations as, *e. g.*, in playing the piano "by heart." Then the motions of the hands and fingers follow each other in orderly succession, which is manifestly due to co-ordinated sensations of touch and hearing—felt touches of the keys, and heard sounds of the strings. Let only one note have become dumb, or one of the keys struck fail to rise, and the whole automatic action may come to an end through a failure of co-ordination in the associated sensations.

But our power of unconsciously synthesising our movements into one complex general action—as in the stone-throwing before described[2]—runs parallel with another remarkable power we have of unconsciously synthesising various pleasurable tendencies into one dominant impulse.

[1] See *ante*, p. 117. [2] See *ante*, pp. 117, 118.

This power is singularly analogous to, though *toto cœlo* different from, volition. That we have such a power is manifest from the actions of persons when walking in their sleep, or during a state of reverie, and also from the actions of some idiots. Another sensuous power we possess, and which we may term "sensuous attention," is one that simulates the intellectual and voluntary act we know as paying attention to, deliberately observing, anything.

Thus persons who walk in their sleep have been observed, when missing some object from its wonted place, to begin to look or feel for it. We may also observe in ourselves, when startled by some new and disturbing object, how our senses automatically direct themselves to it without waiting for the bidding of our conscious will.

But the complex association and co-ordination of a group, or groups, of feelings (sensations and mental images), with resulting co-ordination of groups of movements, may have a yet more remarkable result. They may result in the spontaneous, unconscious, and automatic employment of what are, practically, "means to an end," quite apart from any intellectual recognition of either means or end as such. This result is sometimes strikingly manifested by somnambulists, who have been known to perform very complicated actions. Under such circumstances, a drawer may be opened or a door unlocked in an unconscious search to obtain some object or reach some locality. Such actions are easily explicable in the way above stated. For the consentience of the sleep-walker is impressed by various groups of sensations, such as those produced by the walls and furniture of the room the sleep-walker may be traversing on the way to the desired locality, the door of which is locked. The feelings thus excited arouse his imagination of the inside of the place sought, this in turn excites the nervous channels habitually stimulated in overcoming the intervening obstruction—the hand automatically seeks the key; the feelings produced by its touch stimulate the muscles of the arm; the key is turned, and the door opened. Very complex movements are sometimes thus automatically performed in order to complete a sensuous harmony which the imagination, through habit, has come to crave. It craves for fresh, completing sensations, and is thus led to perform appropriate movements when certain initial sensations have been afresh excited, after which the completing sensations have (in past experience) habitually followed. This, then, is the "practical imagination of means to effect a desired end."

Such sensuous acts are what we should expect to find amongst animals if they are, as they have generally been supposed to be, creatures richly endowed with sensitive faculties, though devoid of those which are intellectual.

But what judgment are we to form with respect to the highest psychical faculties of animals? That is the next question to which we must now address ourselves. The question, however, is not, of course, to be pursued for its own sake in a work such as this, but for the sake of its indirect bearing on Epistemology.

Many persons who have accepted the Darwinian hypothesis as to evolution are inclined to distrust their own reason, as being but the intelligence of a more highly developed ape. If, therefore, the study of animal intelligence should convince our readers that there *is* a difference of kind between the psychical nature of man and that of animals, such reason for distrust must disappear. But, on the other hand, should we become convinced that there is *no* difference of kind, the distrust referred to need not thereby be strengthened. For animals would then be seen to be of a much higher nature than has been usually supposed, since (as we shall see) there can be no doubt as to our own rationality. If animals are also rational, though but potentially so, we may suppose that their environment and some incompleteness of internal development has prevented them from hitherto manifesting their latent rationality. It must have remained hidden, as that of the human infant is concealed by the co-existence of internal and external conditions, which make its external manifestation impossible. There would, therefore, be no more reason to distrust the dictates of human reason, because developed from that of an unconscious animal, than because developed (as that of all men has been) from that of an unconscious infant.

We can, therefore, address ourselves *æquo animo* to the question of animal intelligence and study it with the most complete impartiality, since the absolute value of the dictates of our own intelligence cannot be affected thereby. Nevertheless, the question is most interesting, as bearing on the problem of nature's continuity, and as being one to which many excellent persons have (we believe most mistakenly) attached an extreme importance.

In dealing with this matter, great confusion and numerous mistakes have arisen from the fact that many persons will attempt to understand and explain the psychical powers of animals without having previously obtained a comprehension of their own. As Mr. C. Lloyd Morgan has amusingly remarked,[1] "the psychologist is apt sometimes to smile when, after the recital of some anecdote of animal intelligence, the writer exclaims, 'If this is not reason, I do not know what reason is.' As, however, in such cases, the writer has himself suggested the alternative, there is perhaps no discourtesy on the part of the psychologist in accepting it." Indeed, men often interpret the actions of animals in a way which they regard as being simple and natural.

[1] In his excellent work entitled *Introduction to Comparative Psychology*, p. 261.

"Simple and natural" such explanations would be if they were applied to human beings, but exceedingly forced and unnatural they may be when applied in estimating the acts of creatures the natures of which are exceedingly different. They are also apt to be caught in a snare, which it is as necessary as it is difficult to avoid. This is the necessity we are all under of expressing ourselves in terms which have been gained as the result of prolonged processes of abstraction, since, as we have before observed,[1] all our words are the results of such processes. To make use of such symbols, then, to denote psychical states which are not the result of abstraction, is to run the greatest risk either of misrepresentation or of being misapprehended.

Occam's celebrated saying, "*Entia non sunt multiplicanda præter necessitatem,*" applies to psychology as well as to other sciences, and it forbids us to credit mere animals with the higher human mental powers when their actions can be quite well explained more simply—by those lower psychical activities which we have just passed in review as existing in ourselves. The tales told by the owners of pet animals are often absolutely untrustworthy, so strong is the tendency they have unconsciously to exaggerate the performances of their favourites, and naïvely to interpret them in terms of purely human psychology.

As to the highest psychical faculties of mere animals generally—those which are not pets—many persons credit them with powers (1) of perceiving objects; (2) of perceiving relations between objects; (3) of perceiving their own existence—consciousness; (4) of having ideas; (5) of reasoning; (6) of perceiving moral quality; (7) of expressing their ideas by sounds, and (8) by gestures.

Since the question of animal rationality is for us a subordinate question, with only an indirect bearing on our main

[1] See *ante*, p. 7.

conclusions, we are compelled to consider the eight just enumerated points but very briefly.

That animals in one sense perceive objects is, of course, unquestionable. If they did not do so, coursing and hawking would be impossible. But what is the nature of such perceptions? We have already seen how, by turning the mind backwards and considering our experience, we may recognise that we have had perceptions of which we were not conscious at the time we experienced them. Such perceptions were sufficient to guide our movements, as they serve to guide those of the unconscious sleep-walker—in our words, there was not consciousness, but only consentience. Need we then credit animals with more than this? Such sense-perceptions of theirs may be much more keen and more rapidly cognised than are our own. We ourselves do not know of any animal actions which we think cannot be explained by cognitions of this lower kind. It will be said, however, for a cat to watch the movements of a mouse and to catch it, needs not only that it should see the mouse, but the objects around it, and the varying bearings of the running mouse thereto. This, of course, must be fully conceded, yet such cognition is sufficiently accounted for by that mere unintellectual, unconscious awareness which we have termed[1] the "practical imagination of means to an end."

Again, it may, perhaps, be objected that the cat not only sees the mouse, but knows that it is a mouse and nothing else. This also may be freely admitted in the sense of a mere sensuous cognition or sense-perception. But there is no need to credit the animal with even the direct perception of the mouse, as the embodiment of a universal abstract idea, such as is possessed by the lowest and most uncultured human being who is sane. The cat need only have that

[1] See *ante*, p. 153.

synthesis of sensations and imaginations—that kind of mental image which we distinguish as a "sensuous universal."

If, then, we need not credit animals with the perception of objects as we understand perception, can we credit them with any perception of "relations" between objects? The answer to this question will make yet plainer what we mean by a perception of objects themselves; since, as we shall see directly, such a perception of objects themselves implies a perception of relations themselves.

To perceive anything with conscious perception, though only that of direct consciousness, also implies a direct consciousness of the main relations in which it stands to other things, and which differentiate it from them. To perceive anything with reflex consciousness, which affirms, "I do know that thing to be what it is," implies and necessitates a reflex consciousness also of those of its relations which enable us to be sure it is what it is. For without turning back the mind to reconsider what it had previously done, we could not recognise the relations as relations, and so obtain the certainty we are thus enabled to reach. If we have occasion to note only one relation—as the relation of right and left—we must, to be conscious of it, turn our attention to both these conditions successively, and then simultaneously have regard to both terms, or we could not apprehend the relation.

We think there is no need to credit animals with such complex psychical acts in order to explain even their most startling performances. It seems to us that their consentience affords them practically sufficient sensuous perceptions of the relations in which objects and events stand to each other, as well as of the objects themselves.

Similarly, it is plain that animals have a practical sense of their existence, and run no risk of mistaking another creature for themselves. But for such a sensitive synthesis there is no need of consciousness, as we know by purely human experience. All that is needed is consentience, and this no one can doubt that they possess, and probably exert this faculty with greater energy than we do, on account of the absence in them of a truly intellectual, conscious self-perception, such as that which enables us to perceive that "I am I, and not another."

As to the possession by animals of "ideas," no one can deny them such psychical activities as are often so termed—namely, the faint revival of complex groups of past sensations and imaginations previously experienced, and varied associations of groups of groups of such psychical states. But this is by no means what we understand by "ideas." An "idea" is a "psychical" entity, which spontaneously starts forth in our mind, upon the reception of certain sensuous experiences (sensations and imaginations), like Athene from the head of Zeus. Thus one of our earliest ideas is also the most ultimate and most abstract, namely, the idea of being. For the rest we must refer our readers to what we have said about "ideas" in our first chapter.[1] But it has been very unreasonably contended, since animals examine and reject some things for food and yet eat other things with avidity, that they must have such universal ideas as "good-for-eating" and "not-good-for-eating." Now, the inner nature and faculties of an organism can only be judged of by the outcome of its powers, whatever these may be. If animals really had ideas of the kind, and consciously performed voluntary acts of examination in order to see which of two general ideas might be applicable in any given case, then they would, most surely, soon make us very fully aware of it by other less equivocal manifestations of their possession of intellectual faculties essentially like our own. Interpretations such as the above might carry us

[1] See *ante*, pp. 10–13.

very far. We might say, for instance, that plants have abstract ideas of "suitable-for-nutrition" and "not-suitable-for-nutrition," and of the still more abstract ideas, "big-enough-to-be-worth-a-prolonged-effort," and "not-big-enough-to-be-worth-a-prolonged-effort." For Venus's looking-glass (*Dionæa*) will snap together the blades of its singular leaf to catch an insect, but will not do so to catch a non-digestible object. More than this, if the blades of its leaf have closed on an insect of very small size (not worth catching) they will (it is said) unclose and let it go again; while otherwise they will hold it till it is killed and digested.

Animals, even very lowly ones, possess multitudes of complex associations of feelings and movements. What, then, is more to be expected than that when an animal experiences a group of new sensations from a novel object, it should apply its senses and consentience to aid their reception and instinctively make movements in response thereto? Such movements need be no sign of the existence of ideas when other evidence clearly points to their non-existence.

Sensuous analogues of ideas, then, animals, of course, possess, and the phenomena they present do not, we believe, demand the recognition in them of any higher powers for their satisfactory explanation.

Similarly, the faculty of reason which we possess is, we believe, quite distinct from any power possessed by mere animals. There are, indeed, many actions on their part which at first sight look like reason, but for which that lower faculty of our own we have termed [1] "expectant imagination" amply accounts, so far as we can see.

In considering this question we should always take pains to understand and correctly appreciate the distinction which exists between true "inference," which is an essentially intellectual apprehension of a truth as implicitly contained in

[1] See *ante*, p. 150.

other truths, and that mere sensuous reinstatement of past impressions which may simulate it. The latter affection is what we regard as the "sensuous" or "organic" inference of animals. Let any group of sensations have become intimately associated with certain other sensations, then, as before pointed out, upon the recurrence of that group, an imagination of the sensations previously associated therewith spontaneously arises in the mind, and we have, as before said, an expectant feeling of their proximate actual recurrence—as in the instance of a flash of lightning having come, by association, to lead to an expectant feeling of thunder to follow.

Thus mere "association" may give rise to "feelings of expectation," which when satisfied may give rise to a feeling of satisfaction or completion, and such may certainly exist in animals as well as in ourselves without the presence of any true reasoning faculty.

In Mr. C. Lloyd Morgan's work,[1] already referred to, readers will find a very painstaking examination of the evidence both for and against the rationality of animals.

Although his opinion favours the non-existence of a difference of kind between human and animal intelligence, he is, nevertheless, of opinion that animals can neither perceive relations nor reason, and that with the advent of the latter power a breach of continuity and a fresh departure really took place. The book also contains a careful criticism of a variety of tales concerning animal intelligence.

He is also of opinion that animals are entirely devoid of ethical perceptions; but other persons are not wanting who do credit them with moral perception!

That dogs will not only love their master but readily obey his commands, and feel pain if they have yielded to a temptation to transgress them, may be very true. That dogs and

[1] *Introduction to Comparative Psychology.*

other animals may sometimes feel impelled to assist their fellows in distress on witnessing their sufferings, we should not care to dispute, and it is possible that to some migrating bird, which has left its young behind, an imagination of its deserted brood may arise and cause it a painful emotion. But such feelings have really nothing to do with ethical perception. "Conscience" is the exercise of judgment in a particular direction. It is a particular kind of judgment —namely, a judgment about "right" and "wrong," and nothing else. Acting rightly is often pleasurable, but it is also not unfrequently very painful, for it may tell us we are bound to give up something which is for us the very joy of life, or to take upon us a task as irksome as it is dutiful.

It is plain that we may feel pleasure in doing things which are wrong, for certainly otherwise they would never be done. On the other hand, there may be much painful regret on account of quite innocent actions, such as some trifling breach of etiquette. Keen remorse also may be felt on account of having neglected some excellent opportunity of pushing our fortune, or even of committing some very pleasurable but very immoral action.

The late Mr. Darwin, who may be regarded as the leading exponent of the view which would regard morality as essentially similar in men and animals, said that "conscience" was "that feeling of regretful dissatisfaction which is induced in a man who looks back and judges a past action with disapproval." Now "conscience" certainly "looks back and judges," but not every act of that kind which is accompanied by "regretful dissatisfaction" is a moral judgment.

A French writer has said that no regret is so keen as the regret which may accompany the recollection of the non-commission of pleasant sins which might have been enjoyed.

Such judgments, however much remorse may accompany them, can hardly be called "moral."

The profound distinction which exists between the idea "goodness" and every other idea, will be made plain by a consideration of the reasons which may be urged in favour of the performance of any plain duty.

Every step we take to explain *why* any duty should be performed, must consist of some still more simple assertion of the same kind, till we come to an assertion about duty the truth of which is admitted to be self-evident.

Now all our certain knowledge must be either evident in itself or must depend upon some other knowledge which is evident in itself. As we have before remarked, we cannot go on arguing forever, and every proof must stop somewhere—namely, when we reach what is evident of itself, and therefore needs no proof.

If, then, we want to urge some statement about any particular action being "right" or "wrong," if that statement be not admitted to be evidently true, we can only prove it to be so by means of some more general and elementary statement of the same nature. Therefore the judgments which lie at the root of any system of thought about ethics (about right and wrong) must themselves be ethical.

This profound truth shows us that it is absolutely impossible that the power of ethical judgment could ever have been gained through the experience of mere feelings of liking or disliking, pleasure or pain, sympathy or aversion, goodwill or hostility of other beings.

It is a distinct kind of intellectual perception, and, therefore, if animals are in the least moral, they must possess the power of intellectual perception, and also be able to form and comprehend highly abstract truths. For the purpose of this work, as before said, it does not matter in the least whether a snail or a starfish has or has not this intellectual faculty. We confess, however, that we have been quite unable to obtain evidence satisfactory to us that any mere animals are endowed with intellect, though we are quite ready to consider any better evidence which may be forthcoming. But if we have been mistaken, and if our ethical judgments have been mere congeries of animal feelings, and ultimately of physical impulses, which impulses and feelings have lost their way and come to mistake themselves for something else, then doubts might well arise as to the other declarations of our intellect, *falsus in uno, falsus in omnibus,* and it would be difficult for us thus to arrive at a satisfactory Epistemology.

On this account we deem it well to make a few more remarks upon the essential distinction of the ethical idea, a recognition of the validity of that perception being for our purposes of such extreme importance.

In the first place, the assertion is sometimes made that ethic is but coincidence with "social approbation." But no stream can possibly rise higher than its source. "Social approbation," then, could never have produced the conception of "right and wrong"; for how could a mere habit of obeying society have ever led a moral hero to denounce that habit and defy society?

It has, again, been often affirmed that there is no real distinction between "virtue" and "pleasure." Instead of there being any absolute distinction between them it is said that "good actions" are merely actions pleasurable or useful to the individual who performs them, or are advantageous to his fellow-men. They say, also, that it is the pleasurable or useful *results* which cause actions to be good actions, not the intentions with which the doer may perform them.

It is true we say "That is a 'good' knife" because it cuts well, and any weapon or any other useful article is said to be a "good" one if it well serves the purpose it was intended to serve. But a very little consideration will show that such a use of the word does not bring home to us the fundamental meaning of the term. For " conformity to an end " will not make an action good unless the end aimed at is itself good and agreeable to duty—unless by conforming to it we " follow the right order." If a young person, carefully instructed by a thief, conforms to the end aimed at so completely as to pick pockets with extraordinary deftness, such " conformity " will not make his action a " good " one.

But if the end aimed at is really a good end, and one which is for us a " duty," if we ask, " Why should we do our duty ? Why should we follow the right order ? " the only possible final answer is, " It is right so to do."

If it be urged in opposition that " we should follow the right order because it is our true interest to do so," he who so urges must either mean " we should always follow our own interest," which is abandoning the rule of " right and wrong " altogether, or he must mean " we should follow our interest, not because it is our interest, but because it is right "—a proposition which, however mistaken it may be in fact, yet is one which, in its mistaken way, affirms the very principle, the rule of " right and wrong," which it was designed to oppose.

But persons who say that the morality of any action depends on its results can always be refuted simply by examining into the assertions about duty which they themselves make. Thus that eminent utilitarian philosopher, the late John Stuart Mill, declared that he would rather go to hell than consent to call " good " a God who should violate the laws of the highest human morality, and in so saying he, of course, implied that other men ought to do the same.

The sentiment was a very admirable one, yet singularly inconsistent in the mouth of a utilitarian. For on the one hand, as a utilitarian, he taught that men in all cases should seek the greatest happiness for all, while on the other he declared, in the case supposed, that in so pursuing happiness they should all voluntarily plunge into the greatest possible misery.

But without having recourse to any such extreme supposition, the simplest facts suffice to show that it is not *the consequences* of an act but the *intention* wherewith it is performed which makes the action " good " or " bad."

Let us suppose that two men have each a sick wife, and that the doctor has left with each man two bottles: one a valuable internal remedy, the other a poisonous lotion. One of these men, who is devoted to his wife, gives her by pure mistake the lotion to drink, and kills her. The other man desires to poison his wife, but, by also making a mistake as to the bottles, gives her unintentionally the right medicine and cures her. Can there be any doubt as to who is the truly guilty man? Who would venture to assert that the act of the second man was really a " good " action because, in spite of his evil intention, it had a good result?

Again, it was said that the highest virtue is to do good without thinking about it. Yet it cannot be the mere absence of thought which makes a spontaneously performed useful action specially meritorious; otherwise we should attain the climax of virtue by performing beneficial actions unconsciously, in a state of somnambulism.

The truly admirable nature of good actions done spontaneously and without reflection, lies in their being the result of previously acquired good habits and of a fixed, undeviating direction of the will towards what is right. But this does not make such acts blind actions, and deprive the doer of all power of knowing what he is about. A man cannot act from a sense of justice without knowing justice from injustice, and to approve habitually of kind and good acts he must know what " goodness" is.

But another objection against the existence of any absolute distinction between "right" and "wrong" is sometimes drawn from the fact that different nations (and the same nation at different times) take different views as to the "goodness" of some particular kind of action. But this argument is quite valueless. It would be absurd, indeed, to suppose that all men were somehow furnished with a whole code of laws directing what is to be done and what abstained from in all cases. What we affirm is, that all men (idiots apart) can perceive that there *is* such a thing as "right" and "wrong." Men are not necessarily devoid of morality because they draw their lines and rules in different places, and actions revolting to us, such as the killing of parents, may seem good to those who kill, if they act in obedience to the wishes of their parents, and to procure for them, as they suppose, a happy immortality.

For the existence of moral perception it is by no means necessary that men should always agree about the *application* of ethical principles; what they agree about, though they need not cognise it by a reflex act, is that some actions are wrong and deserve punishment. The merest savage knows that an ungrateful and treacherous injury inflicted on himself is an act of that kind. Australian savages appear to have very clear and precise ethical notions about punishments which they have themselves merited, and will hold out a limb to be speared when they have done an act which merits that chastisement.

Though tribes may differ as to what is right and just, men have never thought an action to be right because it was unjust, or because it was ungrateful, or another act to be wrong because it was just or kind.

So essential is the distinction between the "good" and the "useful," that not only does the idea of "benefit" not enter into the idea of "duty," but the very fact of an action not being beneficial may make it praiseworthy. Its merit may be increased by any self-denial which attends on its performance, and also decreased by gain.

To nurse carefully and tenderly is "good," but our appreciation of its merit is diminished if we know that the patient's death has brought his nurse a rich and hoped-for legacy. A woman may have an immoral connection with another's husband, but if we find that instead of any gain thereby accruing, she has sacrificed herself for him, our censure may be thereby mitigated, since it shows she "has loved much."

In the material gain or loss which may attend our acts it is not that the absence of the former, or of pleasure, benefits our neighbour more; it is that any diminution of pleasure which circumstances may occasion (irrespective of any advantage thereby occasioned to our neighbour) *in* itself heightens the value of an action. But evidently that can never be the substance of duty which makes any act more dutiful by its absence!

The conception of duty is the conception of something supreme and absolute, apart from all question of pleasures and pains, rewards and punishments, and also of utility. As Cicero said, it is "*Quod tale est ut detracta omni utilitate sive aliis præmiis fructibusque per se ipsum possit jure laudari.*"

Some of our readers may, perhaps, fancy that we have devoted too much space to this question of ethics. But without a full explanation of a matter so often misunderstood and misrepresented, the problem concerning the morality of brutes could not be demonstrated with sufficient clearness. There is, however, another reason why we have thought it well to dwell at some length upon this question. We have done so in anticipation of what we shall have to say in our eighth chapter concerning our highest faculties, and we consider that it has a bearing on Epistemology, which cannot reasonably be ignored.

We will now return to the question of the psychical powers of brutes, and notice some anecdotes and examples of their asserted intellectuality.

In considering the value of the reports made about the intelligence of this or that animal,[1] we ought carefully to bear in mind two facts. If the creatures about which the assertions are made are creatures low in the scale of animal life, we should recollect the extraordinary development of instinct amongst the class of insects. If the creatures referred to are animals of a superior kind, then we should compare their actions with those lower faculties which we possess, and which, as we have seen,[2] enable us to do so many things in a merely automatic manner. We should recollect how we every now and then have experienced a feeling of *malaise*, we did not know on what account, till we have found it suddenly relieved by finding something which was previously missing, though we were not conscious of missing it till the shock we experienced on our having automatically found it has called our attention to the matter. We ourselves have frequently experienced this when one of the various objects we habitually carry in our pockets has been unconsciously transferred from one to another. We can, as everyone knows, do many things automatically and without consciousness which we often perform with full consciousness. This fact makes it probable that similar actions may take place in animals, and another fact is also very significant: this is the notorious circumstance that persons deprived of one of their senses often have their remaining senses made more acute. It is also commonly affirmed that some savages, who have very little intellectual power, have much keener powers of seeing, hearing, and, perhaps, even

[1] No one has better or more thoroughly advocated the rationality of animals than the late Mr. Romanes. See his book entitled *Mental Evolution in Man.*

[2] See *ante*, pp. 143–156.

of smelling, than we have. How much keener still may not be the sensitive powers of creatures whose whole being is entirely given up to sensitivity, without its being interfered with by any true intellectual activity! It should surely cause us little wonder if we find them doing many things which we ourselves could not do in similar circumstances. That an elephant should blow through its trunk on the ground beyond some object it sought to obtain, and thus to drive it back; that a bear should paw the water in order to bring a floating piece of bread within reach, or that dogs, accustomed to rivers or the seashore, should automatically allow for the action of currents with which they were practically familiar, need occasion no surprise to anyone. Such actions are just the ones we might confidently anticipate should take place under the given circumstances.

The late Mr. Darwin related the circumstance that a dog of his, on hearing the words "Hi! hi! where is it?" rushed about, looking in all directions and even up into trees; and he considered that these actions clearly showed that the dog entertained "a general idea that some animal was to be discovered and hunted." Now, of course, such sounds uttered in an eager voice excited the dog's emotions and awoke in its consentience reminiscences of before-experienced groups of smells, sounds, colours, and motions and relations of various kinds, between them previously connected with pleasurable activities and feelings of cravings satisfied, etc., etc. But such groups of feelings, vivid and faint, are, as we have seen before, something very different from "a general idea."

Wolves have both a fear of man and a suspicious feeling with respect to traps and snares, on which account they have been credited with possessing an "abstract idea of danger." But the lower human unconscious activities we have passed in review are amply sufficient to account for such phenomena, especially as the smell of man may often lead a wolf not to touch a bait which a man has set for him.

In order correctly to appreciate the limits of the emotional language of animals, we must understand how much they can do by mere consentience, and that actions on their part, at which most ignorant wonder is often expressed, do not imply either self-consciousness or the possession of any abstract ideas. All the actions of the most intelligent animal can, we think, be fully understood as results of powers similar to our own lower faculties described in the last chapter. For such actions on the part of animals, it is necessary, indeed, that they should sensibly cognise things, but not that they should perceive them intellectually; that they should feel themselves as existing, but not recognise their own existence; that they should feel relations between objects, but not perceive them as relations; that they should remember, but not seek to recollect, or know that what actually recurs to memory really relates to a past recognised as such; that they should feel and express emotions, but not know they possess them; that they should seek what pleases them, but not aim at pleasure knowingly, or know that the pleasure they feel is pleasurable. By the exercise of such merely sensitive faculties, brutes can pursue an escaping prey, jump up banks or rocks, climb to attain what is otherwise out of reach, raise up a dam, as does the beaver, or make use of a stone to crack a hard nut, as does the American sapajou ape. Actions such as these are performed to complete a harmony which the imagination craves, owing to associations previously effected between groups of feelings and emotions, and groups of groups of such. A cat does not need to entertain any intellectual knowledge or belief that the sound of clattering plates means possible food, to attain which it must make certain movements. Quite independently of such belief, and by virtue of mere sensuous association, the sound of the plates alone is enough to give rise to such movements on the part of the cat as have previously become associated with pleasant sensations of taste. Let certain sensations, emotions, and movements become associated, and then the former need not be noted; they only need to exist for the association formed to produce its effects. When the circumstances of any case differ from those of some previous experiences, but imperfectly resemble those of many past experiences, parts of these, and consequent actions, are irregularly suggested by the laws of resemblance, until such action is hit on which relieves pain or gives pleasure. For instance, let a dog be lost by its master in a field in which it has never been before. The presence of a group of feelings which we know to indicate its master is associated with pleasure, while the absence of those feelings gives pain. By past experience an association has been formed between this feeling of pain and such movements of the head as tend to recover some part of that group, its recovery being again associated with movements which, *de facto*, diminish the distance between the dog and its master. The dog, therefore, pricks up its ears, raises its head, and looks round. Its master is nowhere to be seen; but at the corner of the field there is visible a gate at the end of a lane, which resembles a lane in which he has walked. An image of that other lane and of its master walking there presents itself to the imagination of the dog; it runs to the present lane, but on getting into it he is not there. From the lane, however, the dog can see a tree on the other side of which he was accustomed to rest; the same process is repeated, but he is not found. Of course, throughout, the dog has everywhere exercised its sense of smell but in vain. At last it goes home. By the action of such feelings, imaginations, and associations, which we know, by what takes place in ourselves, do really exist and act as causes — by these, all the apparently intelligent actions of animals can, in our opinion, be explained without the need of calling in the help of true intellect, the existence of which in them is inconsistent with the phenomena they, as a whole, exhibit, and which, did it exist, would most certainly make itself very plainly manifest to us in many and often in very unpleasant ways.

A stag which "doubles" on its own footsteps, when hunted or before retiring to rest, has been credited, in the former case, with seeking to confuse its trail against real dogs, and in the latter case against imaginary hounds which may possibly be on the scent. But there is not the slightest need of such intellectual conceptions on the part of the stag to account for such actions, which are clearly instinctive, like the actions of the dog, which instinctively turns round and round on a drawing-room hearth-rug before lying down, just as if it were in its ancestral home in the greenwood where herbs needed pressing down and treading round to make a comfortable bed.

Mr. Romanes cites [1] an amusing tale from a Miss Bramston about a certain archiepiscopal collie dog which had acquired a habit of hunting imaginary pigs every evening directly after family prayers. The fact is put forward as an important instance of something beyond mere animal capacity as commonly understood; but, in truth, the fact is so easily explicable by a mere association of sensations, that it may well be cited as a type for other instances more or less similar but not so easily explicable. It appears the animal had formerly been accustomed to be sent to chase real pigs out of a field, and so the sound of the word "pigs" and the pleasurable action of running about after them had become associated in the dog's imagination. It had been the custom for Miss Branston to open the door for the collie

[1] *Op. cit.*, p. 56.

after dinner in the evening and say " Pigs! " when it very naturally ran out and ran about according to its previously acquired habit. Soon this exercise became in its turn a matter of habit, and the phenomena attending the termination of dinner, or, later, of family prayers, very naturally gave rise in the collie to an expectant feeling (such as may arise without consciousness in ourselves [1]) of the door being opened for the accustomed pleasurable excitement. If the door was not opened, the habit being now well established, the expectant feeling, growing more and more vivid with delay, could hardly fail to elicit barks, tail-waggings, and movements towards the exceptionally unopened door, and the accumulating excitement might very well lead it at last to run out and bark without waiting for the utterance of the word " pigs "; nor is it in the least surprising to learn that the phenomena attending family prayers at Miss Bramston's house should arouse in the dog the same kind of expectant feelings and the therewith associated actions, which had become so engrained during its residence at the archbishop's.

We ought, perhaps, also to notice the oft-told tale about crows which have been thought able to count. It appears that somewhere beneath the nests shot at was a watch-house, and by its aid the wary crow was, only after several vain attempts, finally deceived. When about to shoot the nests, in order to deceive the suspicious bird, the plan was hit upon of sending two men to the watch, one of whom passed on while the other remained. This stratagem was without effect. The next day three went, but the bird merely looked on while only two returned, and it was found necessary to send five or six men to the watch-house before her senses were sufficiently confused. But there was surely nothing very wonderful in the fact that a crow, seeing a man go beneath her nest with a gun, should keep clear till she

[1] See *ante*, p. 150.

saw him go away, even if he had hidden himself for a time. What marvel was it, then, that the bird's sense-perception felt a difference between the visual picture presented by a group of three men and another presented by only two? The wonder rather is that the crow should not have been more discriminative.

But obtuseness to numerical differences on the part of highly organised animals, such as dogs and cats, seems to us very wonderful, indeed absolutely to negative their possession of any sensitive faculty which might run parallel with our idea of number. Such is the case, since both bitches and she-cats do not seem to miss a single pup or kitten which may be taken away from the others in her litter when they have not actually witnessed the act of its being taken away.

But the fact which has been most relied on as a proof that a mere animal can understand what "number" is, was the fact that a chimpanzee known as Sally, and which lived a long time at the Zoölogical Gardens, was in the habit of picking up the exact number of straws she was told to pick up by her keeper. She would pick up separately from the ground, place in her mouth, and then present to him in one bunch, two, three, four, five, and, we believe, ultimately, ten straws, as she was told. She had distinctly associated the several sounds of these numbers with corresponding groups of picked-up straws. The ape would also, on command, pass a straw through a large or a small hole in the fastening of its cage, or through a particular interspace of its wire-netting. It would also put objects into its keeper's pocket, play various odd tricks with boy visitors, howl horribly when told to sing, and hold on its head pieces of apple, remaining perfectly quiescent till some particular word was said. This last trick, however, is one of the commonest performed by pet dogs, and the putting of objects into the keeper's pocket was nothing remarkable. The passing of a straw through a special aperture on command would have been more so but for the fact that the basis of the whole superstructure of such tricks was laid by the animal itself having spontaneously taken to the trick of picking up a straw and passing it through a small hole near the keyhole of the door of the cage—possibly as a result of having seen a key put in and out of the keyhole. Having thus itself acquired a habit of picking up straws and passing them through a hole, there could be little difficulty in getting it to pass the straw through other holes, and not much in getting it to pick up more straws than one. That it should have associated certain motions with the sound of certain words is no more than dogs, pigs, and various other animals lower in the scale will accomplish.

There remains, then, as the single distinguishing peculiarity of this case, the association in the ape's imagination and consentience of the words one, two, three, four, five, or ten, with the picking up, holding, and handing over a corresponding number of straws. This fact of association is, so far as we know, exceptional, and it is, therefore, very interesting. But it does not prove that the animal has any idea of these numbers—not of course as numbers—but as so many separate things.

The idea of number implies comparison with a simultaneous recognition of both distinctness and similarity; although, of course, it is not necessary that the fact of our having such apprehensions should be adverted to. No two things could be known to be two without an apprehension that while they are numerically distinct they can in some way be thought of as belonging to one class of objects. We could not reasonably say that four tons of coal and four o'clock are "eight," or that Hamlet's idea of a future life and the Atlantic cable are "two," unless we mean to speak of them as two of our thoughts; in which case they would be two species of the genus "our ideas."

Sally was but one of many animals that had come to associate very complex bodily movements with articulate sounds. The marvel of the matter is, in fact, due to a trick our own imagination plays us. The keeper's words of command expressed and implied the highly abstract idea of number, and as that idea and our sensuous impression of such utterances have become closely connected, so we are apt to picture to ourselves a like connection as existing in the cognitive faculty of the ape. But its presence there is by no means necessary to explain the action, while if such a highly abstract idea was present there, the animal would not allow us long to remain doubtful about such a fact.

We well recollect having specially questioned Sally's keeper as to whether she ever pointed to any object or made use of any gesture with the evident purpose of calling attention to some fact or passing occurrence.

Although he was well disposed to extol the powers of his charge so far as truth would permit, he distinctly assured us that she did not do so. If anyone came in with a gun Sally would show extreme terror, but she never pointed to it, or by gesture called the keeper's attention to the dreaded object. We were unable to see or hear anything which rendered it possible to attribute to this very interesting animal a psychical nature of a higher kind than that possessed by other beasts. It appeared to us to have the same kind of powers they possessed, though possibly somewhat higher in degree. But this, surely, is just what we might have anticipated.

We may sum up the conclusions at which we have arrived as follows: The minds of animals are analogous to ours, but the analogy is expressed, as it were, on a lower plane. They are astonished, but do not know it; things recur to them through their memory, but they know not that they have recurred or that they remember. They recognise objects, both natural and artificial, but they have no idea of them as being either. A dog may fear another dog which is stronger and fiercer, but it will have no idea of courage or fierceness. Even insects will distinguish between differently coloured objects—the white from the blue, the red from the yellow—but no animal knows whiteness or blueness, and still less has it any notion of "colour." Thus, the so-called "intelligence, understanding, and knowledge" of animals are not really true intelligence, understanding, and knowledge. They are the sensuous groundwork of such intellectual faculties. Since, also, they have no abstract ideas, they cannot think "I." Yet, as we have said, though they have not consciousness, they possess consentience, for we cannot doubt that in them, as in us, sensitive influences of different kinds are received into one common sensorium. A tiger not only hears the plaintive cries of its victim, but at the same time can see and feel its writhing limbs, and taste and smell its blood. Such sensations also, no doubt, call up within it more or less distinct reminiscences of similar feelings previously experienced, and give rise to vivid emotions and to appropriate actions.

But the irrationality of animals is shown by what, if they were rational, would have to be called their exceeding stupidity. Acts which would be reckoned as signs of extreme obtuseness in us are common enough amongst animals usually reckoned as the most intelligent. The fidelity of dogs is proverbial, but in a sudden scuffle it is by no means an unprecedented thing for a dog to fly at its own master.

Dogs have seen fuel put upon fires again and again, yet what dog ever puts on any itself to maintain the heat it so much enjoys? Apes have been said sometimes to warm themselves at deserted fires, yet no one asserts that they have replenished them. It is quite wonderful they do not, for such an act seems to come well within the scope of mere sensuous faculties. Some readers may have had a pet cat which has now and again got a piece of bone fixed between its back teeth. The useless motions the animal, when so circumstanced, will make with its paw are sufficiently irrational; but although the accident may have occurred to it several times, it will act in the same way again and again, and will sometimes stupidly struggle against its master while he removes the object which distresses it, and, as soon as it is removed, the animal will go off licking its jaws without a sign of gratitude for the relief afforded.

Swallows will continue to build on a house which they can see is being pulled down, and flies will deposit their eggs on a carrion plant instead of on real carrion. Even an elephant, an animal often thought so extremely wise, has been known to be so extremely stupid as to pull off the end of its trunk (which had got caught in a cord) instead of calling for help and waiting till its keeper came.

But in truth animals merit no such reproach, for, of course, they cannot make use of faculties they do not possess, while they make, as a rule, an admirable and excellent use of those non-intellectual faculties wherewith they are actually endowed.

We venture to think that the facts and anecdotes we have here considered are sufficient for our purpose; but certain alleged cases of sign-making on the part of animals will be noticed in our next chapter on science and language.

In the preceding chapter we cited various instances of the high degree to which the faculty known as "instinct" may be developed as so many physical facts. In the present chapter we propose to deal with instinct *as a feeling*, and consider the question as to what may be its true nature. We have seen [1] that it exists unmistakably in man, though

[1] See *ante*, pp. 126, 127.

it is but very poorly developed in him compared with what we find existing in many of the lower animals, notably insects.[1]

Of course we are unconscious of the performance of our own instinctive actions, and the essence of instinct is that its acts should be performed blindly. But by observation, reflection, and reasoning, we can be very sure that we have performed—that we must have performed—certain instinctive actions in early life. What ground, then, can there be to suppose that such instinctive actions of animals as we have hereinbefore described, are accompanied by anything more than feelings such as unconsciously exist in the human infant ?

Montaigne sought to explain instinct by intelligence, but it is surely obvious that the acts of chicks newly hatched, or of young snakes, who from their mother's womb have been untimely ripped, cannot be due to intelligent purpose. It is impossible to suppose that any form of knowledge guides the actions of the emperor moth, the excavations of the grub of the stag-beetle in proportion to its jaws which are yet to be, or the actions of the beetle sitaris. Intelligence, therefore, is a quite unsatisfactory explanation of the nature of the instinctive faculty. Not less unreasonable is Condillac's hypothesis that instinct is the result of the experience of the individual animal which exhibits it. It is manifest that experience could never lead a creature to perform acts with reference to conditions quite different from all those it has ever had any experience of. Yet such are the acts of the insects before described, and the human infant is certainly not less destitute of experience.

Another explanation was offered by Lamarck, who declared instinct to be "habit which has become hereditary." Of course, this implies, as all Lamarckism necessarily im-

[1] See *ante*, pp. 128–130.

plies, that acquired habits may become hereditary; but granted, for argument's sake, that such is the case, there remains a radical difference between instinct and habit. "Habit" enables an agent to repeat with facility and precision an act which has been done before; but "instinct" determines with precision the first performance of the act.

It is impossible to believe that any of the progenitors of an infant acquired a habit of sucking, or that the insects before referred to acquired a habit of performing their purposive actions unless they were compelled by their organisation so to do, in which case they would already be instinctive.

But an attempt has also been made to explain instinctive action as "lapsed intelligence"—as consisting of acts which were once performed with deliberate purpose, but which are now carried on without advertence by unconscious automatism. According to this view, instinctive actions would be comparable with such actions as playing, without attention, airs to learn to play which laborious, conscious attention was originally required. But here the same objections apply as can be urged against Montaigne's hypothesis. It may well be asked, could an adult female insect be supposed to foresee the future needs of her first progeny, often so totally different from her own wants; or recollect her past experiences as a chrysalis and as a grub, from the moment she first quitted the egg? Not less absurd would it be to suppose that the grub of a male stag-beetle ever deliberately reasoned out the need of making his chrysalis bed twice his own size, on account of the jaws he is destined to grow, but which he not only has not, but has never seen in adult individuals of his own species!

Lastly, the late Mr. Darwin has tried to explain instinct as being partly due to intelligent, purposive action which has become inherited, partly to the occurrence of accidental variations of activity, which have been preserved by "natural selection."

As to the former part of the explanation, the objections we have already made to an intelligent origin of instinct may, we think, suffice. Moreover, this explanation assumes the truth of the proposition that acquired characters may be inherited. As to the other part of the explanation, let us look at one or two noteworthy instincts, and see if it is credible that they should be due to accidental, haphazard changes in habits already acquired.

Can we conceive that the duck which feigns an injured wing that she may entice a dog away from her young brood, can ever have come to do so by pure accident any more than by deliberate intention? Again, there is the case of the wasp sphex, which stings spiders, caterpillars, and grasshoppers in the spots where their nervous ganglia respectively lie, and so paralyses them. According to the doctrine of "natural selection," either an ancestral wasp must have accidentally stung them each in the right place, and so the sphex of to-day is the naturally selected descendant of a line of ancestors which inherited this lucky, accidental tendency to sting different insects differently, but always in the right spots; or else the young of the ancestral sphex originally fed on dead food, but the offspring of some individuals which happened to sting their prey so as to paralyse but not kill them, were better nourished, and thus the habit grew.

Finally, there is the curious instinct by which an animal, when an enemy approaches, lies quite quiescent and apparently helpless—an action often spoken of as "shamming death." The term is unfortunate, because the disposition of the limbs adopted by insects which thus act is not the same as that which their limbs assume when such insects are really dead; while some species are, when thus acting, less quiescent than others. The remarkable circumstance, however, is not that a helpless insect should assume a posture approximating to that of its own dead, but that such a creature, instead of trying to escape, should adopt a mode of procedure utterly hopeless, unless the enemy's attention be thereby effectually eluded. It is impossible that this instinct could have been gained by minute steps, for if the quiescence, whether absolutely complete or not, were not sufficient at once to make the creature elude observation, its destruction would be only the more fully insured by such ineffectual quiescence.

We have hitherto spoken only of instinct as existing in animals, and in certain human actions necessary for merely organic life; but there are a variety of human activities of a much higher kind to which the term instinctive can hardly, it would seem, be positively denied. Such a special higher instinct is that which impels man to the external manifestation by voice or gesture of the mental abstractions which his intellect spontaneously forms, but which does not exist (as we shall see) in animals. The very first beginnings of literature, art, science, and politics may also be considered as activities to which men have been first urged by an impulse analogous to instinct—impulses which, on the whole and broadly considered, have augmented the well-being and happiness of mankind.

But "natural selection" is as impotent to explain man's lowest psychical powers as is "lapsed intelligence." Can it be for a moment seriously maintained that such infantine actions as sucking, deglutition, defecation, or the actions of adolescence tending towards reproduction, ever arose through the accidental conservation of haphazard variations of habit in remote ancestors? If not, then it is impossible to account for such actions without the recognition of instinct as a distinct faculty, so comparable with reflex action that it may be called, as we termed it in the last chapter, a reflex action of the individual as a whole. At the very bottom of the scale of animal life we find it present. Animals utterly devoid of a nervous system, and consisting of little more than minute particles of living jelly, will build up for themselves an external armour symmetrical in form and most artificial in construction.

"From the very same sandy bottom one series [of such minute creatures] picks up the coarser quartz grains, cements them together with phosphate of iron secreted from its own substance, and thus constructs a flask-shaped test, having a short neck and a single large orifice. Another picks up the finest grains and puts them together with the same cement into perfectly spherical tests of the most extraordinary finish, perforated with numerous small pores at regular intervals. Another selects the minutest sand-grains and the terminal portions of sponge spicules, and works these up together, apparently with no cement at all, into perfect spheres, each having a single fissured orifice." (Carpenter's *Mental Physiology*, p. 41.)

However far, then, we may put back the beginnings of instinct, the question as to its origin ever returns, and indeed with increased importunity. How did the first sentient creatures come to take and swallow their food? How did they first come to fecundate their ova or suitably to deposit them? How did they first effect such movements as might be necessary for their respiratory processes? Wherever such phenomena first manifested themselves in sentient organisms, we seem compelled therein to recognise the manifest presence of instinct which may be called the faculty provided by nature for bridging over the interval which exists between the purely vegetative functions (nutrition and reproduction) and the complex activities of sentient, animal life. It is one of the most noteworthy of psychical powers, and its distinct and full recognition in all its bearings will (as we shall see later on) be found to have an important bearing on problems of Epistemology.

The psychical antecedents of science, which we have passed in review in the present chapter, consist of a number of intellectual perceptions of facts and of relations between facts, which enable us to understand the existence and nature of psychical activities which do not rise into consciousness. We have also been forced somewhat to anticipate matters and notice some of our higher psychical acts, such as ethical conceptions, inferences, and reminiscences, of which we are directly conscious, and which can only be scrutinised by reflection with the aid of intellectual memory. We have also (as before said) noted, as occurring in ourselves, various acts of mere sense-perception, sensuous ideas or imaginations, complexly associated with sensation and sensuous memory, which may give occasion to sensuous inference, with feelings of pleasure and pain, and also unconscious co-ordinations of movements and feelings due to a power of consentience—our lower psychical powers. On turning our attention to the world of mere animal life, we saw reason to believe that the external manifestations made by animals are susceptible of explanation by faculties resembling our lower mental powers, without calling into play the action of intellect and consciousness.

If we are correct in our estimate, then it must be admitted that there is a distinction of kind between man and animals.

But we believe the question can only be decided by a careful consideration of the true value and significance of that obvious distinction between the lower creatures and ourselves which is expressed by the proposition, "Men speak, but animals are dumb." Have or have not mere animals the power of expressing mental conceptions by sounds or gestures?

This, which we regard as the crucial question of a distinction of kind between man and animals, demands separate and somewhat lengthy consideration, and to it the next chapter will be devoted.

CHAPTER VII

LANGUAGE AND SCIENCE

IT has been already pointed out in the first chapter of this book[1] that the simplest sentence cannot be rationally uttered without giving expression (for the most part quite unconsciously) to highly abstract ideas. In the last chapter[2] we also noted that there are at least three distinct categories of "signs"—the merely accidental, the emotional, and true signs formally intended to serve as such, as also that all of such signs may be either vocal or consist of some bodily movements or gestures.

Signs which are merely accidental or emotional have now, for our present purpose, to be carefully distinguished from signs made with a rational purpose, and, therefore, necessarily embodying abstract ideas. These merely accidental and emotional signs—gestures and cries—often produce sympathetic effects on those that see or hear them, who may be thereby excited to make similar gestures and cries, all expressive of excited feelings, on which account such signs may be said to constitute a *language of emotion.*

These unintellectual manifestations may be divided into three kinds or forms of emotional language.

They may consist of (1) *inarticulate* sounds only; such as shouts and cries of pain or joy or surprise; chuckles of satisfaction or contempt; murmurs of affection, as of a mother to her infant, etc.; (2) *articulate* sounds, wherein the

[1] See *ante*, p. 7.

[2] See *ante*, pp. 150–151.

syllables have no rational meaning. Amongst such must be included phrases sometimes repeated by idiots, or the verbal exclamations made without real meaning by rational persons during strong excitement—as an Italian may exclaim *per Dio Bacco!* or any Englishman may invoke damage to his own eyes and limbs or those of his neighbours; and (3) *gestures*, which do not express or answer to rational conceptions, but are merely manifestations of feeling, as, *e. g.*, jumping, dancing about, throwing up the arms, tossing the hands, waving a hat, etc., etc.

Very different from all these is the spoken language, composed of articulate sounds, as used in ordinary vocal intercourse. In order to see this distinction clearly, it may be well to analyse a very simple sentence, such, *e. g.*, as "That horse is running away."

The word "that," as thus used, has no signification in and by itself, none without reference to the term "horse," which it qualifies, dividing and separating off the particular horse referred to from all others, and so limiting and determining the application of the universal abstract term "horse" to a single concrete example, for the word "that" conveys the idea of an absolutely individual unity—a unity which cannot be present anywhere else except in the one concrete entity referred to by it.

The word "horse," on the other hand, is a conventional spoken, or written, sign of the idea "horse," and is a universal[1] abstract term, applicable, over and above the particular horse which is running away, to every other actual or possible animal of the kind thus denominated. It denotes no single subsisting thing, but a "kind" or whole class of things—a unity which can be present in many concrete individuals—many horses—besides the particular one referred to in the sentence.

[1] See *ante*, p. 6.

The word "is" denotes the most wonderful, important, and most abstract of all ideas—the idea of "existence" or "being." It is an idea which we must have in order to perform any intellectual act. It is an idea which, though not itself at first adverted to, makes all other ideas intelligible to us, as light, though itself unseen, renders everything else visible to us. But we shall return to the question of the significance of the word "is," and, later on, justify fully what is here said.

The term "running away" is one which denotes another abstract idea—namely, an abstract "quality" or "state" of some object. The idea is one evidently applicable to many things, such as all mice, dogs, lizards—to anything, in fact, which can "run away." Yet the idea *itself* is one single idea.

What is true of the simple sentence thus analysed is true of all sentences. Thus the truth is plain of what we before said about a savage, for all human language—except the emotional signs before distinguished — necessarily implies and gives expression to a number of abstract ideas. Therefore, wherever language exists there the power of abstraction must exist also. Therefore, again, thought is essentially anterior to speech, and the latter is its consequence. It may exist where the faculty of speech is wanting, and may be expressed by gestures, which are also often made use of by those who can speak, to convey a knowledge of their thoughts and meaning to others. Similarly, inarticulate sounds may also be made use of for the last-mentioned purpose.

In addition, then, to the three forms of merely emotional language before enumerated, there are three forms of intellectual language, as follows:

(1) Sounds which are rational but not articulate, such as the inarticulate ejaculations by which we sometimes express

assent to, or dissent from, given propositions. Such inarticulate sounds are intellectual, because they depend on the propositions referred to having been understood, and are used to show that such is the case and what is the nature of the judgment which may have been formed about them.

(2) Sounds which are both rational and articulate, such as are used in conversation, and which constitute speech or vocal language proper.

(3) Gestures which give external expression to internal rational conceptions, and therefore are " external," though not " oral," manifestations of abstract thought. One special manual expression of such abstract thought is writing or the making of any pictorial signs.

Thus the essence of language as ordinarily understood—language used for the communication of ideas—is an intellectual activity. This is necessarily mental, and the root of speech is therefore the " mental word," or *verbum mentale*. The natural result or consequence of this is the external expression, or speech—the " spoken word," or *verbum oris*. This is the normal consequence, but it can be replaced by gesture or bodily expression to *verbum corporis sed non oris*.

It is evident that a man may be dumb and yet possess the mental word, though he is accidentally hindered from giving it expression by the spoken word; but he can still do so by gestures or writing—the *verbum corporis*—as long as he is not paralysed. Should he become so, he would be deprived of all means of external expression, while he might, nevertheless, still be in possession of the *verbum mentale*.

Now we believe that all the external signs of which mere animals are capable are explicable as forms of the lower of the two categories of human language—the language of emotion. We are also convinced that many forms of external expression, of which human beings incapable of speech are reduced to make use, are fully and truly as intellectual as is the articulate language ordinarily used and intended to convey ideas. To this question of the distinction between emotional and intellectual language, then, we will now directly address ourselves.

It has been contended by some persons that there is no essential difference between the language of men and that of animals, and this contention has been based on two assertions: (1) that verbal expressions in us precede corresponding conscious mental conceptions, and (2) that brutes by sounds and gestures can express ideas and so actually convey a knowledge of the facts to which their ideas relate.

No one has advocated these views more zealously than the late Professor Romanes,[1] who, as an exceptionally candid and careful writer, may well serve as the best type of the school to which he belonged.

He brings forward many instances which he considers justify his opinion. Thus he tells us of a wasp, which, on finding a store of honey, returned to the nest, and in a short time brought off a hundred other wasps. But surely there is no need to suppose that here any intellectual communication had been made, but merely an instinctive communication inducing an instinctive response. Unfortunately, superior as Mr. Romanes was to most of the advocates of animal rationality, some of the tales he allows himself to quote plainly show how saturated with prejudice their narrators must have been. Thus, respecting some South American ants, Mr. Belt is quoted as saying: "I noticed a sort of assembly of about a dozen individuals that appeared to be in consultation. Suddenly one ant left the conclave, and ran with great speed up the perpendicular face of the cutting without stopping." Shortly "information was communicated to the ants below, and a dense column rushed up in search of prey."

[1] In his book, entitled *Mental Evolution in Man*, before referred to.

We have quoted this passage as a typical example of increasing unconscious exaggeration. A dozen ants in proximity are first called " a sort of assembly." Now any creatures which happen to come together in close proximity may, in a certain vague sense, be said to assemble; but the word " assembly " implies more than that. This implication is further intensified by the declaration that the ants " appeared to be in consultation," though no fact in addition to physical proximity is given as justifying such a purely fanciful interpretation. Finally, the implication is driven home by calling these physically approximated ants " a conclave." If those who narrate things of this kind would content themselves with accurately describing the facts they witness, the gain would be great indeed.

Such an account has been given [1] by one careful observer, Mr. G. Larden. He tells us of a small South American species of ant which makes a large nest underground with a network of paths converging to the nest.

> " These paths," he says, " are of all lengths, from ten yards up to one hundred yards. As a general rule, one may say that streams of ants, carrying leaves, buds, flowers, seeds, and other valuable odds and ends, are always moving towards the nest, while empty-mouthed ants are meeting and passing them on their outward journey to the foraging grounds."

He then tried the experiment of turning some of these laden home-going carriers round, when they had nearly reached home.

> " The general conclusion I came to," he continues, " was that these ants did not then understand in what direction the nest lay, nor did they (as far as I could see) draw any conclusions from the fact that they now *met* the stream of carriers with which they had

[1] In *Nature* for May 29, 1890, p. 115.

previously been travelling. Thus, one ant carrying a (relatively) huge burden I reversed in direction when already near the nest. I then followed it for about eight yards (or about twenty minutes of time as far as I can say) in its mistaken reversed course away from the nest. Though it met and collided with quantities of burdened ants, and was passed in the same direction as its own by unburdened ants only, it did not seem to take the hint. Its final return home was the result of accident, as far as I could tell —it having got up the right way round after a severe fall. . . . I dug a hole in one of the paths on several occasions. The hole was small, and it was easy, though not so convenient, to go round by the side over the very short grass. Nevertheless, it required the falling of very many ants into the hole, and the leaving of quite a pile of leaves there, before the stream learned to pass about one inch to one or the other side, and so to avoid the pitfall. Some ants even turned back; and I left them carrying their burdens back to the foraging grounds again."

This statement quite accords with some observations we have ourselves made.

As to higher animals and the asserted use by them of gesture language, Mr. Romanes cites[1] a case recorded by James Forbes, F.R.S., of a male monkey, which was said to have begged back the body of a female which had just been shot: "The animal came to the door of the tent, and, finding threats of no avail, began a lamentable moaning, and by the most expressive gestures seemed to beg for the dead body. It was given to him; he took it sorrowfully in his arms and bore it away to his expecting companions." One would like to know what the gestures were. Nothing less than the actions essentially like those used in our ballets would justify their being called "most expressive."

A Captain Johnson is also cited as having seen a monkey which he had wounded run down a tree towards him. He

[1] *Op. cit.*, p. 100.

then "stopped suddenly, and coolly put his paw to the part wounded covered with blood, and held it out for me to see."

Finally, Sir William Hoste is referred to as having recorded that

"one of his officers coming home after a long day's shooting, saw a female monkey running along the rocks with her young one in her arms. He immediately fired and the animal fell. On his coming up she grasped her little one close to her breast, and with her other hand pointed to the wound which the ball had made, and which had entered above her breast. Dipping her finger in the blood and holding it up, she seemed to reproach him with having been the cause of her pain, and also that of the young one, to which she frequently pointed."

Now, that these narratives repose on a basis of truth is not to be doubted, neither is the perfect good faith of the narrators to be suspected. That the mother ape hugged her young one, that the wounded animals made gestures due to anger, pain, terror, or distress, is not to be questioned. But it is only too evident that the kind-hearted sportsmen read, in such movements, motives and meanings due to their own fertile imaginations. Such mistaken inferences are not to be wondered at on the part of military men, who may well have been unskilled in scientific observation, and little read in either psychology or philosophy.

But a very curious tale is told by Mr. Romanes himself with respect to an American monkey of his, which had found out the way to unscrew the handle of that object which is often so much too easily unscrewed, namely, a hearth-brush. He delighted in screwing it on and off, and soon began to unscrew all the unscrewable articles so as to become a nuisance to the household. This showed that the monkey, we are told,[1] had "discovered the mechanical

[1] *Op. cit.*, p. 61.

principle of the screw"—an "intelligent recognition of a principle discovered by the most unwearying perseverance in the way of experiment" (!). But to do what this monkey did, needed as little the "intelligent recognition of a principle" as any white mouse needed such knowledge to learn to make rotating objects go round, or as a canary, which had learnt to pull up a small vessel of water suspended by a thread, need apprehend "principles" of mechanics and hydrostatics. We are also informed that the monkey, "however often he was disappointed at the beginning [of the screwing process], never was induced to try turning the handle the other way; he always screwed from right to left." This would seem to show (on Mr. Romanes's method of interpretation) that the monkey had much greater intelligence than is possessed by many human beings, who often do try screwing the wrong way when their efforts to screw the right way have not succeeded.

But it is yet further asserted that the animal, having discovered this "mechanical principle, proceeded forthwith to generalise" concerning the objects thus mischievously unscrewed, screwed, and unscrewed again. We are gravely assured, as to the separated parts, that the monkey "was by no means careful always to replace them"—as if it was ever careful so to do, and as if those which were replaced, were replaced by a sort of quasi-ethical deliberate intention.

With respect to apes, we have always to be on our guard against the deceptive effects of their tricks and ways, due to the close resemblance which exists between their bodily frame and our own. On this account, if two actions essentially similar are done, one by a pig and the other by an ape, the latter would necessarily appear in our eyes to be far more of a "human" action.

This may, in fact, account for the curious overestimate above cited of the action of the American monkey so fond of screws. But other instances are given still more open to criticism.

The climax of absurdity, however, is attained in an anecdote of a talking bird,[1] which our esteem and regard for the late Professor Romanes do not allow us here to more than refer to.

The vast difference between the emotional gesture-language of animals and the intellectual gestures of men is apparent, while those of infants show that mental conceptions may precede verbal expressions. Colonel Mallery[2] has remarked that

"the wishes and emotions of very young children are conveyed in a small number of sounds, but in a great variety of gestures and facial expressions. A child's gestures are intelligent long in advance of speech, although very early and persistent attempts are made to give it instruction in the latter, but none in the former, from the time when it begins *risu cognoscere matrem*. It learns words only as they are taught, and learns them through the medium of signs which are not expressly taught. Long after familiarity with speech, it consults the gestures and facial expressions of its parents and nurses, as if seeking thus to translate and explain words. . . . The insane understand and obey gestures when they have no knowledge whatever of words. . . . Sufferers from aphasia continue to use appropriate gestures."

The same authority also tells us that Indians from the West, who have been brought into the Eastern States,

"have often succeeded in holding intercourse, by means of their invention and application of principles in what may be called the voiceless mother utterance, with white deaf-mutes, who surely

[1] See *op. cit.*, p. 190.

[2] In his memoir on "Sign-language among the North American Indians," *First Annual Report of the Bureau of Ethnology*. Washington, 1881.

have no semiotic code more nearly connected with that attributed to the Indians thán is derived from their common humanity. They showed the greatest pleasure in meeting deaf-mutes, precisely as travellers in a foreign country are rejoiced to meet persons speaking their language."

Mr. Romanes himself has given [1] a very interesting account of a conversation held between two Indians of different races, and carried on exclusively by gestures, beginning as follows:

"Which of the north-eastern tribes is yours?"

"Mountain river men."

"How many days from mountain river?"

"Moon new and full three times," etc.

A deaf-mute from Washington is said [2] to have related to some Indians, that

"when he was a boy he went to a melon field, tapped several melons, finding them to be green or unripe; finally reaching a good one, he took a knife, cut a slice and ate it. A man made his appearance on horseback, entered the path on foot, found the cut melon, and, detecting the thief, threw the melon towards him, hitting him in the back, whereupon he ran away crying. The man mounted, and rode off in the opposite direction."

Another story of the kind, also told in gesture-language only, was much appreciated by the Indians, and completely understood.

A truly wonderful amount of abstract thought was thus expressed and apprehended by means of gesture only. And there is no evidence that speech generated or facilitated gesture, but rather the contrary, while it is very evident amongst many peoples—notably in the more southern part of Europe—how very much gesture aids and enforces the

[1] *Op. cit.*, p. 108. [2] *Ibid.*, p. 112.

meaning of speech. No doubt speech has greatly, must have greatly, aided the elaboration of ideas, and so enriched the mental pabulum for gesture-language; but it can have had no tendency to develop gesture-language itself, but rather the contrary, speech being so rapid and serviceable an agent compared with gesture only.

Deaf-mutes possessing an extraordinary manual dexterity in signifying their ideas, could never have inherited it from speaking ancestors, while they may well be supposed to have inherited the structure common to those ancestors as the physical means of speech. The nervous conditions relating to abundant gesticulation, on the other hand, must have been going through a process of atrophy for ages during all the many generations of these loquacious ancestors of such deaf-mutes. The latter also seem to have a special construction of their own in their gesture sentences—a mode of construction which could never have been inherited from their speaking forefathers.

This special and peculiar construction is stated [1] by Mr. Romanes to be uniform in different countries. The deaf-mutes "do not say 'black horse,' but 'horse black'; not 'bring a black hat,' but 'hat black bring'; not 'I am hungry, give me bread,' but 'hungry me, bread give.'" But such modes of construction answer every practical purpose, and are as distinctly intellectual as any others.

The innate intellectuality of, and voluntary purposive expression of ideas by, gesture is made specially clear in the following statement,[2] which also shows how the deaf and dumb express first that idea which they are most anxious to impress on those they address:

"If a boy had struck another boy, and the injured party came to tell us, if he was desirous to acquaint us with the idea that a

[1] *Op. cit.*, p. 114. [2] *Ibid.*, p. 115.

particular boy did it, he would point to the boy first. But if he was anxious to draw attention to his own suffering rather than to the person by whom it was caused, he would point to himself and make the act of striking, and then point to the boy."

The celebrated Abbé Sicard asked a deaf and dumb pupil, "Who made God?" The answer he received is very remarkable from the highly abstract conception which it showed was present in the pupil's mind. His answer was, "God made nothing," meaning thereby that nothing whatever made God—*i. e.*, that God was not made by anything, but was self-subsisting.

The deaf and dumb express a conjunctive sentence by an alternate contrast. Thus the sentence "I must love and honour my teacher" would be expressed thus, "Teacher I beat, deceive, scold, no!—I love, honour, yes!" This is logical enough in spite of being a roundabout mode of expression.

Colonel Mallery's evidence is invaluable. His account of such an enunciation of the parable of the prodigal son by signs is an example of an extremely elaborated instance of the use of gesture-language. It is as follows:

"Once man one, sons two. Son younger say, Father property your divide: part my me give. Father so. Son each, part his give. Days few after, son younger money all take, country far go, money spend, wine drink, food nice eat. Money by-and-bye gone all. Country everywhere food little. Son hungry very. Go seek man any, me hire. Gentleman meet. Gentleman son send field swine feed. Son swine husks eat, see—self husks eat want—cannot—husks him give nobody. Son thinks, say, father my, servants many, bread enough, part give away can—I none—starve, die. I decide: Father I go to, say I had, God disobey, you disobey—name my hereafter *son* no—I unworthy. But father servants call, command robe best bring, son put on, ring finger put on, shoes feet put on, calf fat bring, kill. We all eat, merry, why? Son this formerly dead, now alive: formerly lost, now found: rejoice."

Even that most abstract of all ideas, the idea of "being" or "existence," can be expressed by deaf-mutes. Colonel Mallery tells us that the sign they use to express this is stretching the arms and hands forward, and then adding the sign of affirmation."

The idea of "equality" they can also signify by extending the index fingers side by side—as when repeating the expression in the Lord's Prayer, "As in heaven." We see, then, how intellectual conceptions may be expressed, and distinct statements as to fact made—the copula remaining latent and implicit—by this wonderful language of gesture. By its means the most lofty abstractions can be both mentally entertained and externally expressed. Church services for deaf congregations are carried out by gesture only.

That born mutes, without any teaching, do sometimes make vocal sounds more or less articulate is an unquestioned fact, and though we will not assert, we certainly suspect, the existence in man of an instinctive tendency to produce such sounds and to signify meaning by gesture. When once anyone has a meaning to convey, he must, if he can succeed in conveying it, convey it by some visible, audible, or tactile sign. The employment of any one means must be due to an internal impulse. How else could the language of gesture have arisen?

Therefore, if there ever was such a thing as a human community entirely dumb, a natural and instinctive language of gesture would, we are persuaded, be evolved by it. We are thus persuaded, not only on *a priori* grounds, but also from the evidence afforded by such extraordinary examples of defective existence as that of Laura Bridgman and the still more striking case of Martha Obrecht. The former is a well-known case of a girl who was blind as well as deaf, and had become so afflicted when too young to have retained any recollection of seeing or hearing. Yet she learned to apprehend abstract relations and qualities, and to read and write.

Martha Obrecht[1] was deaf, dumb, and blind, and was confided to the care of the nuns at a convent at Larnay (Poictiers) when eight years old. Then, by intelligent and patient instruction, she was enabled gradually to acquire the power of apprehending and expressing intellectual conceptions, and highly abstract and lofty ideas, with distinct and clear moral and religious notions. She was also taught not only to read but to write perfectly well.

When first received she was a living, almost inert, mass, with no means of communicating with her fellow-creatures, though she emitted cries and made certain movements in response to impressions she received. The first thing was to give her some means of communication, and this was done by making her touch different objects, and then touching her in different ways appropriate to each object, so that each mode of touching became a sign to her of that object. Thus, when a piece of bread was given her, she was made, as it were, to cut her left hand with her right. Very soon when hungry she began to make that sign herself. When she did anything wrong she was slightly pushed away, and thus she soon learnt to push away from her things she did not like; and so little by little from one point to another her intellectual development was slowly completed.

It may be, as it has been, objected to these facts, that they show no more than the influence on an infant of a long line

[1] See *Apologie Scientifique*, by Canon F. Duilhé de Saint-Projet, pp. 374–387. Toulouse, 1885.

of ancestors all capable of speech. But, as we before remarked, there could have been no inherited nervous structure and conditions specially related to gesture-language. Yet it was *exclusively* by gesture-language that the latent intelligence of Martha Obrecht was developed.

Thus thought is evidently the cause, and not the effect, of language.

We have said that the idea of "being" or "existence" can be expressed by gesture, and also that the copula is habitually implied and latent in gesture-language. But its existence is, of course, no less effectively real because it is thus latent. In every gesture statement, as in every orally expressed proposition, the predication of existence is most important. Its importance has been disputed on the ground that "merely to say a thing *is*, is to form the most barren (least significant) judgment about it." Now, of course, it is manifest that so to affirm is to give the minimum of information about any object; but though it tells us little as regards extent of information, it yet tells us a truth of the most profound and intensely important kind. The reader will readily appreciate how much more important to him is his "existence" than a variety of other properties with which he would be much less unwilling to part.

Having, we trust, to our reader's satisfaction, shown the essential rationality which may be possessed by deaf-mutes, we will next point out what we regard as the essential, though latent, intellectuality of infants. We contend that evidence shows intellect to be potentially present, *i. e.*, that the normal conditions being supplied, it will infallibly come to show itself as *actually* present. On the other hand, no evidence plainly indicates that it is potentially present in brutes, and that changes of mere environment can make it actual. We are, as we said before, perfectly willing to recognise the intellectuality of animals as soon as we can obtain any evidence thereof. All evidence we have been able to obtain, however, points, we think, the other way.

But Professor Romanes seemed extraordinarily blind to the intellectuality of even his own children. Thus we read[1] that a daughter of his, aged rather more than eighteen months, called first her brother, and then other children, "ilda," and then whenever she came upon a representation of a sheep with lambs, she would point to the sheep and say *mama—ba*, while of the lambs she would say *ilda—ba*. Nevertheless, he affirms that in her case formal predication had not begun. On the other hand, we regard these utterances of the child as distinctly intelligent predications.

Similarly, he denies that a child two years old, who says *dit ki* (sister is crying) makes an intellectual assertion. But in saying those two words the child really enunciates a true judgment composed of two concepts and an implied copula. If such were not the case, if the child did not consciously perceive both his sister and her crying condition, the statement would be mere meaningless babble. But, of course, the child does not advert to such psychical facts and recognise what it says with reflex consciousness. Such a mental act is but rarely performed even by an adult.

But much simpler, merely monosyllabic, utterances may be true implicit judgments. Thus when a child on seeing a dog looks up at her nurse and, pointing, says "bow-wow," or taking food exclaims "ot" (hot), or letting fall a toy says "dow" (down), it may thereby express what is truly a judgment in each case. For in what respect does the utterance of the monosyllable "ot" differ from "dit ki"? It merely differs in the emission of two sounds instead of one. "Ot" really means as much as do the two sounds "dit ki"—namely, that the child's food is hot. In one case the meaning of a sentence is conveyed by two

[1] *Op. cit.*, p. 218.

articulate sounds, and in the other by the utterance of a monosyllable. The latter mode is in no way inferior except that it seems incapable of being adapted to express the complex ideas of later life. But very frequently the monosyllabic mode is made use of by adults and fully understood. Suppose some men are watching, at a distance, certain birds indistinctly seen, and that they are trying to make out what they really are. When one man, having made sure, cries out "Grouse!" it is as true and clear an expression of a judgment as would be the four words, "Those birds are grouse." If it were only possible to follow out that mode without the danger of confusion, then the use of monosyllables to express whole sentences, instead of being inferior, would be the very highest ideal of language. This reflection brings us naturally to the consideration of different forms of language and its possible origin. But there is one form of language which exists, abundantly in low as well as in higher races of mankind, and that is metaphorical language. But what is metaphor, and what sort of being must that have been which first employed it?

Had not the intellect the power of apprehending, through the senses, and expressing, by bodily signs, what is beyond the reach of mere sense-perception, metaphor would not and could not exist. Neither could it exist if thought was the mere outcome of language, and followed it, instead of the opposite. It is precisely because speech is too narrow for thought, and because words are too few adequately to make known the ideas of the mind, that metaphor exists. It is interesting also to note that figurative, metaphorical language is natural, and especially abundant amongst various savage and semi-savage tribes. Few things would be more unwise than to take the plainest and most material meanings of primitive words as being necessarily their only meanings. Figure or metaphor has been occasioned by poverty and sterility of visible and audible signs, but their *cause* is the wealth and fruitfulness of thought. Probably many primitive terms had double meanings from the first.

As Carlyle has said, " An unmetaphorical style you shall seek in vain, for is not your very *attention* a *stretching to?* " The sensuous element in language is but a necessary consequence of our animal nature, and the necessity of phantasmata of the imagination as supports to (as before said) even our most abstract thoughts. It does not follow from this that thought once was mere sensation, but, on the contrary, it manifests the wonderful spontaneity of the human intellect, whence, by the help of the " beggarly elements " supplied by the senses, the loftiest concepts spontaneously spring forth like Athene, armed with the sharp spear of intellectual perception, and swathed in the ample mantle of signs, woven of the warp of matter and the woof of thought.

It is just this power of metaphor-making which most plainly displays to us the intellect in its creative energy, giving rise to new external expressions for freshly arising internal perceptions. This power belongs to man alone, and no one even pretends that any brute can evolve a metaphor.

It is ethical propositions especially which demonstrate to us that a higher meaning must be latent in terms which to some persons seem merely sensuous. For everyone must admit either (1) that he does not really know what an ethical proposition means, that he does not know the difference between right and wrong, or (2) that he recognises it as a distinction *toto cœlo* divergent from every other, and one which, as before pointed out,[1] could have had none but an ethical origin, and therefore could never have been evolved from the sensuous life and perceptions of mere animals.

As folly or prejudice makes tales of animal intelligence so

[1] See *ante*, p. 166.

often quite untrustworthy, so also the statements as to the mental defects of savages are hardly less so. Love of the marvellous, credulity, exaggeration, and, above all, hasty and inconclusive inferences, abound in both. Mr. Tylor, who has devoted his life to the study of such things, has again and again protested to this effect.

It has, for example, been objected against the intellectual ability of the Society Islanders that they have separate words for "dog's tail," "bird's tail," "sheep's tail," etc., but no word for tail itself—*i. e.*, tail in general. But, really, the experience of the use of that word by ourselves leads us to consider the condition of these Islanders in this respect to be no great misfortune. We have our word "tail"—tail in general—and it is constantly made use of in a way which is hopelessly misleading. To use the same term, as we do, for what we call the "tails" of a peacock, a monkey, and a lobster is, so far, to be in a worse plight than that asserted of the Society Islander.

Much has been said about some savages being unable to say "I." Thus Professor Sayce tells us that a Malay who would mean "I" says *ulun*—that is, "a man" in Lampong—and also that at least one other race expresses the idea "a man" in a similar manner.

But that is of not the slightest consequence as regards the intellectuality of the speaker. As a child will say "Charley don't like it," meaning "I do not like it," so if an adult Englishman were to speak of himself as "this one here," pointing to his breast, his meaning would be as clear as if he articulated the sound "I."

It has been supposed that the Grebo two sounds "*ni ne*," which may mean "I do it" or "you do not," according to the context and gestures of the speaker, may be taken as evidence of conscious speaking in the making. Yet we have in our own language equivalent instances of the explication of sound by context or gesture. Thus the expression "my work" may be shown to signify either "I do it" or "you do not." A man may say "my *work*," pointing to the product with a look showing lively satisfaction at being able to boast himself as the performer of so remarkable a feat; or he may say "*my* work" while pointing to his own body, with a look of indignation at the idea of anyone else pretending to have done it.

A few further examples of what have been deemed forms of predication so low as to border on mere sensuous and animal language, must here suffice.

We have been told by Mr. Romanes[1] that if a Dyak wants to say "Thy father is, or looks, old," he has, for want of words, to put together such expressions as "father of thee," "age of him." Also he says that if such a man wants to say of another "He is wearing a white jacket," the form of the statement would be "he with white with jacket," or more tersely, "he jackety whitey." But this does not in the least tell against the presence of distinct intellectual meaning in the utterance of such phrases. They may strike the imagination of some persons so as to call up a smile, but in sober truth, as regards meaning (which is the only important thing), the expression, "he jackety whitey," is essentially as good as the expression, "The external upper garment of that man is of the colour of the driven snow."

If in Fiji the response "I will" is expressed by the form "will of me," that surely is sufficient. It would be easy enough to parallel such rendering by means of examples from English slang.

No doubt the parts of speech of English grammarians may be, in their external form, inapplicable to the Polynesian languages. But the fact, however interesting, has no significance as regards the essentially abstract nature of the

[1] *Op. cit.*, p. 317.

ideas conveyed. Our expression, "I will eat rice," may require to be rendered, "The eating of me the rice; my eating will be of the rice." But such expressions are quite reasonable and logical.

If it can be pointed out of any object that it is here, or there, or thus, or sitting, or standing, or waiting, there can be no doubt whatever of the implication that it *is*—that it exists—even though no special articular sound may be devoted to the explicit assertion that such is the case. And how great is the significance of that small word "*is*"! If a brute could think "is," brute and man would indeed be brothers. "Is," as the copula of a judgment, implies the mental separation and recombination of two terms that only exist united in nature, and can therefore never have impressed our sensitive faculty except as one thing. "Is," again, considered as a substantive verb, as in the example, "This man is," contains in itself the application of the copula of judgment to the most elementary of all abstractions—"thing" or "something." Yet if a being has the power of thinking "thing" or "something," it has the power of transcending space and time by dividing or decomposing the phenomenally one—ideally separating the individuality, or hæcceity, of an object or idea from its existence. This is an act done with reflex consciousness by philosophers, but entirely without advertence by the immense majority of mankind. Here is the point where "instinct" is entirely left behind and where reason has begun.

We have now examined and reviewed the several asserted cases here considered as giving the best clue to the real nature of animal language. If we are right in deeming that no evidence has been brought forward to show that brutes can evolve and entertain abstract ideas, it is plain they cannot possess intellectual language, since the presence of such mental abstraction is a *sine quâ non* for its existence. No doubt the songs and calls of birds have, in a sense, meanings which are practically understood by their fellows. Some dogs will make certain facts, *e. g.*, the presence of a rat or a thief, known to their masters, and may also indicate which of the two it is by the kind of sound they make. Pointers and setters, by their movements and the postures they assume, will make known other facts, while parrots and jackdaws can be taught to articulate whole sentences. All this is very true, but it is nothing to the purpose, because it does not surpass that lower emotional language which we also possess. We have, we hope, sufficiently shown how truly intellectual may be the language of gesture which mutes can use. Could animals do likewise, could any of them by gestures make us understand what the language of pantomime used in certain ballets can very plainly signify, there would be no need for them to utter sounds—such movements alone would be amply sufficient to demonstrate to us their rationality. And they have ample bodily powers so to do, especially the apes, which are so like us in structure. Their senses, also, are quite keen enough to give them ideas about the things they sensuously perceive, were they not destitute of some higher faculty such as enables us to form intellectual conceptions. On the other hand, they might do much more by sound and gesture than they do, and yet neither possess nor express such conceptions. It is quite conceivable that a parrot might learn to utter certain words which, by teaching, he has come to associate with something pleasant to follow, just as a dog who "begs" has associated that felt gesture with the imagination of biscuit which he has habitually received after begging. But such actions and imaginations do not tend even to bridge over the chasm which exists between intellectual speech and the language of emotion.

Similarly, dogs or pigs, trained to select from a number of cards with letters on them, those bearing the letters CAKE, are animals very curiously and ingeniously trained; but their actions prove nothing more than that there has been established in their imagination sensuous associations similar to those which have been formed in the psychical nature of any dog that "begs."

It now only remains to consider what may be said with respect to the origin of human speech. In the absence of all direct evidence only more or less plausible hypotheses are possible. One thing, however, we regard as quite certain, and that is that thought, the *verbum mentale*, was anterior to the *verbum oris*. The phenomena presented by deaf-mutes are sufficient to show that abstract ideas can exist without spoken words, and that oral terms are the consequence of thought ordinary experience suffices to prove. When, in the cultivation of any new science or art, newly observed facts or newly devised processes give rise to new conceptions, new terms are invented to give expression to such conceptions. Thus new words arise as a consequent, and not as an antecedent, of such intellectual action. New terms are always fitted to fresh ideas, and not fresh ideas to new terms. Whoever attentively follows the mental development of a child, will see that in it also, notions are formed spontaneously, and often give rise to new words of the child's own coining.

The antecedence of thought is also shown by the wonderful rapidity—far exceeding the rapidity of speech—with which the mind may detect a fallacy in an argument. And such detection is always due to some reason our mind perceives to be fatal, it may be, to a long chain of reasoning. A mere cry or gesture of negation may be the sign of intellectual perceptions which would require more than one sentence to express fully, but which are perceived too rapidly for even the mental repetition of the words of such sentences. We have seen how deaf-mutes may spontaneously evolve a gesture-language, through which they can convey ideas to one another. Dr. W. W. Ireland has recorded[1] the case of a boy who could not speak ordinary words, and yet had invented a few of his own, to which he attached fixed meanings. Thus he said "weep-oo" for night or black; "burly" for wood or for a carpenter; "tatteras" for soldiers, and so on. An analogous case has come within our own experience, and Dr. Bastian has described another,[2] which seems to show that the faculty of rational speech is so potentially present in us that it sometimes manifests itself spontaneously and very unexpectedly. It appears that in 1877 he was consulted concerning the health of a boy of twelve, occasionally subject to fits. When five years old he had not spoken, but before another year had passed, on the occasion of an accident happening to one of his favourite toys, he suddenly exclaimed, "What a pity!" which were his very first words. He was then silent for a fortnight, but thereafter became very talkative. A medical friend of ours was much alarmed about his son (now an eminent medical man himself), because he was long unable to speak, though he showed clearly by an elaborate language of gesture that he had very distinct intellectual conceptions which, after a time, he began to express vocally. The cases of Laura Bridgman and Martha Obrecht have been already described.[3]

Speech has, in many cases, been shown to be reducible to a certain number of probably primitive terms called "roots," and a large number of these denote some kind of action or movement. On this account the suggestion has been made

[1] *Idiocy and Imbecility*, p. 276. Churchill, 1877.

[2] *The Brain as an Organ of Mind*, p. 606. Kegan Paul, Trench and Co. 1880.

[3] See *ante*, p. 200.

that speech arose through a custom which grew up of emitting peculiar sounds when performing certain actions, as seamen and others often utter sounds in common when working together.

But it is conceded by all that speech could not have arisen except by the utterance of sounds, the meaning of which was understood both by those who uttered them and those who heard them. Speech requires an apprehending intelligence on the part of the hearer as well as on the part of the speaker if it is to be more than a monologue. Without the attainment of this mutual comprehension spoken language could never have arisen. It is true, of course, that one man performing some act in the presence of others would know what he was about while the onlookers would know it also, and thus a sound repeated by him while so acting might generate a term to denote such action, which term would be understood by him and by those who saw and heard him. But for this it must have been necessary to have the mental conception of what was being done, that is, an abstract idea. If the man acting and the onlookers only uttered the sound accidentally, without will and intention, and then repeated it automatically, and not as a sign deliberately meant, such sounds (articulate or not) could be no form of speech. It is evident none of them could understand or apply it except by first acquiring the idea or conception itself. Therefore the doctrine, " Speech begot reason," cannot be maintained, for speech cannot exist without the existence with it of that intellectual activity of which it is the external expression. As well might the concavities of a curved line be supposed to exist without its convexities, as the spoken word be supposed to have arisen prior to the idea which it represents. Experience shows us, as we have already observed, that it is new thoughts which generate new words, and not the reverse. As the deaf-mutes teach us, rational conceptions can exist without words. The intellect is the common root from which both thought and language (whether of word or gesture) spring.

This radical distinction between sounds denoting abstract ideas and sounds which are but the expression of emotional feeling is the distinction between the language (whether of speech or gesture) of men on the one hand and of animals on the other. That we cannot imagine how so fundamental a distinction arose should be no bar to our recognising its existence as a fact. This break, or new departure, in the order of nature is by no means an isolated one. There is an absolute break between the living world and the world devoid of life; and though it is true that at some period life for the first time appeared upon the surface of this planet, whenever it did so appear, there must have been a breach of continuity and a new departure, which is no whit less certain because we cannot imagine how it took place. We are convinced there was another breach of continuity and a fresh new departure when the first organisms appeared which were capable of sensation.

That all the higher animals "feel" will not be disputed. They give abundant evidence of sensitivity, and they possess the special living substance—nervous tissue—which we know is the organ of sensation in ourselves. But the world of plants affords us no such evidence. The movements of the leaves of some—as notably of the sensitive plant and of Venus's fly-trap—might be thought so to do, but they are explicable without sensitivity. That the vegetable world is devoid of sensation is what should be expected, since plants are devoid of all trace of a nervous system; and it is a universally admitted biological law that structure and function vary together. If, then, there are any organisms whatever which do not feel, while certain other organisms do feel, then (as a gate must be shut or not shut) there is and must be a break and distinction between the one and the other.

But it may be objected: "The transition is so gradual, it is impossible to draw a hard and fast line between sentient and insentient organisms." Even if this assertion be true, such an objection would be of no avail, because an apparently continuous and uninterrupted course of action is often not really such, but only seems to be so on account of our organisation—our very limited power of vision.

Let us suppose an action to take place at precisely such a rate as to permit of our seeing its steps separated from each other by just appreciable intervals; then we have but to suppose the period needed for our nervous activity to be slightly increased, and it would necessarily follow we could no longer perceive the intervals, and the supposed action would seem to be continuous. Next let us suppose that an action, which is really interrupted, takes place so quickly that we cannot perceive the intervals; we have but to imagine our nervous activity accelerated to a sufficient degree and the intervals would be plainly perceptible to us.

Absolute interruptions and new departures take place every day in nature. Such, for example, take place at every junction of the ultimate sexual elements in impregnation and in the final separation of the embryo from the parent at birth.

Because we cannot imagine the origin of an intellectual nature or any other origin, no argument thence arises against such breaches of continuity—such new departures. We cannot imagine them, simply because we cannot see, feel, or in any way sensuously cognise them. We cannot perceive them, as we cannot perceive the ultimate constitution of matter, because we have not been provided with the organs necessary to minister to such perception. As Professor Miers once remarked to us, we cannot perceive them any more than we can distinguish colours by listening, however attentively, with our ears.

But however impotent may be our imagination, our reason assures us that wherever a distinction of *kind* exists, there must also be a breach of continuity, and a new departure. For a "nature" or a "kind of existence" does not admit of augmentation or diminution—of "greater" or "less"—it simply "is" or "is not," and there is no possibility of any intermediate condition.

Seeing, then, that there is now existing an absolute difference between the non-living and the living, and between non-sentient organisms and those endowed with sensitivity, we may, on grounds of analogy, deem it antecedently probable (what a study of the question seems to us to make almost certain) that there is also a breach of continuity and a new departure in passing from merely sentient creatures to beings endowed with reason.

The distinction which exists between that lower form of language, of which mere animals are capable, and by which they express their feelings and emotions, and that external manifestation (by words or gestures) of abstract ideas of which man alone is capable, constitutes the strongest possible argument for the existence of a difference of kind between human reason and the cognitive faculties of brutes. A recognition of the existence of this distinction of kind, then, removes every cause for doubt and wonder that the intellect of man should be capable of apprehending absolute truths to which all the other inhabitants of this planet are blind, and should dispose us to accept with readiness and without distrust whatever our highest faculties declare to us to be absolutely and necessarily true.

CHAPTER VIII

INTELLECTUAL ANTECEDENTS OF SCIENCE

WE have now passed through our preliminary inquiries respecting the objects, methods, and antecedents of science. We have recognised that there is a real, external world, the conditions, laws, and relations of which it is the business of science to investigate, as it is also its business to take note of the existence, laws, and relations of the investigating human mind. We have seen what are the main physical and psychical conditions necessary for the very being of human knowledge, and what are those fundamental psychical activities of which we must make use for even its most trifling increase.

In our last two chapters we carefully distinguished between our lower and our higher mental powers, and it now becomes our business to direct our whole attention to the latter, as they are the only tools of which we can make use in exploring the foundations of science and seeking to obtain a satisfactory Epistemology.

But before we can advance one step further in our inquiry, we must make sure that the ground beneath our feet is perfectly solid and secure, so that there shall be no danger of our falling into an abyss of intellectual nihilism, or a quagmire of doubt and uncertainty.

We long ago[1] remarked that we are all certain about

[1] See *ante*, p. 97.

many things, and that certainty is necessary for any real scientific progress; and later on [1] we noted, in an introductory manner, the absolute certainty which attends our reflex consciousness. These remarks were necessary preliminaries to some subsequent considerations which we then brought forward. Now, however, the time has come for us to study the question of certainty deliberately and as fully as we are able, and to call the reader's attention to those considerations which earlier (when speaking of reflex consciousness) we said we would reserve for a future chapter.

In the first place, it is evident that we must be certain of something, and that, do what we may, we cannot get rid of our certainty. For if anyone were to affirm he was certain of nothing, and that to no proposition could he give an unhesitating and fully confident assent, he would thereby contradict himself, for he would at the same time be affirming the certainty of his own disbelief in and denial of certainty.

To avoid this charge of self-contradiction, he might, perhaps, go on to say: "Oh! I do not *affirm* that there is no certainty; I am far from denying that there may be such a thing; all I affirm is that I doubt everything, even whether I have any conviction about certainty one way or the other." But by so objecting he does not cease to affirm certainty: all the difference is that his certainty takes a different form from that before attributed to him. Instead of asserting the certainty of his denial of certainty, he would thereby be affirming the certainty that his mind was in a state of doubt. But that is a matter about which anyone may be as certain as of any other fact of belief or conviction.

Concerning the present mental state in which anyone knows himself to be—whether it be a state of doubt or belief, or a state of having a sensation of blue or of a sour

[1] P. 138.

taste—he has the most absolute certainty possible; for it is a fact concerning which Omnipotence itself is powerless to deceive him. It may be, indeed, that his sensation of blue is a merely subjective one, and the sourness he tastes may be occasioned not by what he puts in his mouth, but by some abnormal condition of his gustatory nerves or of his brain. That, however, does not make it in the least the less certain that he *has* the sensation he feels. The reality of the fact of the feeling is in no way lessened by whatever may have been the cause producing it. Similarly, he may believe what is the merest delusion, *e. g.*, that his legs are made of glass, or may doubt what is most evident to his senses, as that there is light when the sun is shining at noonday. But none the less, his belief *is* his belief while he has it, and so is his doubt, his doubt. Both are, and can only be, to him just what they are while he is experiencing them. As to this, he has the most absolute certainty conceivable, that is, the certainty of both his direct and his reflex consciousness. He can with full consciousness direct his attention on his own mental state and say: "I certainly have such a belief, or such a doubt." As to this, if he thinks about it, no man can really doubt. But a man, nevertheless, may not think of it, and not having realised that he has a subjective, absolute certainty which nothing can even weaken, he may yet fall into an unreasonable doubt as to his own mental faculties. Being fully aware that he has in his life made many mistakes, and that most men also frequently make them, it is conceivable he might say to himself, "As my faculties have deceived me in something, may they not deceive me in everything? What guarantee have I that they are not always fallacious? I cannot get outside myself and compare my convictions with external realities; therefore I have no satisfactory evidence of their truth, and so I really know nothing, and am intellectually, as it were, entirely at sea, drifting I know not where or how. The idea that I can be really certain about anything is for me an absurdity. What can I ascertain about the cause and origin of the faculties I possess? For all I can tell, I may be the sport of a demon who amuses himself with deceiving me in all things!"

But to such a man we would say, Why do you feel this distrust of your faculties? It is evident that your want of certainty about them can only be due to your certainty about something else.

You are convinced that you cannot surely arrive at truth because your faculties may be deceptive; but on what is this conviction of yours founded? Why cannot you trust them all the same? It is, and must be, owing to your perception that *no one can arrive at conclusions which are themselves certain by means of premisses which are false, or even uncertain.* Now, in this perception of yours you are evidently quite right, but please observe that you cannot have the conviction you say you have about it except by trusting your faculties after all. Therefore, if you are convinced, as you say you are, about this impossibility of attaining conclusions which are certain from false or uncertain premisses, you must be convinced that your faculties are not always fallacious, and you must also perceive that your imaginary demon cannot deceive you in everything.

Therefore, doubt as we may, certainty is the inalienable possession of even the most absolute sceptic, who, when he says he is certain of nothing—even of his own scepticism—simply contradicts himself, and says what is mere nonsense.

At the outset of this our most important inquiry, namely, the study of our highest faculties, it is necessary for the reader thus to see clearly that certainty exists, and that he not only can but must possess it about some things, or else pay the penalty of drifting into imbecility and mental impotence. He would, indeed, be compelled to affirm the certainty of uncertainty, and so to contradict himself, and to deny the truth of the system he at the same time upholds. Such a position is so unspeakably foolish a one, that it cannot be understood and seriously maintained by any sane mind.

From this fact it is well to note that an important consequence follows: no proposition, no argument, and no system of thought, which logically and necessarily results in such absolute scepticism, can be valid; and every system, argument, and proposition which carries with it such consequences, can thus be shown to be false by a process of *reductio ad absurdum.*

Unquestionably, then, certainty exists; but the recognition of this truth constitutes but a very small step on the road to an inquiry as to what propositions are most true, and on what evidence do they depend?

Now, our imaginary sceptic was shown to have based his scepticism on the following process of reasoning—on the syllogism:

All conclusions resulting from uncertain or false premisses	are untrustworthy.
But the declarations of my mental faculties . .	are conclusions resulting from uncertain or false premisses.
Therefore, the declarations of my mental faculties .	are untrustworthy.

He, therefore, must have been under the persuasion that reasoning is the test of truth, and there are not a few persons who are similarly minded and think that, in order to be absolutely certain about anything, it must be capable of proof, as also that to accept as true anything which is incapable of proof, is to accept a conviction blindly.

Of course it is common enough and reasonable enough to ask for proof to be given with respect to any new or extraordinary statement, and it is most reasonable not to assent to any proposition which does not possess sufficient *evidence*.

It is also true that the greater part of our knowledge is gained by us indirectly, by inference or testimony of some kind. And thus it has come about that many persons (as before said) have acquired, half-unconsciously, a persuasion that to believe anything which cannot be proved is an act of irrational credulity, and thus a tendency has arisen to distrust any assertion for which no proof is offered.

But, as we before pointed out,[1] however long our processes of proof may be, they must stop somewhere. We cannot go on reasoning forever if anything is ever to be proved. Therefore, every valid process of reasoning must ultimately depend upon propositions which need no proof, and are undemonstrable—not "undemonstrable" because, like matters which have been taken on trust, we can obtain no evidence for them, but because they are so luminously self-evident that they admit of no demonstration, nothing else being so clearly and necessarily true as they are. We have, indeed, just said that it is most reasonable to demand sufficient *evidence* for any proposition to which our assent is demanded. But that evidence need not be *external* evidence, and the evidence of those ultimate propositions which need no proof is, and must be, *internal* evidence. They carry with them their own evidence, and so are evident in and by themselves.

Thus the reasoning of our supposed sceptic—his syllogism—reposes on premisses which are accepted by him as true—the major very reasonably, though the minor, most mistakenly.

Either, therefore, we have no certainty as to anything—a

[1] See *ante*, p. 103.

position we have seen to be absurd and untenable—or the propositions upon which our certainty ultimately reposes are such as are self-evident and need no proof. If, also, it is reasonable to accept as true, statements which are shown to be so by reasoning, it must be still more reasonable to accept propositions which are shown to be true in and by themselves: which are evident to our intellect as necessarily true, as is the statement that we have a feeling which at the time we know by our consciousness we actually possess.

If any reader still has some feeling of dissatisfaction or discomfort about the self-evidence of ultimate truths, we would ask him to reconsider the reasoning of our supposed absolute sceptic. We represented him as objecting that he could obtain no external evidence as to the correspondence of his internal convictions with external realities.

Let us then suppose that he could, by some unimaginable miracle, get outside his present mental state and view his convictions and the objects they were related to, from outside, so that he could compare them one with the other, and obtain a higher kind of conviction—in a secondary mental state—as to their correspondence. But how could he thereby gain any better assurance as to the objective correspondence of the convictions of his subjective secondary mental state with respect to the objective realities of the comparisons he had originally made? For this he would need to go outside himself again, and then again and yet again forever, without ever attaining to any better grounded conviction than the one wherewith he originally set forth. Sooner or later he must accept self-evidence as sufficient (as we before provisionally pointed out),[1] or he must fall into absolute scepticism, which is a form of idiocy. What other or better criterion, or ground of belief, could any ultimate truth possibly have? Any criterion of an ultimate proposition must

[1] See *ante*, p. 57.

be contained either in that proposition itself, and so make it luminously self-evident, or else in something external to it. Now any external criterion, however complete and perfect it may be, could only be appreciated by us through our perception of it and our judgment about it. If a proposition suddenly appeared written upon a cloud, or on the face of the full-moon, we could not on that account accept it as certainly true till we had examined the evidences which circumstances could possibly afford us. Our first impression, of course, would be that we were the victims of a hallucination, and next, the question of the possibility and probability of common hallucinations would have to be taken into consideration. But, finally, and at last, if we did accept the proposition as true, it would only be because we perceived that our ultimate judgments about it were self-evidently so. If the proposition so written were, "Two added to two make five," we should not believe it to be true any the more for its inexplicable appearance. By no external criterion, then, neither by the absurd one just imagined, nor by any other, could we be furnished with better evidence than we already possess. We could but have self-evidence, after all, as our ultimate criterion. It will be clearly seen, on reflection, that nothing external—no common consent of mankind, common-sense, or any amount of human testimony—could ever take the place of an ultimate criterion of knowledge, since some judgment of our own mind must always decide for us with respect to the existence and the value of such criteria. Self-evidence, then, is the necessary and only criterion of truth. The principle of evidence is one which is really ultimate, and must be accepted under pain either of futile reasoning, or of complete intellectual paralysis. It is, of course, necessarily incapable of demonstration or any kind of proof, since it depends on nothing else. We all of us assume it as a criterion unconsciously, and it is confidently acted on by everyone who reasons. But when we ponder over the matter, we see that what we have thus done spontaneously, through the natural activity of our intellect, has been done *most* reasonably. Did we not adopt it, we should not only be utterly unable to think logically, but should be plunged into the most utter and most absurd mental disorganisation.

On the other hand, by recognising that criterion for what it must be, and is, we gain a secure foundation for our knowledge, and are enabled to make progress in science. Our mental condition is, by such recognition, transformed from a hopeless chaos into an orderly cosmos.

It has now, we trust, been made sufficiently clear to the attentive reader (what has been incidentally put forward in earlier chapters) that his own mind—that the mind of each one of us—already possesses absolute certainty about some things, and that his intellect declares that things which are clearly seen to be evident in and by themselves possess the greatest certainty which it is possible for the human mind to attain to, and that such certainty is abundant.

If one is so unfortunate as not to be able to see this clearly, and not to be able to have a firm conviction that there is such a thing as certainty, as also that many things are actually and in fact certain, then he had better close this volume and abstain from opening any other work on science, contenting himself with simple matters, the toils and pleasures of every-day life, without a thought beyond.

Having satisfied ourselves once for all that certainty exists, and that the criterion of certainty is evidence, whereof intrinsic self-evidence is the highest kind, our next step should be an endeavour to ascertain what things are most evident—what things are supremely certain.

In our third chapter we contended that we have an intuition of an external, independent world of extended things.

This is equivalent to the affirmation that extended things are self-evident, and that we do actually affirm them so to be. Nevertheless, as we have before pointed out,[1] the self-evidence and certainty of the existence of such an external world do not attain to the very highest degree of certainty and evidence. They have not this pre-eminence, because we have to obtain their certainty through the ministry of the senses, by the aid of which, together with reflection, we recognise the action of external bodies upon us, and the sensations they excite within us, through which (without our at first attending to and recognising our sensations) such bodies are made present to our minds so that we perceive them. The fact that we gain this perception by so complex a process (though, through it, we cognise objects directly and not reflexly, or by inference),[2] makes us able to entertain a sort of fictitious doubt about the nature of our perceptions of external things, but for which all idealism would be absolutely impossible. We may (because many persons do) believe that our inevitable perception of the world about us is either an inference or a delusion, even to the extent of regarding ourselves as the one only cause of everything we perceive — that is to say, we may accept solipsism. As our own body is, for our mind, one portion, though a very peculiar portion, of the external world, doubts which may be entertained about that world must apply also to it. Moreover, what we perceive with the greatest certainty about the external world is just that which our senses do not and cannot show us. That secondary qualities should be, objectively, very different from what we subjectively feel them to be we can easily admit; but that, underlying them, there should not be an unperceived and imperceptible substance in each body, constituting it essentially a "thing in itself," belies that intuition of extension

[1] See *ante*, p. 46.

[2] See *ante*, p. 62.

by which we know bodies to be the self-evident entities they are, and thus and therefore it is that idealism is in conflict with sound sense.

So with respect to the existence of our own bodies: the supreme certainty we have about it is not merely what is present in the feeling of the moment, but the cognition we have of it is gained (as we shall shortly see) through our faculty of memory together with the exercise of reflection.

Thus all that is most evidently and supremely certain for us is not, as so commonly supposed, anything we experience in sensation, nor anything we cognise in examining or experimenting with material things, but, on the contrary, exclusively that which is immaterial, abstract, and mental.

The truth of whatever is true, and the evidence of whatever is evident, can be most perfectly known to us only by thought and not sensation. Not observation, not experiment, not sensitivity, but thought and thought only (as we pointed out earlier),[1] is and must be our supreme, ultimate, and absolute criterion. Our last appeal in all cases is and must ever be to a perception—an intuition—of the intellect.

Nevertheless, a mental world of abstract intuitions and nothing else could never supply us with a knowledge of science, still less with a perception of the groundwork of all science. Abstract intuitions furnish us with fundamental principles, which are not only priceless in themselves, but are also indispensable elements in all reasoning. But besides such processes of reasoning and such fundamental principles, science requires a knowledge of absolute facts. Without such facts all our reasonings must remain, as it were, in the air, and could never descend to earth and become of practical utility to us. There are, therefore, three categories of truths, the perception of all of which is indispensably necessary for science. These are: (1) certain general

[1] See *ante*, p. 14.

principles; (2) certain particular facts; and (3) certain processes of reasoning.

Without a knowledge of certain general principles we could not argue; without a knowledge of certain facts all our reasoning would merely concern abstract ideas; and without a reference to concrete reality, and without some criterion of valid reasoning, we could never arrive at any conclusion or discover and explicitly recognise implicit truths, no inferences could be deduced, and no advance in science could be consequently attained.

We will select from the category of particular facts one which may serve as a solid foundation and starting-point towards a pursuit of our object.

Let us suppose that certain definite observations and experiments have been carried on—such, *e. g.*, as those which were performed by the late M. Pasteur with a view to the treatment of rabies. Now there is one supremely important truth which is implied in our certainty as to the result of any such experiment, whatever that result may be. Unless we can be sure that it was we who both began the experiment and also witnessed its conclusion—that there had been no change in our personality while experimenting—such conclusion could not be confidently relied on by us, as we have before pointed out.[1] The most fundamental of all facts for our purpose is the fact of our continous personal existence.

Now, of course, no one is so mad as to deny that he knows his existence at the moment he thinks about it. We have already noticed the absolute certainty we have about any feeling while we feel it; and as nothing can feel which does not exist, the certainty about the existence of a feeling makes no less certain the existence of him who feels it. It is not this momentary knowledge of self-existence—what

[1] See *ante*, p. 101.

is known as the "empirical Ego"—which is here in question, but the existence of our being continuously, from hour to hour, from day to day, from year to year, and from childhood till the present time.

Such a "continuous self," it has been again and again affirmed by followers of Hume, cannot be known (1) with supreme certainty, such as attends our certainty about our possession of any present feeling we may have; and (2) that it cannot be certainly known because it cannot be known absolutely and by itself, but always as some modification or present state of consciousness.

But, in the first place, though we may be perfectly certain about our possessing any present feeling, that certainty is not in the *feeling* but in the conscious *thought* which recognises the existence of the feeling. Secondly, not only is it untrue that we cannot have supreme certainty about our continuous existence, but the supremacy and certainty we have of that is actually higher in degree than is our certainty about our possessing any present state of feeling.

What we are conscious of when not directing our own mind backwards upon its own experiences is a direct consciousness of whatever we may be about—what we may be doing or feeling—and whatever may be done to us—what we are doing or suffering. The focus of our consciousness (the apex of the conscious wave) is not directed either upon our own existence from moment to moment, or upon the particular feeling or state of consciousness which we may then have. We can, however, at almost any moment direct it backwards and reflect upon either of these, and so attain supreme certainty either about our continuous existence from moment to moment, or upon the feeling or state of consciousness then present with us.

Let the reader test this assertion by his own experience. As, for example, let him examine what his mind is occupied about while sitting and attentively reading these pages.

He will find his mind is not occupied about the feelings occasioned by his sitting in the chair which supports him, or the book he holds in his hand, any more than it is occupied about his own continuous existence, but about the contents of this book. Yet he can at will make himself explicitly aware of either his feelings or his perception of his own self-existence. After thus turning his mind back upon itself he will then be able to say, either "I have the feelings which attend holding and reading a book on the Groundwork of Science," or he may say to himself, "It is I who have these feelings." But, as before said, this is not a natural, primary act, but an act of reflection—that is, a secondary act. No one, when he begins to think, adverts either to his "present feelings" or to his "continuous personal existence." No one begins by perceiving his act of perception a bit more than he begins by expressly adverting to the fact that it is he himself who perceives it.

Only by reflecting on the direct spontaneous perception of the mind is it that we can explicitly see (by such a secondary act) that our perceptions and feelings *are* perceptions and feelings, or that it is truly *we* who perceive and feel. When a man playing cricket is having his innings, he has all the "perceptions" and "states of consciousness" which attend the assumption of the fit postures for the reception and striking of the ball, and for gaining such runs as his address may make possible. He knows very well all the time what he is about during his play. But he never directs his mind upon "his states of consciousness," or "the persistence of his being." What he directly regards is what he is doing and what is being done to him—the defence of his wicket from the attack of the bowler. If he were to divert his attention therefrom to either his own "perceptions" or his "persistent existence," the result would certainly not contribute to the success of the eleven whereof he was a member.

But we said that when men do so reflect, the certainty thus gained of a persistent existence is even higher in degree than that of any present feeling, perception, or state of consciousness. And in fact, it is the "self" which is the more prominently given. For the "feeling" or "perception" is perceived as our present "feeling" or "perception," and cannot be cognised altogether apart from the "self." But our "self-existence" can be cognised without our advertence to any feeling which may accompany such cognition or to any "perception" as such.

In all our ordinary perceptions, wherein there is but a "direct" and no "reflex" cognition of either "self" as "existing" or of our "perception" as being such, it is the self again which is, as it were, nearer the surface of the mind. For we are sure, at least in our own case, that a more laborious mental act is needed to bring explicitly before the mind the "feelings" implicitly contained in any perception, than to bring explicitly before the mind the self-existence implicitly contained in any such perception, as also that the existence of the self, as self, is more readily recognised than the existence of a perception as a perception.

Men repeatedly and very quickly advert to the fact that actions or sufferings are their own. They are generally prompt to claim any merit there may be in the former, or to cry out against the unmerited character of the latter. They do not, however, by any means so repeatedly and quickly advert to the fact that the feelings and perceptions they experience are "existing feelings and perceptions."

We think, therefore, it is impossible to deny that to assert we can know our "states of consciousness" more certainly and directly than we can know the "continuously existing self" which has them, is a most profound and fundamental mistake.

We are at this moment writing: we feel the pen and the motions of our hand and arm, and recognise that we have such sensations, and that we perceive hand and arm, pen, ink, and paper. But ordinarily, when writing, we no more advert to such "perceptions" than we advert to our "perceptions" when running up or down stairs. It is plain that we do not so advert; for as surely as our attention is so directed, our movements in writing become hampered in the one case, and a stumble on the staircase[1] is very likely to occur in the second. Much less inconvenience ensues from turning the mind inwards (while writing or running up or down stairs), and recognising our existence, than from adverting to our bodily movements while thus occupied. Thus here, again, we may recognise the fact that of the two certainties, the certainty of our own existence from moment to moment is more easily attained than the certainty as to what is the nature of the various feelings and perceptions which may accompany the actions above referred to, or any others.

But, as we have noted, it has been objected against the possibility of our self-knowledge that we can never know ourselves absolutely and unmodified, but only in some state or under some relation. Now it is very true that we have no intuition of our own psychical being in its essence, and apart from any of its activities, passivities, and relations. But then the same thing can be, and must be, said of everything else we perceive. In fact, nothing we can in any way perceive exists apart from everything else, or "absolutely" —as it is (in our opinion) very unreasonably termed.

Everything which exists, exists always in some state or

[1] See *ante*, p. 117.

condition, and stands in some definite relation to other things. Small wonder, then, if we do not know things in a way in which they never do and probably never can exist. We can know nothing by itself, for the very good reason that nothing exists "by itself." It is quite true that we have never known our own existing being except in some state; but then we have never known anything else except in the same manner. Our knowledge of ourselves is, in this respect, like our knowledge of anyone else. Many persons knew, as we did, the late Professor Huxley, but no one ever knew, or could possibly imagine, him except in some state—either standing or not standing, speaking or silent, etc. But that did not in the least prevent them from knowing him well, and the fact of his continuous existence for a greater or less number of years.

To many of our readers this exposition of the certainty we have concerning our own continuous existence may seem superfluous. But just as we have been convinced that it was necessary to make as evident as it was in our power to do, the truth that certainty exists and what is its criterion, so we are convinced it is necessary to do our best to show that the first and most fundamental of all facts is the fact of our continuous being. If doubts as to either of these truths cannot be entirely expelled from the mind of any inquirer, that mind must remain subject to a sort of intellectual falling-sickness, rendering all steady progress in what concerns science really hopeless, and a pursuit of Epistemology utterly futile. The fact of self-existence from day to day is the most fundamental and important of all facts about which our minds can give us any information—not on its own account so much as on account of the consequences which follow its distinct recognition, as we shall clearly see when we come to speak of memory.

But before leaving this subject, we must notice one further objection against the possibility of our knowledge of our own continuous and substantial being.

It has been said that the self of each instant, the self the existence of which no one denies (the "empirical Ego"), must, if we know our continuous substantial existence, be identical with an underlying principle of unity, continuous and enduring (the "pure Ego"). This, we are told, is impossible, because the Ego of each instant is the feeling "subject," while the underlying principle is an existence—is a thing—thought about, and is an "object" of cognition. But the "subjective" and "objective" are necessarily antithetical, and therefore the "pure" and "empirical" Egos must be separated from each other by the unfathomable chasm which divides "subject" from "object."

Yet, as we have seen, the "pure Ego" can be perceived in conjunction with its states, modifications, and relations, and recognised as being the "Ego" which also recognises that identity.

The fact is that our own being—our Ego—differs from everything else whatever in that it can be, and is, *both* "subject" and "object." It is, as we before noted,[1] in a sense *subject and object identified;* though more cognised as especially the one or especially the other, according to the direction taken by the mind at one or another moment.

We have but to turn our minds carefully inwards and advert to what our consciousness tells us in order to be able clearly to see that the fact of our own substantial existence is a truth which carries with it its own evidence, and is absolutely certain in and by itself.

We say, "what consciousness tells us," but by that we do not mean consciousness only of the present but also our consciousness as to some of the past. For it is not a momentary existence, but a substantial and continuous

[1] See *ante*, p. 139.

existence, the certainty of which we have been affirming is both so fundamental and supreme.

Our knowledge of our continuous existence carries with it the conviction of the validity of our *faculty of memory*.[1] It is, of course, obvious that by asserting the validity of this faculty we do not and cannot mean that our memory is always to be trusted. For everyone knows, and generally regrets, that there are things he is certain he once knew but which he can no longer recollect. As age advances, the recollection of the facts of the recent past becomes gradually less, and there are many instances of exceptionally defective memory, sometimes of a whole subject-matter, sometimes of particular parts thereof. But all these exceptional phenomena do not affect the assertion of the general trustworthiness of memory — the assertion that what most people remember clearly and distinctly, and which they are certain really was as they remember it, did in fact occur as they remember it. Putting aside exceptional persons, in pathological conditions, it is certain that everyone can recollect a portion of his past experience—either what has just occurred or what happened at a somewhat earlier, or very much earlier, date.

It is also obvious that the trustworthiness of memory is implied in our knowledge of our own existence, since we could never know either what our most recently experienced feelings or our direct perceptions of the empirical Ego have been save by the aid of memory. Therefore the certainty we have as to the one or the other of these carries with it a certainty that our memory can inform us truly as to the past.

As we have before pointed out, in order that memory should exist, it is necessary that whatever is remembered should be recognised by him who remembers it as having

[1] See *ante*, p. 100.

occurred before, and without such recognition no recurrence of a bygone mental image, however many times it should occur, would be an act of memory.

But there are two forms of real memory. All our readers, we are quite sure, have now and again tried to recall something they know they before knew and ought to recollect. As memory is not truly a voluntary act, they can only turn their minds in this or that direction, which they think may possibly or probably lead them to it, till at last they have thus succeeded, and have before their minds once more the thought they wanted to regain. Such a mode of reappearance, due to a more or less prolonged effort of the imagination directed in different directions by the will, is distinguishable as *recollection.*

But very often an image of the past suddenly appears in consciousness unsought—unbidden—and, it may be, its reappearance is far from a welcome one. Such a spontaneous resurrection of past thoughts and images is distinguishable as *reminiscence.*

It is "recollection," the presence of which is implied in our reflex knowledge of our own existence, because for that we voluntarily turn the mind backwards on itself. We have spoken of our knowledge of our existence "from moment to moment," because we are not sure that it is possible ever to know the present moment by a reflex act. It is true that it is possible to look at a coloured object and say, "Now I see red." In our own case, it seems to us that we can thus be reflexly conscious of the present moment. Nevertheless, we cannot be sure that in this we do not deceive ourselves. For since we are a unity made up of material existence, thought, and feeling; since the mind cannot act in any way without some concurrent action of the nervous system; and since no nervous action can take place without requiring a certain time for its performance, it appears to us that the reflex act which recognises "I am I," or "My feeling is now being felt," must be one that occupies a portion of time, however minute, and that therefore the existence, or act, thus reflexly cognised, must be an existence or act of the moment past. That our faculties, with our bodily organisation, may fail to seize on this minute and momentary state of succession, is no more wonderful than that an iron bar, red-hot at one end, should, when very rapidly twirled, give our eyes the impression of a circle of light.

But, however this matter may be, though mistakes of various kinds are possible, we are none the less all of us certain as to *some* past events in our lives. It may be an event of childhood; it may be one when leaving school; it may be our marriage; or it may be the last thing that those who are now reading this did before they began to read it. As to some portions of the past, memory gives us as much certainty as we can have with respect to some portions of the present—if we can have reflex knowledge of anything *absolutely* present.

If we could not trust our faculty of memory, not only would all history be impossible, but we could never order our future conduct according to the lessons our experiences of life ought, and are supposed, to give us.

But the veracity of the faculty of memory can never be proved, and is, manifestly, a self-evident truth carrying with it its own certainty. There can be no possible proof of it, because we cannot argue at all unless we already trust it. How could we ever reach the conclusion of a syllogism if we could not trust our memory as to what the assertions of the major and minor premisses were?

Yet, marvellous to relate, an eminent physicist once declared that we may trust our memory because we learn its trustworthiness *by experience!* Surely never was fallacy more glaring! How could we ever gain experience *at all* unless we trusted our memory in gaining it? What the physicist said, in effect, amounted to this: "You may trust your present memory because experience has confirmed it, while you can only know that it has confirmed it by trusting your present memory!"

But memory, as will be quickly pointed out, performs a yet more wonderful office than any we have yet described.

In the beginning of this work[1] we pointed out the great distinction which exists between the "objective" and the "subjective."

Every "feeling," "thought," "desire," "volition," or other "state of consciousness" present to the mind of whoever is the subject of it, is spoken of as being "subjective." It is a thing which pertains to the subject—to the mind which feels or thinks. The whole of such experiences, taken together, constitute the *subjective world*, or the sphere of *subjectivity*.

On the contrary, everything whatever which exists externally to our present consciousness or feelings is spoken of as being "objective"; and all that is thus external to the mind constitutes the *objective world*, and is the region of *objectivity*. It is the world of real *objects*—the world which occasions thought or feeling as opposed to the subjective modifications so occasioned.

Everything which is *subjective* pertains to the *self* or Ego during the time in which that "self" is feeling or thinking.

Everything which is objective is external to the self which is feeling or thinking, so that all states, even of the "self" or "Ego," which are anterior to the time when that self or Ego feels, are also objective—objects of thought, indeed, but not the thought or feeling of the thinking subject—not *subjective*.

[1] See *ante*, pp. 8, 9.

All thoughts and feelings are "objects" and *objective* while they are being thought of or reflected upon, while the acts of "thinking about" them or "reflecting on" them are *subjective.*

It is generally recognised that there is no greater antithesis than that which exists between the subject which thinks and everything which may or can be an object of thought. It is the great distinction between the "self" and the "not-self." Every modern philosopher, beginning with Descartes, has sought in vain to discover a bridge capable of spanning that abyss. To avoid the difficulty the materialists have simply ignored the need of a bridge, and pretended they were already on the other side, having effected the transit by an act of blind credulity; while the idealists, like the philosophers of Laputa, have tried by elaborate calculations and manipulations of mere feelings to bring the other side over to themselves.

Yet all the time nature has provided us with the simplest and most practically useful of bridges in the mere existence of that conscious memory which is involved in our perception of our own substantial being.

That is the "yet more wonderful office" performed by memory to which we recently made reference. It is the bridge implanted in our own being between object and subject. It is memory which enables us to get intellectually outside our present selves and our present feelings and sensations, in a way no sane man can question.

For memory, inasmuch as it reveals to us part of our own past, reveals to us what is "objective," and so actually introduces us into the realm of *objectivity*, shows us more or less of *objective* truth, and carries us (as we have before said) into a real world beyond the range of our present feelings, our sensations and sense-impresses.

The power which memory possesses of thus lifting us, as it were, out of our present selves and showing us facts which otherwise we could never know, is certainly a *most* wonderful power; and, if we only have certainty as to one of our past experiences, even if that took place but a few hours ago, one such certainty would alone be sufficient to prove indisputably that we can and do, through the faculty of memory, learn real *objective* truth and can be certain about much more than mere "impressions" and "sense-impresses," more than "appearances" and "present feelings," more than mere "phenomena"—namely, about objective reality.

Thus the fact that we can know with certainty our substantial, continued existence, and facts anterior to our present feelings, is a truth fruitful indeed with far-reaching consequences.

We have said that in the recognition, by a reflex act, of our continued being, subject and object were, "in a sense," identified.

We used the expression "in a sense" for a very definite and important reason, for though in that recognition subject and object are to a certain extent conjoined and so "identified," yet what memory vouches for remains truly "objective"; our past states and experiences are distinct *objects* of cognition. Nevertheless, the consciousness which recognises them and affirms, through them, our own identity (all through the changes and experiences we have undergone), is no less completely and truly "subjective"—it is the conscious act of the *subject* which cognises and witnesses its own being and past experience.

Therefore, in this act, subject and object, in one sense, keep the distinctness of their two natures, while, in another sense, they become identified in a single act of reflex conscious cognition.

In this circumstance we have indeed a vast and profound distinction between human nature and anything of which the psychical being of mere animals has as yet, to our knowledge, shown itself capable. No one pretends that brutes possess this marvellous intuition, while it is and must be present, however unrecognised, in any savage who has but one recollection of anything he has done or has had done to him.

It is thus alone that we can unite the past with the present and say "I am." These two words have an immense significance for anyone who will carefully ponder over them. They signify that he who utters them intelligently recognises certain past acts as his own acts, and that a continuous unity (himself) has persisted, essentially the same, for a longer or shorter time and has had more or less varied experiences. He who utters them also thereby indicates that he has the power of knowing at least one objective existence which his senses cannot perceive.

Such must be the case, because our senses can only feel what is present to them; they can never feel the past. The very fact of our feeling anything shows, with certainty, that something is actually present which occasions that feeling. But it is clear to everyone that his intellect can, by the help of memory, know with certainty something which is far from being present here and now, namely, some event of his past life. Similarly, he is thus able to perceive his own continuous existence, which is most certainly a thing which cannot be felt. Our body can, of course, be felt as often as we like, in several ways at the same time, and as long as we choose to feel it. Nevertheless, each time we feel it we can but experience the present feeling, and without memory and without reflex acts of the intellect, we cannot know that our own body has, and has had, a continuous enduring existence. It can never be *felt as* "enduring," although by the aid of repeated sensations it can be *intellectually perceived* to be enduring. But the intellect, aided by memory, can know very well, by itself and directly, that it has an enduring permanence, and that the thought of the day before yesterday was its own thought. It can know this with a degree of certainty which it is impossible to attain to as regards any other fact. To doubt the continuous existence of our body from day to day would be absurd indeed, and a sure sign of lunacy; but to doubt the continuous existence of the intellect, while illuminated by a clear memory as to some of its past acts, known with certainty to have been performed, would be infinitely still more absurd.

This power of memory, however, is so wonderful, and the consequences which follow the recognition of the work it does are so profound, that it is in no way surprising its value should have been underestimated. Yet, as we have seen, its validity cannot be impugned without intellectual suicide and falling into a fatuous system of universal scepticism. The self-evident truth that our faculty of memory is valid is one, the acceptance of which is absolutely necessary for the pursuit of any inquiry, and for the full recognition of what is for us the most certain of all facts, namely, the fact of our own existence.

We have now seen (1) that certainty does exist—that there is such a thing as certainty—(2) that our own existence is a most certain fact, and (3) is vouched for by our self-evidently valid faculty of memory.

But facts alone, however certain and well-remembered, cannot constitute science without the aid of some abstract fundamental principles. We require a knowledge of some principles which are self-evidently true ever and always. Otherwise we could never arrive at certain truths with respect to any matter of investigation or study. These principles, also, must not merely be laws and conditions of our own mind, but must be true of all objects open to our ken. They must be true objectively as well as subjectively, and must be laws of "things" no less than laws of "thought." They must be seen to be necessarily true everywhere and everywhen, quite independently of any or of every mind. If such be the case, the same laws must apply to the most common circumstances of every-day life as well as to the highest matters of philosophy. They must also be no mere blind mental processes, the result of any faculty such as instinct, or be due to any kind of non-rational impulse. Their influence must be seen in daily life, in actions resulting from definite and certain intellectual first principles and necessary and evident truths, to which the competent philosopher can always trace them. This does not mean they are evident *as* such principles and truths to the mind of every man who uses them, but that their truth is completely evident without reflection. In vain will the village grocer try to persuade the farmer's wife that if from sixteen ounces of tea two ounces be removed, the rest is none the less equal to a pound. She will be quite sure such is not the case, though she may be quite guiltless of the knowledge of a single axiom. Similarly, if a labourer has given the whole of his week's wages to his wife, he will be quite sure no part of them is still in his pocket, though he never heard a word about any first principles. The intellectual light of such first principles illuminates the intellect of every sane man, be he civilised or savage. Not, most certainly, that savages and ignorant men can know such principles *as* abstract truths. But those principles, none the less, reveal themselves to the mind in the concrete facts of every-day life as practical motives for judging and acting. It is true we cannot explain *how* these truths became thus practically apprehended in the objects and actions of our constant experience, but we are and must be ignorant of

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"how" anything, which is for us ultimate, is, whatever it may be. The "that" must ever be final. The "how" can never be so, for the answer to every "how" must be a "that."

The first and most important of these principles is the perception of the reality of existence—that what we perceive to exist evidently does in truth so exist. This is often expressed by the formula, "A is A," a formula which to some persons appears utterly trivial, but which, nevertheless, lies at the basis of all our knowledge, and is a fundamental certainty without which no science could even begin to be.

Another principle is that known as "the excluded middle," which affirms that any given thing must either be or not be, closely allied with which is that great regulative principle to which we have already adverted,[1] and which is called "*the principle of contradiction*"—the principle, namely, that nothing can, at one and the same time, both be and not be.

Now it has been strangely objected against this law of the universe, that it is but a law of grammar, or, at most, of logic. It has been said[2] to be but "a verbal convention," not possessing "objective validity."

But the objector might be (as, in fact, he was) asked "whether, if he had lost an eye, he would still remain, after that loss, in the same condition as he was in before?"

If anyone does not see the objective impossibility of such a thing in all places and at all times—*i. e.*, if he does not apprehend the application of the law of contradiction—then he either does not understand the question, or his mental condition is pathological.

Men may pretend to doubt such principles, their own

[1] See *ante*, p. 105.

[2] See *Nature* for Dec. 20, 1891, and Feb. 11, 1892.

existence, or the objectivity of mathematical truths. But their practice demonstrates their unfailing confidence in them on each occasion as it arises—as when cheated by false accounts, personally injured, or busied with some serious investigation. That nothing can simultaneously be existent and non-existent does not at all depend on the words employed to denote that truth, but is "a law of *things.*" It would not lose its validity and objective truth, not only if there were no such things as "words" at all, but it would not lose them if the whole human race came to an end. The necessity and universality of this principle is easily recognised. Thus if we think of what the condition of things must have been a long while ago—in the days of Julius Cæsar, or when palæolithic implements were first fashioned—we shall see that the law of contradiction is as sure and certain with respect to the past as it is with the present. We do not "think," we actually "know" with absolute certainty that had Julius Cæsar been drowned off the coast of Britain he could not also have been assassinated in the Roman Senate House, as also that at the time when some early palæolithic man was in the act of fashioning a flint implement, he had not then both his hands empty. The same certainty exists as to the most distant regions. We are quite sure that the moon's surface cannot be both mountainous and also absolutely smooth, and that the spectrum of a fixed star which shows certain definite lines, cannot at the same time be devoid of them. Such assertions might well seem too superfluous and trivial did not men who have written letters to the journal named *Nature*, make it only too evident that they are sorely needed.

This first principle, this law, then, is one of those which are at once both absolute and universally necessary, while they are incapable of proof and carry with them their own evidence.

But it is possible that one or two of our readers may be startled at those words which we have more than once used, namely, "absolutely necessary" and "universal." They may feel some vague doubt as to how this matter may be in the Dog-star now, or how it may have been long ages before our nebula was churned into worlds—supposing the solar system did so arise. We may be asked: "How is it possible for creatures such as men are, mere insects of a day, inhabiting a floating atom in an obscure corner of the universe, to know that anything is, and must be, absolutely true for all regions of space and the most distant abysses of time?"

Yet, in fact, we know much more even than this. However poor, feeble, and incomplete intellectually human nature may be, it is nevertheless endowed with power to see necessary limits to the action even of Omnipotence itself.

Let us suppose that our planet might have been the abode of vegetable life only; its hills and dales and plains abounding in forests in which the voice of no songster could be heard or even the hum of insect life. Let us also suppose that the world might have been devoid of dry land and covered everywhere by an ocean, in the waters of which animal life existed exclusively and abounded. However possible we may suppose each of these conditions to have been, it is manifest that no power, however omnipotent we may believe it to be, could ever have made both of these possible states of our globe simultaneously actual. Such considerations as these may help to give confidence to any of our readers who, from want of thought, may have been disposed to doubt their powers of perception as to necessary truths and truths of a lower order. It is necessary, indeed, to be careful not to declare anything to be certain till it has been seen to be clearly and indubitably true; but it is no less necessary that we should not shrink from declaring that to be true, the certainty of which is evident to our minds, however wonderful it is, and however inexplicable may be the fact of our knowledge of it. We are able to explain how it is we know many things, but how we know primary and fundamental truths which are self-evident and necessarily incapable of proof must ever remain for us entirely inexplicable. Were they explicable they could not be ultimate.

The feeling of distrust which some persons experience when they are told they can know with absolute certainty certain truths to be both universal and necessary, seems to be due to a habit of mind which has been brought about by an unconsciously formed association between ideas. Things which are very remote in space or which happened ages ago are generally known to us as results of elaborate mental processes, and some uncertainty about them is by no means uncommon. On the other hand, we often feel very confident about matters the circumstances and conditions of which are within easy reach of our powers of observation. Thus we have come to associate a feeling of uncertainty with respect to statements concerning things which are very remote in either time or space. It is not, then, surprising that a feeling of vague distrust should arise when beginners in philosophy hear it affirmed that the law of contradiction applies equally to whatever concerns the Dog-star and our portion of the universe, myriads of ages before the solar system had its first origin.

It is, as we have before said, very wonderful that we should have this knowledge of necessary truths, but, as before[1] pointed out, it is most wonderful that we should know anything.

Yet if we deny or doubt " the law of contradiction " we fall, as before said, into the most unutterable absurdity—

[1] See *ante*, p. 56.

that of absolute scepticism, which shows, by a *reductio ad absurdum*, that our denial, or doubt, was itself absurd, and that we must admit that law's universal validity.

But, once more, it is no mere law of our own minds, no affair of mere logic, since, if we are to accept as absolutely true what our reason declares to be self-evident, it is a law which applies to all things from physical phenomena to mental states. Such we have seen to be the case with respect to the various instances we have put forward as examples. When we say that the number of balls in a bag cannot at the same time be both " odd " and " even," we are certain that this is not a truth due to our organisation, but to the real necessary objective conditions of existence of the balls themselves. Our reason declares that the law of contradiction is no " form of thought " imposed on our intellect, but is a certain and inevitable law of objective existence independent of our intellect.

To doubt this would be to destroy all certainty, since it is a fundamental truth on which all reasoning depends.

If we could not be sure that the fact that " all men are mortal " did not necessarily imply that none could live forever, we could never infer the mortality of anyone as a consequence of his humanity. Thus for anyone to attempt such a task as that of " proving " the law of contradiction would be, in the highest degree, absurd, since he would be compelled already to assume its certainty at the very outset of his demonstration—at the very first assertion he made.

Our perception, therefore, of the necessary validity of the law of contradiction, teaches us both an absolute verity with respect to objective existences—with respect to the matter of all science—as well as the existence of our own mental perception thereof.

Another principle of universal application and self-evident validity is the well-known axiom: "Things which are equal to the same thing are equal to each other."

As with the law of contradiction, so with this axiom—it is practically known and constantly acted on in every-day life without advertence to its axiomatic character, and even without any knowledge of it as a recognised truth at all. The familiar application of a yard measure to different objects is an amply sufficient demonstration that such is the case. But the principle applies not only to the equality of material things but to every kind of equality—equality of motion, illumination, and feeling—and it is evidently a principle of objective validity, and is a law of things no less than of thought.

This axiom about equality, though it can be illustrated by any number of instances, can never be proved by reasoning. It is a self-evident truth which reposes on its own evidence—as do the other axioms of mathematics. The same may be said of the fundamental laws of mathematics and geometry.

Yet a very curious argument against the objective validity of our perceptions in such matters has been put forward by persons no less distinguished than the late Professors Clifford and Helmholtz. Their object in advancing it was to show by an example how truths which appear necessary to us are not objectively necessary. But the result of their efforts was the direct contrary of what they intended. Their intention evidently was to support the proposition, "We can know no truths to be absolutely necessary," but the result was to show that even according to them some truths are (and were, even in their own eyes) absolutely necessary. The necessary truths they proposed to controvert were: (1) "A straight line is the shortest one which can be drawn between two points," and (2) "Two straight lines cannot enclose a space."

To prove their contention they imagined the existence of curious living creatures possessed of length and breadth but devoid of thickness, living on a sphere with the surface of which their bodies coincided. They were supposed to have experience of length and breadth in curves, but none of height or depth, or of any straight lines. To such creatures, it was said, our geometrical truths would not appear to be "truths" at all. A straight line for them would not be the shortest line between two points, while two parallel lines prolonged would enclose a space.

But beings so extraordinarily defective might well be supposed incapable of perceiving geometrical truths evident enough to others less imperfect—such as ourselves. Nevertheless, if they could at all conceive of the things we denote by the terms "straight lines" and "parallel lines," then there is nothing to show that they could not also perceive those same necessary truths concerning them which are evident to us.

It is strange that the very men who brought forward this fanciful objection actually showed, by the way they made it, that they themselves perceive the necessary truths of those very geometrical relations the necessity for which they verbally denied. For how, otherwise, could they affirm what would or would not be the necessary results attending such imaginary conditions? How could they confidently declare what perceptions such conditions would certainly produce, unless they were themselves convinced of the validity of the laws regulating the experiences of such beings? Anyone who should affirm (as they did) that they can perceive what would necessarily be the truth with regard to the perceptions of such beings, would thereby implicitly assert the existence of some necessary truths, or else their own argument itself must fail as utterly futile.

There is one more general principle which, for the end we have in view, we must endeavour to depict as fully as we can, namely, the principle of causation. It is, however, so important in our eyes that we will reserve its treatment for the following chapter, and terminate the present one by presenting to our readers the remarks we have yet to make with respect to the process of reasoning.

The process of deduction, its validity, and the force of the word "therefore," have been already referred to in our fourth chapter,[1] but here they must be considered more fully.

Of the many truths to a perception of which the human mind has attained, a large proportion have been reached by reasoning, and the reasoning process is, as we all know, one so important even to the progress of science, that any attempt to dispense with its use would be an endeavour fit only for a lunatic. For an exploration of the groundwork of science, a clear perception of the validity of the process of reasoning is an indispensable antecedent. Of course, it is in the first place necessary that all reasoning should be strictly logical. Logic has two ends in view: one is to teach us how to avoid certain errors, the commission of which would vitiate all our reasoning; the other is the manifestation of truths which are involved in, and depend upon, the recognition of other antecedent truths, from the truth of which they necessarily follow as consequences. It is with the latter end of logic we are here concerned, and we have to make manifest the fact that the conclusion of any properly constructed syllogism, the premisses of which are true, is a proposition which, as a consequence, is necessarily and self-evidently true.

If it is really a fact that all female whales have mammary glands, or organs for suckling their young, then if a particular animal just caught turns out to be a female whale, we

[1] See *ante*, p. 103.

may, in that case, most confidently expect to find it provided with such organs.

But many objections have been made to such syllogistic reasoning on the ground that the conclusion is already contained in the premisses. If "all men are mortal," such objectors say, then those who know that, know that any special man, such as Socrates, is mortal also, and, therefore, the assertion that he is mortal can be nothing more than a repetition of part of the major premiss. Here then, they say, we have no true "inference" at all, but merely a restatement. We do not "conclude" that Socrates is mortal, but only say over again, with the use of his name, what was said before without the use of his name.

Now, of course, the mortality of Socrates, and the mammary glands of the freshly caught female whale, were implicitly included in what was previously known about "all men" and "all female whales." Unless they were thus "implicit," they could never be seen to follow as explicit consequences in the conclusions of the respective syllogisms. But the syllogism really does afford fresh knowledge to the mind, and often very important knowledge, by making truths *explicit* and manifest, so that they can be most clearly recognised, which before were merely *implicit*, and so were not necessarily obvious.

There is, indeed, a very great difference between implicit and explicit knowledge. To cause a knowledge which we only possess "implicitly" to become "explicitly" present to our minds, may often be, in effect, to give us fresh knowledge altogether—practically to give us a knowledge of something whereof we had before no available or conscious knowledge at all.

Let us suppose that a youth has learned by heart the characters which respectively distinguish the four classes of backboned animals—beasts, birds, reptiles, and fishes—but that he has seen and knows very little about specimens of different kinds. It would be by no means wonderful if such a youth should consider a porpoise to be a kind of fish. But his teacher might remind him that all creatures possessing certain characters of brain and heart were beasts. He might thus come to see that the porpoise, which he took to be a fish, must, since it has those characters, really be a beast.

Referring again to the character of this class of beasts, he might further exclaim, "This fish-like thing, when alive, must, as being really a beast, have had warm blood." His conclusion would have been a perfectly correct one, and in this way his inferences would really have supplied him with knowledge which he certainly did not possess before.

So great, indeed, is the difference between explicit and implicit knowledge, that the latter may not deserve to be called "knowledge" at all. Probably there is no opponent or derider of the syllogism who will venture to affirm that a student who has learned, and recollects, the axioms and definitions of Euclid, can, by that fact alone, have obtained such a real knowledge of all the geometrical truths the work contains, that he will fully understand all its propositions and theorems without having to study them. Yet all the propositions, etc., of Euclid are *implicitly* contained in the definitions and axioms. Nevertheless, in spite of that, the student will have to study much and go through many processes of inference, by which he may be enabled to recognise these implicit truths explicitly, before he can truly be said to have any real knowledge of them.

Of course, in the very rare instances in which the major premiss expresses a truth which has been arrived at by an examination of every instance referred to in it—a "complete induction"—there is nothing implicit.

Thus, if we knew with absolute certainty that *every* man, woman, and child in some Indian village was a leper, then to say that a man came from that village would be equivalent to saying *explicitly* that he was a leper. In such a case there would be no evolution of implicit into explicit truth—there would be no process of inference, and the word "therefore" would, if used, be quite out of place.

Such cases are, however, most rare. No one can pretend to know by a complete induction that all the radii of a circle are equal. It is absolutely impossible to examine all existing circles; besides, the assertion that all the radii of a circle are equal applies not only to all existing, but also to all *possible*, circles.

Similarly, if we are shown a triangular figure and are asked, "Are its angles equal to two right angles?" we may not be able at once to answer the question by directly inspecting the figure. If, however, we already know that the angles of every triangle are together equal to two right angles, then we should be able at once to infer the truth, and to say that in so far as the figure approximated to an ideally perfect triangle, would its three angles approximate to two absolutely perfect right angles. We should arrive at this truth mediately, and reach the conclusion by the combined help of a major and minor premiss.

A very great part of the knowledge we acquire throughout our whole lives is acquired, in this indirect way, by the help of that mental process which is expressed by the word "therefore."

But we have no special reason to be proud of that word, since it implies that we are compelled to get at truth by a very roundabout process. Were our intellect of a much higher order,[1] it is conceivable that we might be able to see equally well, and at one and the same time, all those truths which a proposition may contain implicitly as well as

[1] See *ante*, p. 102.

explicitly. In that case, of course, we should be saved the trouble of any process of inference. The truths we now have to gather indirectly, would then be directly evident to us, just as our own actual mental activity is evident to us. Only having, however, the imperfect nature we possess, we must be content with the more laborious, though practically sufficient, process of inference or ratiocination. We must be content to gain actual knowledge from implicit truth by placing propositions side by side, and so evolving explicit truth as a consequence of that process properly performed.

Reasoning, then, is an indirect process of attaining truths, and one which, when properly carried out, is necessarily and self-evidently true. It is not, however, the highest kind of act our intellect is capable of. Its highest possible act is the direct apprehension, or intellectual intuition, of a universal and necessary truth or of a concrete fact as absolutely certain and self-evident.

Just, however, as certainty, self-perception, the principle of contradiction, and axiomatic truths, may be perceived directly with reflex advertence to each, so also correct reasoning can be carried on, and the force of the term "therefore" (as the expression of a truth which is a consequent from truths antecedently known) appreciated, without any reflex consciousness of ratiocination as a process, and a process performed by us.

It is, of all things, important to note and keep in mind the truth, that "thought" as we know and experience it, is our only means of arriving at knowledge, and gives the highest certainty thereto. It is evidently necessary to state this very distinctly, since there are men who profess to be philosophers and yet ignore or deny this truth. To suppose that by any kind of reasoning we can come to understand what we can never think, may seem an utterly incredible folly; yet at a meeting of a metaphysical society in London, a speaker, a few years ago, expressly declared "thought" to be a misleading term, the use of which should be avoided.

"Thoughts" may be, and should be, carefully examined and criticised; but however much we may do so, and whatever the results we may arrive at, such results can, manifestly, only be reached by thoughts and must be expressed by the aid of our thoughts.

We are far indeed from denying that unconscious activities of various orders take place in our being; yet, whatever influence such activities may have, they cannot affect our judgments save by and in thoughts. Even if a man should become convinced that his thoughts were worthless tools, he could only arrive at that conclusion by making use of the very tools he declared to be worthless. What, then, ought his conclusion to be worth even in his own eyes?

We can never justify reason, because we must employ reason in criticising and seeking to justify it, and so work in a circle. Not to trust our reason before we have justified it, is to be, as Hegel said, like the prudent σχολαστικός who would not enter the water till he had first learned to swim.

It is simply impossible by reason to get behind conscious thought, and our thoughts are, and must be, our only means of investigating problems however fundamental.

Yet some persons appear to believe that our convictions even as to self-evident truths may be invalidated on account of the causes which have, or may have, been at work in eliciting them. This question forces us to consider the principle of causation, its nature and effects, in this relation amongst others. To that consideration, then, the next chapter will be devoted.

CHAPTER IX

CAUSES OF SCIENTIFIC KNOWLEDGE

IN the introductory chapter to the present work we observed how constant was the desire of ordinary men to know the "how" and "why" of things—to know the causes and circumstances of events. To know this is, as before said, above all, the aim and object of science, and to the successful man of science the old adage eminently applies: "*Felix qui potuit rerum cognoscere causas.*" But not only the devotee of science, but every man on every day of his life, experiences what he regards as the effects of causes, and deems that he produces effects himself. Whatever may have brought it about, it is plain that notions of causes as really acting, and of effects which are produced by them, have somehow become embedded in the mind of man and are ready to start up and manifest themselves at any moment. Indeed, so strong is the notion of the necessity of causation, to account for all we see about us, often felt to be, that it has given rise to the assertion, so often made, that "everything must have a cause."

Yet such a dictum is quite untenable, and would lead us to a *regressus ad infinitum*, since, should our reasonings and our intuitions convince us there must be a first cause, we should have then to postulate another cause for that first cause's existence, and so on without end.

But if we examine our own minds as to the nature of our conception of cause, and especially what seems to call it forth, we shall find that it stands in close relation to our perception and idea of "change."

When some change occurs, or when anything strikes us as being a new thing, we spontaneously look out to see what has brought it about—what is its *cause*. And very often our investigation is quite satisfactorily repaid. We find what the cause was, and that we can by experiment again produce the effect whenever we will.

Think over the matter as we may, when we perceive a change, or that a new existence has come into being, we are at once certain that *some* cause must have produced it. If we have gone out of doors, leaving our library window open, and on our return find it shut, we are at once absolutely certain that some person or thing must have shut it. If an infant begins to cry violently without any external cause, we are sure that it has experienced some painful feeling, produced through some internal modification. If we find in a bird-cage which has long been shut up and tenantless, a living thrush, the notes of which have attracted our attention, we are at once as certain as it is possible to be that, if it did not find its way in itself, someone *must* have placed there this, for us, new existence.

This mental conviction of ours is no negative one, such, *e. g.*, as that "we *cannot* conceive such changes or new existences without a cause," but that we positively *do* see "*that every change or new existence is, and must be, due to some cause.*"

This proposition, indeed, expresses an intellectual intuition which is for us a necessary and universal truth, and one self-evident. As such, of course, it is quite incapable of proof; but a little pondering over it will, we think, make its self-evidence quite clear, and show that it is no *blind* habit of mind "due to custom," as Hume said (as if the *origin* of any idea could be explained by such a notion!), but is one *seen* to be necessarily true.

Thus, in the first place, a new thing could never have caused itself, because it could never have acted before it came into existence. It must, therefore, have been brought into being by something else.

Secondly, every change in anything which already exists is, in fact, a new mode of being; and therefore equally demands a cause for its existence. It must, then, be due either to something distinct from it, or to some antecedent mode of being of that which now exists in its new mode.

Thus, when we awake from sleep, our awakening must be due either to something external which has awakened us, or to some change which has taken place in our own organism. In the latter case, that change or new mode in our being, which we call "wakening from sleep," had for its cause an antecedent state of our body—increased vigour of the circulation or what-not.

Moreover, all the various objects we see or feel must, each of them, we know, be a result of the action of some cause or causes external to it. This is, of course, most manifestly evident with respect to every artistic product, and everything which has been made by man. But a little reflection will show that the same is the case with all the products of nature. No stone we tread upon, no patch of sand or mud, can have come to be what it is, save by the action of antecedent causes. The shape of every mountain is, at least, largely due to the action of water, and so on. And this law of causation applies to the most minute and simplest, as well as to the largest and most complex, of bodies. Even pieces of matter, which, so far as we yet know, consist of but one chemical element—such as a fragment of gold or carbon—owe the shape, place, and the relations in which we find them, to conditioning causes. And carbon in its brilliant condition as a diamond (a state we term crystalline) is equally an effect of causes; and, as yet, all the causes which have produced all the diverse and most definite forms of crystallisation, which are characteristic of different minerals, are for us mysterious.

Any and every such object demands a cause for its actually being in the place it is, at the time it is there, for its size, its shape, etc., and for all its relations to surrounding things, as well as for any special qualities of its own internal conditions. These special conditions would demand a cause, even if such a body existed alone and by itself in an otherwise empty universe—if we may permit ourselves to frame for a moment so absurd an hypothesis.

Therefore, everything which can be seen not to contain a sufficient cause for its own existence within itself, must be due to some cause or causes external to it. Nothing which is composite, capable of division, or which gives evidence of having had a beginning, can be so seen to contain within itself a sufficient cause for its being.

Moreover, this perception of the necessity of causation is not, as before said, the mere result of a mental impotence of the imagination—it is not a negative inability to imagine a complex thing uncaused—but a positive and active power of perception. Let the reader first consider his own idea of a stone of some definite shape and size, made of two or more mineral substances. Then let him ask himself whether he does not actively and positively *see* that its shape and composition must positively be due to influences of different kinds, or whether he finds himself merely passive and unable to help himself to an actively intelligent conviction on the subject.

The idea of a " cause " is closely connected with the conception of " power " or " force "—ideas gained through our own personal experience. When we make strenuous efforts, or are overborne by the active energy of somebody or something else, we have this experience. We know, also, our own power to think and act, and the influence exercised by our own will. But there is another yet more noteworthy instance of the exercise of power which may come within our experience. When under strong temptation to indulge in some very keen and entrancing pleasure, we can easily perceive, if we will, the strong hold the desire for self-indulgence has over us and its power and force in attracting our will in one direction. Similarly, when the thought of most repulsive consequences which will probably, or certainly, follow such indulgence occurs to us, we may feel the power exercised by that thought in repelling us from it and in some contrary direction.

The idea of "power" or "force" is a primary ultimate idea which cannot be resolved into other more fundamental or elementary conceptions. If the reader doubts this, we would recommend him to try so to resolve it himself.

But the reality of our conception of cause—of our perception of the universal and necessary truth of the law of causation—has been denied on the following grounds. It is objected that though we have, of course, seen one condition, relation, or event follow another condition, relation, or event, we have never once perceived any inflow or passage of influence from one thing to another; and yet the law of causation implies the existence of such a thing. We have never, it is further stated, really seen or felt any "causation," but only sequences of one kind or another. Therefore, it is concluded, there is probably nothing but sequence, and our idea of the passage of influence in causation is a mere mistake, derived from foolishly transferring in imagination to external things that "feeling of effort" which we experience in our actions, such mistake being then perpetuated by custom.

This objection is very easily answered. It is, of course, quite true that we never see the act of physical causation over and above the things which act and react, because it is invisible as well as intangible. But though our senses cannot perceive it, our intellect can and does. When we knock a nail into a board with a hammer, it is simply nonsense to tell us that because we can only perceive the nail, the board, and the hammer, we cannot *know* that we exert a force which *makes* the nail go in.

But there is one instance in which a man can be aware, through his actual *feelings*, not only of an antecedent and consequent, and the relation of causality between them, but also the very bond or nexus between them may be not only distinctly perceived by our intellect, but its inflow actually felt. This is whenever a man is in doubt about what course to pursue owing to his being drawn in different directions by different motives. Then the inflow and force of the conflicting motives acting upon his own mind can be distinctly perceived by him. This instance is substantially the same as that we before adduced with respect to our perception of the emission of "force." We can all also perceive force when anything resists our will. Thus, let us suppose that the stem of a small tree has been partly sawn through, and that we then try whether we can pull it down. If the coherence of the part not sawn through is still very great, we may have to exert all our force to overcome it. When at last we have succeeded, and are exhausted with our efforts, we may feel very vividly that anyone who denied we had *caused* the tree to come down must be as great a lunatic as anyone who denied the real objective existence of the tree itself.

But it may be said (we know it may, because such follies have actually been printed) that, though we may be conscious of our own force, we err if we assert efficient causation in any other instance. In fact, Mr. Herbert Spencer has said that by such an assertion we make the great mistake of attributing to inanimate things feelings like those we experience in making such physical efforts. Surely greater nonsense has rarely been written. Let us suppose the partly-sawn-through tree to be not even touched by us, but that a gale has sprung up which, after having swayed it to and fro, breaks it off, and prostrates it, just as we have supposed it prostrated by human efforts. Are we not then to say that the wind has exerted as much force as was ours ? Can we not say this confidently, without being such idiots as to attribute " feelings " to the wind ?

Truly, then, we have in our observations and experiments with external things, as well as in the consciousness of our own efforts and the action of motives on our minds, actual experience of causation, while, as we have seen, a very moderate study of the matter suffices to show us that the law of causation is a necessary and universal truth which carries with it its own evidence.

A clear perception of the law of causation gives efficient support to a great principle, without which all science would be absolutely impossible. This is the law of *the Uniformity of Nature.*[1] It is true that the ordinary experience of mankind makes men perfectly contented that things will take their normal course, *e. g.*, that the sun will daily rise and set, and that any tool dropped from the hand will at once fall towards the ground unless otherwise upheld. In circumstances which seem to recur under, so far as we can see, the same conditions as those wherein they occurred before, we naturally expect the same results to ensue as we before met with; and such expectations are fulfilled.

Nevertheless, mere common sense and human testi-

[1] See *ante*, p. 106.

mony cannot suffice, any more than the experience of any individual can suffice, to show that the uniformity of nature is, and must always be, positively certain and absolute. Our mere observation of natural laws can never suffice to enable us to affirm that never and nowhere is there a lawless condition of things, or that such a lawless condition may not one day come within our own sphere of experience—utter irregularity of co-existences and sequences. But here that necessary and self-evident principle, the law of causation, comes in, and supplies us with the basis for science which is so imperatively required. For, since there can be no change without a cause, it follows there can be no difference between the results of two perfectly similar sets of antecedent conditions, and that the more completely two sets of conditions are alike, the more completely similar will be the results produced by them.

Thus the uniformity of nature is a necessary result of the law of causation, which necessary and self-evident truth gives the efficient and necessary support to that expectation which good sense and human testimony combine to produce in us.

But there must also be a certain proportion between any physical or mental cause and its effects; and our reason assures us that we can to a considerable extent judge as to causes by the effects they have produced. We can often form a rational judgment as to the adequacy of some cause to produce a given effect. No child with a toy hammer could level the Great Pyramid of Egypt, and no ignorant peasant could translate and adequately comment upon Plato's *Symposium*. No creature devoid of intellect could ever perform a truly virtuous action, for it could have no perception about ethical relations. That a cause must be adequate in order that a given effect may be produced, is an absolute, universal, and necessary truth, no less than is the law of causation itself, as is commonly if tacitly assumed.[1]

But, as we before observed, an objection is often raised to this assertion on the ground that there is no resemblance between the steel blade of a dagger and the wound it can inflict or between a red-hot coal and the burn it may occasion. How, we are asked, could we know, *a priori*, the "adequacy" of either to produce the "injuries" they respectively cause?

But, in the first place, there is a certain resemblance between the width of the cut and that of the dagger's blade, and between the size of the coal and the extent of the burnt surface. In addition to that, it is plain, after a moment's thought, that the "adequacy" of the cause to produce the effect is neither in the steel nor in the coal, but in these as affecting a sensitive organism which they may injure. The organism and the agents are together adequate to produce the effects cited, and that adequacy is evident to our reason, and sufficient.

But the one appeal of physical science is to "experience"—to observation and experiment, and the verification of hypotheses thereby. And what does experience teach us? In many instances, of course, our ignorance of the intimate nature of, or the powers and properties of, bodies, makes us quite unable to anticipate, *a priori*, what effects may be produced; these we can only learn by experience. But in multitudes of every-day observations, the inadequacy of some things to produce certain effects (as with the child's hammer and the pyramid) is manifest, as is the impotence of an ignorant man to teach Greek, or of an impecunious one to lend a sum of money; so that experience fully bears out the ancient dictum: "*Nemo dat quod non habet.*"

[1] See *ante*, p. 66.

We have now passed in review in the preceding and present chapters the questions as to: (1) the existence of certainty, and that what is, exists; (2) what must be our ultimate criterion; (3) our perception of our own substantial existence; (4) the validity of our faculty of memory; (5) the principle of contradiction; (6) mathematical axioms; (7) the validity of the reasoning process; and (8) the law of causation. We hope the views here advocated concerning these questions may have commended themselves to the judgment of our readers. If so, we have already succeeded in the greater part of our task. For there can be no question that if the fundamental principles we have put forward are necessary and universal truths, which carry with them their own evidence and constitute the ultimate criteria of human knowledge, they must also constitute a large part of the groundwork of all science.

These truths we can recognise for what they are, namely, absolutely certain and self-evident facts and principles. But however evident they may be, it is no less evident that we did not always recognise them. Not only in our infancy, but during childhood and early youth we were either altogether ignorant of them or, at any rate, did not take them for what we now see them to be.

How, then, did we come to obtain a knowledge of them, and is it possible that the mode in which we acquired them, whatever it may have been, can give us reasonable cause to mistrust them, or be half-hearted, as it were, in our recognition of them as absolutely true facts and principles? Can we gain any light as to what may have been the causes of our certitude, and have such causes any real bearing on that certitude's validity?

We have already disposed of that most unreasonable of all suppositions, namely, the supposition that what we have represented as first principles can possibly be based on reasoning. We have seen[1] that such a system results in a *regressus ad infinitum*, and would necessarily emasculate reasoning by depriving it of its indispensable premisses. But some persons would represent our deepest convictions as nothing but the result of habit and associations of images and ideas, which have become so inveterate that it is quite impossible for us now to detach ourselves from them.

This conception we have, it is hoped, incidentally shown to be quite insufficient. For how, in the first place, could habit give rise to ethical perceptions in beings who were entirely devoid of them? How could habit formed amongst the experiences of life have enabled us to perceive that true and absolutely certain conclusions could never be obtained through premisses which were false or uncertain?[2] It is quite true, of course, that reason is developed and maintained by complex associations of sensations, images, and ideas, as it is, in another way, maintained by the food we eat and the air we breathe. But none of these things, in whatever combinations, could give rise to intellectual intuitions in creatures devoid of intellect.

Other persons, again, who vehemently repudiate the last-noticed hypothesis, would have us regard as supremely certain, the truths which are at first recognized by the dawning intelligence of the child. Only such ideas do they consider to be what they call "a genuine testimony of consciousness." But why should truths recognised by a dawning human intelligence be worth more than those recognised by a man's intelligence at its full noontide? It is against all our experience to assert that the ideas of young children are more true and profound than those of full-grown and well-educated men. This theory would be utterly absurd but for a conception latent in it and unexpressed, which we think must be its real, though unavowed, foundation. It is

[1] See *ante*, p. 103. [2] See *ante*, p. 218.

the notion that the infant mind bears, as it were, the fresh impress of a Divine Creator, on which account its dicta should be more regarded than persuasions of later days, when that mind has become subjected to the corruptions and delusions prevalent in the world. This fancy, it seems to us, must also be the ground upon which other men have declared that what we should most trust, and may entirely trust, are ideas which are *a priori*, and have never been gained by experience. For why otherwise could anyone think we should attach less importance and validity to impressions and conclusions which have been gained by the most patient and painstaking efforts, when large stores of knowledge have been acquired in many different ways, than to others (did any really exist), for the possession of which antecedent experiences were in no way necessary ?

Obviously, the only ground upon which the latter could make any special claim on our acceptance would be that they had been implanted in human nature by " an All-wise Creator."

Yet it is no less obvious that such a conviction could never serve as a basis for our knowledge, because it would first be requisite to prove that " an All-wise Creator " exists.

That His existence is not known by any intuition is manifest from the fact that so many books have been written to prove that existence, as well as from the circumstance that so many persons doubt or positively disbelieve it.

But to prove any such theistic doctrine it is manifestly necessary antecedently to possess a sufficient knowledge of truths apt to serve as premisses for so important a conclusion.

Now there is one assertion as to the cause of our convictions—especially about our confidence in the real existence of the external world and the inevitableness of that confidence—which deserves special notice, not so much on its own account as because it harmonises with a fashion of the day. A strong tendency exists to try to account for everything by the action of "natural selection," and that cause has been specially invoked to account for the inevitable character of our convictions about the reality of the external world.

It is indeed a persuasion of many men of science that all the characteristics, all the sense-organs, and all the intelligence which any animal possesses, are and must have been due to "natural selection," that is, to the preservation in the struggle for life of the creatures possessing such sense-organs and intelligence. Why then, it is asked, may not human reason be in the same case? Why may it not be the mere result of a fortunate psychical variation which has enabled the primitive brutal man to destroy and feed on the brutal animal a trifle more easily than before? Is it possible for us to trust and confide in a faculty which has been attained slowly through the persistent endeavours of our semi-simian forefathers to feed and breed? A faculty so developed may be admirable as a weapon, but what guarantee have we to regard it as suited for very different purposes, namely, to reveal to us the true nature of the world in which we find ourselves, and to show us what it is reasonable for us to do in other directions?

This objection we have long before referred to,[1] stating that it would be more fully considered later on. For such fuller consideration the time has now come.

But we may here remind our readers of what we before pointed out.[2] If our conviction about the existence of an external world had been produced by "natural selection," that would constitute a triumphant argument against idealism. For, unless an independent, extended, and external world really existed, no sentient organisms would be de-

[1] See chapter iii., p. 46.

[2] See *ante*, p. 47.

stroyed by contravening the laws and conditions thereof. If it had acted so efficiently, it must have been a reality. But, though there has been, and still is, a great deal of talking and writing about "natural selection," it is surprising how many persons talk and write about it without knowing what it really is. It may be useful, therefore, to say here a few words upon the subject, so that our readers may run less risk of being misled and wasting their time over questions which are in no way to the purpose.

In the first place, we must remember what the action of "natural selection" is, what it can do, and what it is impossible that it should ever effect.

"Natural selection," as everyone knows, was put forward by the late Mr. Charles Darwin to account for the origin of new kinds (new species) of animals and plants. Considering that no two individuals of either kingdom are absolutely alike, and that every species tends to increase rapidly, it is evident that any variation (whether structural or functional) which should arise, of a seriously detrimental character, would render almost inevitable the destruction of the individual possessing it.

It is no less evident that any animal or plant which should come to possess a new character exceptionally favourable, would have a better chance of survival amidst the various adverse influences which threaten the lives of all animals and plants.

Thus individuals which survive by escaping the elimination which awaits others, are said to be naturally "selected." It is not, however, any active "selection" which takes place; it is merely an escape from destruction through the possession of some favourable characteristic.

"Natural selection," therefore, is in reality a term denoting all the destructive powers of nature taken together and considered as an active unity.

Whether or not this is a sufficient account of the origin of species is a question upon which we cannot enter at any length here, and it is the less necessary to do so as we have elsewhere explained our views and the arguments which, in our opinion, support them.

It is, of course, obvious that the origin of a new species must be due to the development of new positive characters which distinguish it from other species; the action of nature can be but that of a pruning-knife applied to the sprouting tree of organic life.

This, of course, Darwin well knew, and he never for a moment pretended (as some of his opponents have very unjustly and foolishly represented that he did pretend) that "natural selection" could account for, or produce, the variations upon the occurrence of which the origin of every new species must absolutely depend.

But Mr. Darwin was most exceptionally fortunate in the character of his hypothesis, for it was of such a nature as to be almost incapable of disproof. Having taken up the position that every characteristic of a species exists through its utility to that species, and that it may be assumed to have so originated unless proof to the contrary can be given, his opponent was thereby reduced to sore straits indeed, and it would be similar even if we knew, from some infallible source, that the hypothesis was a false one.

For its opponent would have to show that minute, haphazard variations in all directions in all the organs of every species, were impossible or did not take place; he would also have to show that there were structures or functions possessed by some species which were not only of no use to it now, but could never have been of any use to any of its ancestors at any period of the world's history, or, under any possible conditions, of any use to even any hypothetical ancestor which an advocate of "natural selection" can suggest may have existed under conditions widely divergent from those which form the present environment of the species in question. A disciple of Mr. Darwin can also always say: " It is very true that this or that character could not have been produced by 'natural selection' directly, but it may have been produced by it indirectly, for you cannot deny that it may have been an accompaniment of some other character which *was* useful." Thus such a disciple may claim a victory on the mere ground of his being able to imagine some possible cause for the past or present existence of which he is unable to bring forward a shadow of proof.

The Darwinian is free to invoke climatic changes, geographical modifications, and the presence or the absence of rivals or of enemies at his will and discretion. Easy, indeed, is it for such an one, with some flexibility of imagination, to construct suggestions of utility when provided with such an unlimited field of free speculation. Let an animal be black, and reasons can be very readily found to show that blackness may have saved it from destruction. Let it be shown to be white, and another set of reasons are easily imagined to show that the snowier its tints, the more assured are its chances of survival. Thus, upon a rabbit's white tail being adduced as a character dangerously conspicuous, it has been replied, " Oh, but it serves as a signal in danger to guide the young on their way to the burrow!"

Perhaps the most notable character of the Darwinian theory is the extraordinary easiness of its advocacy and difficulty of its refutation, quite apart from any question of its truth. The chances of its author in such a game of biological speculation can only be expressed by the well-known vulgarism, " Heads I win, tails you lose."

Nevertheless, there are characters which—as it has always seemed and still seems to us—defy explanation even amidst such extraordinary facilities. Some such could easily be now brought forward, but it would be out of place to adduce them here, as, though "natural selection" has some indirect bearing on Epistemology, the question as to the origin of animals and plants has none save in one respect only.

The tendency of Darwinism has plainly and manifestly been to propagate a conviction that the origin of species has been due to what we must call chance—that is, not to any rational cause. The essence of the hypothesis is the origin of species by the fortuitous action of the destructive forces of nature on individuals which differ by innate, indefinite, haphazard variations in all directions. Purposeless energy is conceived as the cause of the variations, and the selection of certain kinds is also conceived of as due to the chance action of physical forces and of other organisms. By this expression we mean, of course, that the cause of variation is thus deemed to be not only unknown, but to be due to no definite law which is the outcome of any kind or sort of intelligent energy. By this system, then, unreason may be regarded as practically lord of the universe, and the source of all the beauties and harmonies which exist in organic nature.

The above philosophical conception, which underlies the Darwinian theory, has a very distinct though indirect bearing on Epistemology, as we shall see later on.

We must now return to the consideration of the asserted genesis by "natural selection" of the inevitable character of our perceptions of an external, extended world. The main answer to this objection is the answer which we shall shortly give to all the theories concerning the *origin* of human knowledge. It consists in pointing out that what is supremely important is not the origin of knowledge but the *grounds* of knowledge—the reasons why it should and *must* be confided in and trusted. It is strange that so many persons should be blind to this fact, which, in our eyes, is so obvious a truth.

But, putting aside for the present this reply, let us consider whether we possess any knowledge which could not have been due to the action of "natural selection" upon minute variations in the clearness and extent of our perceptions.

Now, as we have more than once before pointed out, our intuition of the extended is not the most absolutely certain of our intuitions or one of the highest rank, and it certainly is not our only intuition.

If it did stand alone, if that were our only intuition, then there might be some plausibility in attributing its origin to such a cause. But we possess other intuitions which "natural selection" could never have developed. If, therefore, we are forced to assign the existence and development of those other intuitions to some cause quite different from "natural selection," then the cause which developed them may obviously also have developed our invincible conviction that an external, independent universe of extended objects (things in themselves) exists.

Now amongst the intuitions possessed by us for which "natural selection" cannot account, are those gained by our reflex consciousness respecting the necessary truth of first principles, such as that of the principle of contradiction, the force of the word "therefore," the certainty that for every new existence there must be a cause, etc.

But more striking still, in this relation, are our certainties about purely hypothetical verities, *e. g.*, "If premisses are false or uncertain no certain conclusion can be derived therefrom"; "If an engine can travel only thirty miles an hour, it could never traverse one hundred miles in an hour and a half"; "If A, having been entrusted with money to pay a debt of B, should spend it in gratifying some desire of his own, he would commit an unjust act," etc. "Natural selection" has efficiency to compel action in harmony with the requirements of physical conditions, but none to teach us speculative, and especially hypothetical, propositions.

If, then, there is some efficient cause which can, independently of "natural selection," produce these intuitive results, *a fortiori* it could produce the indefinitely minor effect, namely, "sense-perception," the apprehension of spatial relations, and a conviction that the objects we see and feel really exist independently of any imaginable feelings.

We have said above that had we no other intuition save that of things extended, that intuition might plausibly be attributed to the action of "natural selection." But it certainly would be only a plausible attribution, and not a truly reasonable one. For, as we have seen, "natural selection" can give rise to nothing; all it can do is to favour the existence and development of that which has already risen.

But between a mere sense-perception such as we suppose animals to possess exclusively, and an intellectual intuition, there is a profound difference of *kind*, and such a difference can never arise by spontaneous development. For the origin of a new kind of perception—a new power and faculty—some adequate cause must intervene, as we have lately urged when considering the law of causation.[1]

Between a power which can reflect upon its experiences and recognise relations as relations, gifted with self-consciousness and the power of ratiocination, and another power which possesses none of these things, it would surely be difficult to exagerate the difference.

And yet this difference is by no means all the divergence which exists between the mind of man and the highest

[1] See *ante*, p. 256.

psychical power commonly attributed exclusively to animals. There is, further, the power of apprehending a distinction between right and wrong, and conceiving of moral responsibility, and also the power of forming abstract ideas and apprehending absolute, necessary, and universal truths as such. Surely the difference between a nature possessing all these powers and one which has them not, must, indeed, be a difference of kind.

The difference of kind which we have before[1] represented as existing (and which we consider does exist) between man and mere animals, must, we hope, be now evident to the reader's mind.

Nevertheless, as we declared when directly considering the psychical powers of brutes, we have no desire to dogmatise with respect to this matter. That there is, and must be, a very real and great difference of kind between a nature essentially, though latently, intellectual, and possessing a capacity for the apprehension of these highest truths, and a merely sensitive power, is, for us, unquestionable. But whether that higher psychical nature exists latent and incapable of manifestation in animals, as it does in the human infant, is a question not absolutely evident, though, as we believe, the amount of evidence which does exist tells strongly against the view that animals have a nature which is in its essence potentially rational.

Yet there is no absolute impossibility that they may, and, if they do, then variations in the amount and kinds of its incipient and ultimate manifestations might have been developed by "natural selection." But to this question we shall return in our next and final chapter, when we consider possibilities as to the nature of the cosmos. Were human intelligence really evolved from a hidden intelligence in animals, that fact would in no way invalidate or weaken the

[1] See *ante*, p. 214.

difference between a higher nature, such as man's, and a much lower one, such as that commonly attributed to animals. Its only effect would be, as before said, to raise mere animal life in our esteem, and in no way to depress or diminish our respect for our own mental powers. It would be a process of psychical "levelling up."

It is the opposite process, that of "levelling down," which is so profoundly unreasonable, and which we shall almost immediately [1] proceed to consider.

Thus one and the same answer can be given to all the different representations which have been made concerning the value to be attributed to human perceptions and the development of intelligence from the germ, as to which different persons have advanced special claims for exceptional security of one and another mode, as lately stated. All such inquiries are interesting and valuable for some purposes (such as the study of the human mind), but they are all utterly beside the question which supremely concerns us.

We have seen [2] that the ultimate ground of certainty, whatever proposition we may be considering, is, and must be, its own intrinsic self-evidence—its manifest certainty in and by itself.

All inquiries into the origin and causes of our convictions—whether they are gained by experience, or innate, or dawning in the mind of the infant, or only acquired at mental maturity, or brought forth from intelligence latent at birth, or brought forth by "natural selection" from intelligence truly latent in our animal ancestors—are futile for Epistemology.

That a fruit we at the same time see, feel, smell, and taste exists; that it cannot, at the same time, have a seed within it and be seedless; that we are the same person we were before we saw this fruit; that if we give half of it away, what

[1] See *infra*, p. 277. [2] See *ante*, pp. 221–222.

of it remains to us will be thereby diminished; that if all peaches are juicy, and we know a peach has been given to a child, we may be sure it has been given something juicy; that if a fruit was in a cupboard, but is now there no longer, its absence is to be attributed to some cause, and that a really ungrateful action must be bad—are plain truths, no whit less certain whatever may have been the mode in which we have come to know them. In other words, the certainty of our knowledge of the objective reality of bodies, and of the objective validity of the first principles of human intelligence, is in no way affected by the nature of the agency, or the modes of action, which have furnished us with the certainty we possess. That is of the highest possible kind, so that no one can even conceive of any mode by which greater certainty could be given to us than is given to us by self-evidence. It matters not to us what was the intellectual condition of our immediate or our remote ancestors, nor what was our state in infancy, nor how it was we acquired the intellectual intuitions we have. Their validity is not affected thereby, for their self-evidence to us, *hic et nunc*, is clear and luminous. Of nothing else have we, or can we have, such complete and absolute certainty.

So far, then, the suggestion of the development—the improving and perfecting—of intellect through the action of "natural selection" upon creatures already latently intelligent, and varying in their approximations towards its incipient manifestations, is one which has no bearing upon Epistemology, and may therefore be put aside by us, as nothing but a waste of time could ensue from its further study.

Very different, however, are the consequences which ensue from that approximation between the highest psychical powers of men and brutes, which we have spoken of[1] as

[1] See *ante*, p. 275.

a "levelling down," and from the philosophical system which underlies[1] the system put forth by Mr. Darwin, and that which Mr. Herbert Spencer has recently brought to its termination. The consequences which thence ensue do indeed bear upon the science of Epistemology, and, indeed, not only upon the groundwork of science, but upon every separate science, and therefore, necessarily, on the basis of them all. They are thus fatal because they spring from, and can only exist with, a complete want of apprehension of what the human intellect is and what are its powers.

In the first place, we now desire to call attention to the law and principle which Mr. Spencer has enunciated as specially his own, and as one extending from the foundation of his whole philosophical construction to its highest pinnacle.

This great law and principle propounded by him—his version of the process of evolution—is the assertion that all things in nature are proceeding "*from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity.*"

It will be well for all readers who may be inclined to defer to and reverence Mr. Herbert Spencer's doctrines, to ponder a little over this, his first principle, which he long ago chose as a starting-point, and which his very latest writings profess to enforce and illustrate.

The process and procession of evolutionary changes are thus declared by him to start from what is homogeneous, incoherent, and *indefinite!* Could any procession be more unfortunate as to its starting-point, any process more necessarily impotent, any philosophical structure more baseless?

Hegel has received far more than his share of ridicule for saying that "being and not-being are identical." But Hegel was dealing with abstract ideas, regarded in a certain way, while Mr. Spencer is busy about concrete things. As

[1] P. 271.

to them he, in effect, makes an assertion which is utterly self-contradictory. The starting-point of his procession lies nowhere, the fulcrum for his process is nonentity, and the foundation of his system is an absolute vacuum.

For, according to him, everything depends for its origin on the "indefinite," and, most unfortunately for Mr. Spencer, the "indefinite" is just what does not, never did, and never can exist.

It is absolutely impossible for any concrete entity to be "indefinite." Whatever is, is necessarily a thing of some kind or another. It must have certain qualities and characters, be they what they may. Let us conceive of the most attenuated and amorphous nebula we can; it must yet be quite *definite*. It must have some composition, some characters of cohesion and possible resistance, some limits as to size, and some shape, change as it may from instant to instant. In reality it is as definite a thing as a plum-pudding, and it is nothing but a trick of the imagination which may make it seem not to be so. Less easily perceived by our sense-organs, and therefore less easy to imagine and less easy to describe, it certainly is. But less "definite" it no less certainly is not.

Here then, at the very base, or the very starting-point, of Mr. Spencer's whole philosophy, lies an absurdity so profound as necessarily to destroy the philosophical value of the entire system based upon it. And his system agrees with that "levelling-down" method of treating human intelligence which now demands our attention. We need, however, occupy but little space here or little of our reader's attention, if he is already convinced that self-evidence, as recognised by the intellect, is the supreme and ultimate criterion of the truth of those propositions which lie at the base of all our "ordered knowledge"—*i. e.*, of all science.

The process of "levelling down" seeks to explain our highest faculties by our lowest, and to make not intellect but sense the criterion of our judgments. After what we have before pointed out, we think it needless further to criticise that fundamental error which forms a main part of the system of philosophy which underlies the system known as Darwinism. Its result, for those who are so unfortunate as not to have forced their way through it, is to hide from their intellectual eyesight the objective truth of these principles which are logically necessary for all science,[1] and which if not (as they should be) expressly accepted, must at least be unconsciously assumed when pursuing science.

The ultimate result of that system is necessarily self-destructive, ending (when consistently carried out to its consequences) in a scepticism which amounts to intellectual paralysis.

The system to which we here specially refer is that which affirms the essential *relativity of knowledge*.

Now that all human knowledge is relative is, in one sense, of course, a most obvious truth. Our knowledge plainly depends upon and is relative to our powers of discernment and reasoning—our senses and our intellect. Had we more senses we should doubtless know many things which we now cannot even conceive of because the imaginations necessary for such conceptions are lacking. Had we deeper powers of intuition and a greater capacity for ratiocination our knowledge would be indefinitely increased thereby. In such senses as these our knowledge is truly relative. But though we can thus know only in part, we can know many truths with absolute certainty and complete adequacy, and we can and do see the self-evident certainty and completeness of such knowledge.

Even Omniscience could not know with an essentially greater certainty than we do the fact of our own existence,

[1] See *ante*, chapter iv.

the fact that one moon, and not two, circles round our planet, the truth of the principles of contradiction and causality, etc. About such knowledge there can be no uncertainty on the ground of its relativity or on any other ground. It is absolute knowledge. But this is what the upholders of the doctrine of its relativity deny. They deny that, being relative, it can ever at the same time be absolutely and perfectly true.

This system became, a short time ago, widely popular, and its doctrines may be conveniently summed up as follows:

(1) All our knowledge is merely relative.

(2) We can know nothing but phenomena.

(3) We cannot be supremely certain as to our substantial existence.

(4) We cannot emerge from subjectivity and attain any knowledge of objective truths.

The second, third, and fourth of these doctrines we have already, we hope, sufficiently passed in review. As to the mere assertion of relativity as implying untruth or untrustworthiness, a very brief consideration will, we think, suffice.

Every system of knowledge must start with the assumption, implied or expressed, that something is true and can be certainly known so to be. Therefore, those who uphold the doctrine of the relativity of knowledge must evidently hold, since they honestly teach it, that their doctrine of the relativity of knowledge is true and can be known with certainty to be true.

Yet if we cannot know that any of our internal convictions correspond with objective reality, if nothing we can assert can be and be known by us to be absolutely true and certain, then this character must also appertain to the doctrine of the "relativity of knowledge." Either, then, this system of philosophy is merely uncertain, and cannot be known to be true, or else it is absolutely true and can be known so to be.

But it must be merely uncertain, and possibly untrue, if everything which any human being can ever know is such. Its value then can be only " relative," cannot be known to correspond with external reality, and cannot, therefore, be declared to be true. Now anybody who asserts that he can know it to be true, thereby asserts that it is false to say that all our knowledge is relative and cannot be known to be true. But in that case some of our knowledge must be absolute. Therefore, he who asserts that all our knowledge is necessarily relative and uncertain, affirms at the same time that some of it is necessarily absolute and certain, and thus plainly and explicitly contradicts himself. With a perception of which fact the reader need not, we think, trouble himself any further concerning the doctrine of the necessary relativity of knowledge.

But is the special Darwinian view, which regards the forms of the organic world as being the result of minute indefinite variations acted on by the chance conflict of fortuitous influences of all kinds, one which really harmonises with the teaching of nature ?

The universe open to our ken gives us no positive evidence of life elsewhere than in our planet. No doubt, analogy suggests that many other worlds are inhabited, and for our own part we cannot doubt that such must be the case. Still, from what astronomers teach us, it would seem that great spaces in the heavens are destitute of animal or vegetable life, and that the worlds which are destitute of it probably predominate in number. Even in our solar system the majority of its planets seem unfitted to be the abode of living creatures.

When, from considerations of extent as regards space, we turn to consider duration and ponder over the past history of our own globe, it seems difficult to think that the vast series of succeeding ages which have seen so many races of living beings successively arise and perish, were not preceded by even a vaster series during which the earth revolved a mere mass of inorganic matter.

And even in our own day such inorganic matter forms an enormously preponderating part of its total composition. How small a film upon its surface would be formed were the whole mass of creatures now living spread over it.

Surely, then, when we begin to consider the universe known to us, as its laws, as one whole, it becomes clear that the vastly preponderating inorganic part of it is what we should take as our norm, or standard of comparison, when endeavouring to understand, as far as we may, the nature of its constitution and laws. It is to the inorganic world we must address ourselves if we would attain to the most comprehensive view possible for us, of the order and method which dominates and pervades nature. Such is especially the case since, however we may be impressed by the probability that life such as exists in this world exists also in others, we cannot actually know that such is the case. But we do actually know, by the aid of spectrum analysis, that the laws, properties, and species of inorganic substances, such as those of our own earth, do extend into the remotest regions of the cosmos which our telescopes enable us to explore.

What, then, is the order of nature revealed to us by the inorganic world?

Throughout that world and amongst the multitude of mineral, and especially of crystalline, species which compose it, most definite and ceaseless order reigns.

Each species has its own absolute internal constitution and laws by which it continues to be, from age to age, just what it is and no other, whether or not such stable substances originally arose from diverse combinations of one primitive matter.

And the changes which take place in that inorganic world are all most definite and ruled by rigid laws. All the various chemical combinations which can and do take place are definite combinations. And only certain such combinations are possible. Mix substances, compound or elementary, as we may, we can only induce certain syntheses resulting in new substances, and by no means a fresh substance for every possible blend.

These various syntheses, moreover, can only take place under certain definite conditions, and most frequently the states and properties of the separate substances, the synthesis of which produces a new one, by no means give a clue to the states and properties possessed by such new substance. Of this fact, the simplest and most familiar of all chemical syntheses—the synthesis of oxygen and hydrogen in the production of water—affords an instance as striking as it is familiar. Between the physical condition of the substances before synthesis and that of the new substance after synthesis, there is a manifest breach of continuity. Somehow or other we meet here, as in the instances previously given,[1] with a "new departure." Surely we could hardly have more plain and unmistakable evidence of permanent law and order than that with which the inorganic world supplies us.

But law and order are not the only characteristics of the cosmos thus made evident: symmetry and beauty are not less conspicuous. In crystals, as they form from solution, the most definite, and often the most charmingly symmetrical, forms are produced. Nor are the junctions of crystals with crystals in compound aggregations less orderly and beautiful, as we see in the fern-like growths upon our

[1] See *ante*, pp. 213–214.

window-panes during frost, and in the marvellous symmetry of snowflakes.

What, again, is more wonderful than the beauty of marble and serpentine, of malachite and *lapis lazuli*, of the sapphire, the emerald, and the opal, and the other gems of different hues as well as the silky, fibrous textures and flakes as of pearl which the mineral world has produced ? The lovely and varied tints of humming-birds, of butterflies, and of some Coleoptera are thus rivalled, while neither beauty of tint nor matchless symmetry of form can, even in them, have been the product of that process suggested by Mr. Darwin as auxiliary to "natural selection," namely, "sexual selection."[1]

Yet all these species have their special properties and active powers—their definite physiology—as have, preeminently, all crystalline substances their complete and specific anatomy.

Passing now from the consideration of the inorganic world

[1] According to that notion, all the special characteristics of the male sex in each species—all that seems to us beautiful, bizarre, or revolting (strength and nimbleness apart)—have been evolved by means of the constantly recurring exercise of choice by the female amongst contending suitors. We thus find it as impossible as ever to believe that the brilliant tints displayed by certain apes were thus produced, when we recall to mind what are the psychical natures of the females, and the physical force of their would-be spouses.

The tastes of female animals also must not only have been strangely diverse but wonderfully persistent. One of the oddest notions thus promulgated was the assignment to such feminine influence of the gradual denuding of men's backs of the hairy coat with which they were supposed to be at first copiously clothed. It is evident that the primitive ladies of the Kalmuck and Persian nationalities differed widely in their sentiments as regards the beard ; but, nevertheless (if the theory is true), the females of every tribe and nation of mankind—in spite of the frequent mutations of fashion—must have unanimously and persistently agreed in abhorring hirsute shoulders, and this though the females amongst their immediate pithecoid, supposed ancestors entertained a directly opposite sentiment. We refer our readers, as to sexual selection, to a work on *Animal Colouration*, by Mr. Frank E. Bedhard, F.R.S. London, 1892.

to that of the world of life, and granting the truth of the hypothesis of evolution, it seems to us clear that we ought to start on our inquiry imbued with the lesson impressed on us by the characteristics of the practically infinite and eternal laws of the inorganic universe, which lies apart from the brief and passing episode of existence endowed with life.

The anticipations of the kind with which we shall thus set out on our exploration will by no means be disappointed when we come to consider the beautiful sculpturing of the hard parts of many very lowly organisms, such as Diatoms, and the complex symmetry displayed by Foraminifera, and, above all, by the siliceous skeletons of numerous Radiolarians. How remarkable is the sculpture on certain pollen grains, on many an egg-shell, as also the patterns on various shells, and on multitudes of feathers and of flowers. As little is it conceivable that they should have been brought about by "natural selection," as that it should have caused the pearly lining of shells or their subsuperficial beauty, or that of gems and other minerals buried for ages in the bowels of the earth.

One of the most obvious characters presented by the bodies of animals, including our own, is that each has a right and left side, and that these two sides, and their parts, correspond as our right hand proverbially resembles our left one. When deeply considered, this fact is by itself sufficient to prove that the body of an animal has its own innate laws, which regulate its development; for this kind of correspondence—technically called "bilateral symmetry"—shows itself not only in these familiar conditions, but in the effects of disease and in very peculiar structures found in some exceptional species of animals. Indeed, on the hypothesis that a blood-relationship of descent binds together different kinds of animals, nature actually forces upon us the perception that new and more intensely marked forms of bilateral symmetry have arisen in a space of time which, geologically considered, must be called brief. Thus, naturalists now are generally agreed that birds have descended from reptiles; but the very diversity of the bilateral symmetry which exists between the two wings of birds on the one part, and between their two legs on the other part, is far more striking than any which is found in their hypothetical progenitors.

Another form of bodily symmetry in animals is known as "serial symmetry." Such symmetry is most plainly seen and obvious in the successively similar segments and pairs of limbs in the centipede and its allies; but it is also to be traced in the bony structure of the human chest, with its successive ribs, in the series of bones (called vertebræ) which compose our spinal column or backbone, and in the resemblances which can be traced between the arm and the leg and between the hand and the foot.

A vast number of instances of variations which have appeared suddenly have recently been brought forward in a very interesting and important work.[1] It has been sought to lessen the value of these instances on the ground that the great majority of them may be called "monstrosities." But this effort shows much shallowness of mind on the part of those who made it. For what, after all, is the real nature of these variations? However they may merit to be called "monstrosities," as structures out of harmony with the whole whereof they form a part, they are, almost all of them, orderly and perfect *in themselves*. They eloquently proclaim that organic nature is *not* a passive mass of matter, devoid of innate laws of self-regulation, but that every fragment of it, even each of its very aberrations, is replete with order of its own kind and in its due degree.

It is impossible to have somewhat widely studied the

[1] *Materials for the Study of Variation*, by William Bateson, M.A. London, 1892.

science of zoölogy or that of botany without being impressed with the plain fact that considerable or small gaps between the various kinds of living creatures are manifest on all sides. The existing creation is plainly discontinuous, not only in the inorganic world, but also in that which is organic, however much its gaps may be filled up by the discovery of the remains of organisms which exist no longer.

That they could ever be entirely filled up had we full cognisance of every form of life which has passed away, cannot certainly be affirmed with reasonable confidence when we reflect on the great facts of discontinuity to which we before called attention.[1]

There is, in the first place, the chasm which exists between everything which lives and all that is devoid of life. Granting that the universe may have had such a constitution that, upon the occurrence of certain conditions, life (which previously existed *in potentia*) should suddenly manifest itself, such a possible process of evolution does not make it less the fact that for all our experience no life arises save from what already lives, and could never come to be save through some adequate cause.

Secondly, there is the chasm between everything which feels and all that is devoid of sensation. Everyone must admit that this chasm exists—everyone, that is, who is not prepared to affirm that the pen he writes with and the ink he uses are not both sentient existences.

For ourselves, we are profoundly convinced that we cause no pang when we pluck an apple from a tree, and that we may send grain to the mill with a perfectly good conscience.

But if the living world enables us to understand these two great instances of discontinuity, that world, when we include men within it, makes us aware of a chasm much greater still: we mean the chasm which yawns between every being

[1] See *ante*, p. 213.

capable of self-consciousness and a recognition that some things are true and some actions laudable, and all that is devoid of self-conscious life.

The laws which we have seen to be impressed, not only upon mineral species, but also upon structure as known to us in plants and animals, though they cannot be said to coincide with the dictates of human reason, yet proclaim order as innate in the world so far as it is known to us; and law and order are certainly akin to intelligence taken in the broadest significance we can assign to it.

We have briefly considered certain facts concerning the inorganic and organic worlds, but to form any satisfactory conception of either, it is necessary to take into our consideration, as best we may, the entire cosmos as one whole.

Preceding considerations must, we think, make it plain to every thoughtful mind possessing a somewhat wide grasp of science, that the universe does not consist of an unordered flux of amorphous matter.

So much is evident, *a posteriori*. Experience and science show that something analogous to reason, as we know it, pervades the great whole, the existence of which is revealed to us by the synthesis of our mental powers.

Can we gain any further light as to this matter by *a priori* reasoning?

We saw in our last chapter that the law of causation is a primary, universal, and self-evident objective truth, which declares that there must be a cause for every change which takes place, for every new existence which comes into being (an extreme form of "change"), for the special concrete conditions of whatever exists, and for the very existence of anything which has not within itself a sufficient reason for its being. We also saw[1] that science is continually occupied with investigations concerning causes.

[1] See *ante*, p. 255.

But the world is in a condition of incessant change, and new existences are constantly arising within it. The entire universe known to us is also incessantly changing, and new conditions are incessantly arising, for the planetary and sidereal bodies are never for two instants in the same relative positions, and, apparently, their relative position of any one moment never recurs, but is ceaselessly replaced by another altogether novel.

That each and every one of these changes, new collocations, and new existences must have had its causes—its group of causes—cannot be denied; and more and more of these are every day being discovered by men of science.

But putting aside now all questions as to the causes of existences and changes considered individually or in groups, how about the universe considered as one great, unimaginably complex whole? In the first place, does reason absolutely show that it must have had a beginning? That our own world, her sister planets, and our whole solar system must have had a beginning can hardly be questioned; but it does not seem necessarily thence to follow that the same must be said of the whole cosmos. It certainly is not evident to us that the cosmos, considered as one vast unity, must have had a beginning, or need ever come to an end. For all we see, the universe may constitute a true system of perpetual motion in one of two ways. It may be conceived of (1) as eternally passing, as one whole, from a state of nebula to that of suns, with their attendant planets, their satellites, etc., and thence backwards to a state of nebula once more, and so alternating in one unending rhythm, unceasingly pulsating to and from a nebular condition, for ever and ever; or (2) as undergoing such changes partially, at one time here, at another time there, such a change eternally creeping, as it were, over the face of the cosmos, so that each part in turn, but never the whole simultaneously, may undergo such a transformation.

Such conditions, for anything that *reason* can affirm with certainty, might be eternal as the result of an eternal arrangement or collocation of causal agencies and conditions.

As we before pointed out,[1] our reason by no means affirms that everything must have a cause, but only changes, new existences, and existences which do not contain within themselves any sufficient reasons for their being.

Now if the universe ever had a beginning, it must evidently have had a cause. If it never had a beginning, it must as a whole have eternally been what we now see it to be, substantially, whatever the succession of changes in its various parts. It could never have had the form of one universally diffused and everywhere similar substance, unless it had been acted on from without by something external to itself. The attribute of instability applied to the conception of a homogeneous universe could not, as has been most absurdly supposed, account for the development of the universe from a primitively simple condition. The term "instability" is a mere abstract term denoting the quality, as such, of what is unstable. But whatever is unstable is not thereby endowed with any active power; it is merely easily upset and disturbed by anything external to it. Anything quite homogeneous might be unstable to the most extreme degree possible, and yet remain absolutely unchanged forever if nothing external ever came to act upon it. It must be an action from *without*, since in a universe absolutely homogeneous no possible change could ever take place from within. For whatever is thus homogeneous must be everywhere identical in the mode of its being and activity, and therefore could never change of itself unless it were pervaded by some existence really distinct from it, change

[1] See *ante*, p. 255.

produced by which, though materially an action from within, would be essentially an action from without—namely, the action of something distinct from and external to it in nature and being.

One most important consequence follows from the fact that the universe is necessarily one. Since the universe embraces all that we know now or can conceive of as hereafter to be discovered, it is all-embracing. Were it not this, it could not be the universe.

Now, since the universe is thus one, it could never itself have been evolved by any process of "natural selection." An eternal universe could never have been naturally selected—that is, have proved itself, through competition, to have been a universe able to survive others, since it never could have had any competitor. Therefore, if the universe is eternal, it must have existed from all eternity in the multiform complexity in which we know it now to be.

On this account, reason postulates a cause for the universe, considered as one whole, even though it were eternal. A cause is required to account for the special orderly conditions, and the definite actions of the multitudes of secondary causes it contains, the specific laws of the bodies and substances which enter into its composition, and the peculiar collocations of the substances, causes, and conditions which pervade it. For the material universe cannot be shown to contain within itself any sufficient cause for its existence—for its existence as it exists and in no other mode. An eternal complex mixture of different substances, with very different powers, all harmoniously co-ordinated, and which were never otherwise than harmoniously co-ordinated, could not evidently contain within itself the sufficient cause for its own existence; and the greater the number of the natural laws which physical science reveals to us, thus acting in harmony, so much the more does reason make evident to us the necessity for one great integrating and pervading cause sustaining that harmony unchanged. Such a cause is necessary for the existence of the universe at all, and however far back the duration of such a universe be supposed to extend, even to eternity, so far back must the duration of its cause evidently extend.

The existence and operation of that cause can be no more dispensed with at one epoch than at another, and so backwards for an eternity of duration. Hence, an ever-present, constantly causing, and everywhere active and sustaining principle must endure and energise now, as in the past, and forever onwards for a future eternity, should the universe persist eternally under the same laws.

As to that cause we can, in some respects, judge of its nature from its effects, since a cause must, as we have seen,[1] always be at least adequate to produce the effects it causes. As we said before, "*Nemo dat quod non habet*," and what experience and reason combined assure us is true with every portion of the universe open to our examination, reason declares to us no less necessary when applied to the universe considered as one whole.

What, then, do our powers of sense-perception, observation, experimentation, reasoning, and intuition, combine to assure us respecting the nature of the causal principle underlying and pervading the entire cosmos? No student of science can dispute that our faculties combine to bear witness to the universal prevalence throughout it of an unceasing uniformity and a definite order. We know it to be not a chaos but a cosmos, possessing such a uniformity, with respect to all the different successions and co-existences within it, as to be not inaptly termed a universe governed by natural laws —that expression serving conveniently to summarise all the

[1] See *ante*, p. 262.

various uniformities of orderly successions and co-existences which have been observed within it.

Though the order which we thus see pervade the organic and inorganic worlds alike, does not clearly proclaim the existence throughout the irrational universe of an intelligence in a certain extent analogous to the reason of man, there is, nevertheless, an unmistakable congruity between order and intelligence, such that it becomes impossible to regard anything non-intelligent as the dominating causal principle. Not only would it be a verbal contradiction, but it would contradict the evidence which science affords us on every side, to proclaim "unreason" as pervading the orderly universe, which is made known to us by physics and biology, quite apart from any consideration of man and of his works. But when we add the consideration of human faculty to the other powers and existences we know the cosmos to possess, it must assume an altogether different character in our eyes. So considered, its causal principle must be indeed a rational principle, since it has been adequate to be the cause of the reason and intellect of man.

Human beings, whatever the feebleness, follies, and defects of multitudes of them, are, nevertheless, endowed with the wonderful power of knowing their own existence, of reflecting on it and on the universe which is their abode, and of recognising abysses of space and time far exceeding the utmost possible powers of their imagination. Man can apprehend existence and non-existence, necessity, impossibility, and contingency, and, most wonderful of all, he can perceive truth as such, the existence and bearings of objective relations and verities, which are absolute and necessary, recognising them, meantime, for what they truly are.

The adequate cause and principle of a nature thus endowed must possess powers indefinitely exceeding that human reason which it has called into being. It must be intelligent, not only beyond all our possible powers of imagination, but beyond all human conception. For the special character of those primary and fundamental principles of our intelligence which we have passed in review, is that they need no proof, being self-evident in and by themselves, while they constitute the indispensable foundation of all proof whatever it may be. Such primary principles may be said to be rays of light which radiate into our intellect from a source which is entirely hidden from our direct mental gaze, and only to be imperfectly apprehended through meditation, reflection, and inference. Truth being the correspondence of thought with things, what must be that hidden cause in a correspondence with which the truth of all our highest, ultimate, and most certain intellectual principles consists ?

After pondering over the fact that the cause of the universe is the cause of all truth and of all the knowledge to which it is possible for us to attain, it seems impossible to regard it as other than an eternal and ever-present reason latent in all the phenomena of which we can take cognisance. If, then, we turn back our mental gaze over the devious path we have traversed, and survey it in the light thus gained, an important consequence appears necessarily to follow.

We have considered, in successive chapters, a variety of intervals, breaches of continuity, and fresh departures which have now and again occurred in nature. We have taken note of the gap between the non-living and the living, the insentient and the sentient, the irrational and the rational. But these breaches of continuity present a difficulty and seem repugnant to the mind of the modern student of nature. It needs the distinct recognition of a profound and pervading reason, as underlying and governing nature, satisfactorily to do away with such difficulty and repugnance, and to enable us to apprehend how such difficulty and repugnance may be merely due to the impotence of our imagination to picture to itself *how* such new departures could ever have taken place. We must frankly concede the utter impossibility of any imagination thereof, while at the same time recognising once more the important truth that our inability to imagine anything is no necessary bar to our conception of it or to our perception that what is unimaginable is none the less necessarily true and certain.

Other marvels which have similarly tried our imaginative powers have been the varied instincts wherewith so many animals are endowed, and the first occurrence of the external expression of abstract ideas by human gestures and vocal utterances. But a cause replete with intelligence as well as power, may serve perfectly well to assure us that however little we can picture such energies to our mental vision, the determination of blind psychical energies and of spontaneous intelligent efforts, resulting in the external manifestation of new-born ideas (language), forms part, and a rational part, of that wonderful complexity of activities of the most diverse natures and degrees, which together compose the wondrous cosmos, the gradual and patient comprehension and explanation (so far as possible) of which it is the task of science to pursue. It is its most noble task gradually, and step by step, to make more and more plainly manifest to the reason of man that intelligence (not only unimaginable but inconceivable) which seems latent in the cosmos, and to reveal itself diversely in the manifold aspects of the universe of which it is, in our eyes, the evident and ultimate cause.

CHAPTER X

THE NATURE OF THE GROUNDWORK OF SCIENCE

THE various preliminary inquiries and considerations, which it has appeared to us necessary to make or entertain before addressing ourselves to the main question, having been now disposed of, we will endeavour to draw out what appears to us to be the answer to that main question —the question, namely, What is the groundwork of science ?

As we said in the beginning of this book, we selected for our title the phrase " groundwork of science " because its object was to examine the essential nature of the efforts of scientific workers, of the tools they have to use, as well as of that which constitutes their field of labour.

The question, then, as to what is the nature of the groundwork of science resolves itself into the three subordinate questions:

(1) What is the nature of that field wherein scientific labourers have to work: what is the matter of science ?

(2) What are the tools which it is absolutely necessary for such workers to make use of in their labour ?

(3) What must be the nature and qualifications of the workers themselves in order that they may be able to obtain good results from their labour ?

Assuming the validity of our contention that we possess an intuition of the extended, we have seen that the matter of science consists of two divisions: (a) a division made up of what is physical and material, and (b) a division made up of what is mental and ideal.

The first division includes all extended bodies and their energies; for no concrete existence can possibly be merely passive, but must actively respond to stimuli (as iron to the blacksmith's hammer) according to definite internal laws, by which powers and activities it is we recognise the nature of each such concrete existence.

Some readers may object to our subdivision of the matter of science on the ground that we have assigned no place to entities of such supreme importance as the various physical energies.

We have not, however, really omitted them, for we include them amongst the active powers of material bodies. We have no experience of any physical energy save in connection with some extended substance from which it is sometimes said to emanate, and thence to be transmitted to others. But the terms energy, force, light, heat, sound, etc., are but so many abstract terms. We have no evidence that they can really denote "substances," but only certain real actions of real bodies considered in the abstract. Thus light and heat are commonly thought of as set going on their radiant but very unequal course by the fires of the sun (as one source), and thence transmitted by the universally disposed ether to the surrounding bodies of the solar system beyond. Similarly, the vibratory agitation of some sensuous body sets going corresponding vibrations in the air, which may ultimately cause similar agitations within the ears of men and animals, so giving rise ultimately to what we know as "sounds."

This way of speaking of the transmission of energies has not unnaturally arisen from the discovery of what was originally termed "the correlation of the physical forces," in other words, the discovery of the quantitative equivalence which exists between the different kinds of actions which different bodies exhibit, as, *e. g.*, between heat, light, chemical action, motion, etc.

But though it is convenient to express such definitely correlative actions of different kinds in terms of persistent "energy," and of different kinds of persistent energy, yet all the physical phenomena capable of expression in such terms may also be described in terms denoting the existence of real bodies exercising real activities in different modes. The conception of the same, or of different bodies being successively affected, and acting successively in different manners, with a quantitative equivalence between the modes of their affection and activity, seems a sufficient conception to apply to the mechanism and action of a moving body (*e. g.*, a locomotive engine) and one as consonant with the facts as is the conception of a force which is transformed from heat into motion. On the other hand, to speak of energy persisting and being transformed, favours the conception of energy as some objectively existing substance, which really passes out of one body and into another, and has a positively enduring, though protean, existence.

It is often said that bodies may by impact communicate motion, as when one suspended ball, falling against a row of others (suspended so as to be all on the same level), ceases itself to move, while another, the terminal one of the series, begins to be in motion. We have here, however, no real evidence of any "communication" or "transference" of "motion," but only of successive and correlative motions. The above-noted frequent mode of expression shows the existence of a tendency to regard the abstract quality "motion" as a substantial entity, actually passing from one body and into another.

Thus it has sometimes been said that a coal-bed contains the heat and light of the sun of bygone ages shut up, like enchanted knights, within it, and set free again when that coal comes to be burned. But, in fact, it contains nothing of the kind, but is itself in a state resulting from bygone solar energy, and will under certain circumstances become active in ways similar to the activities of the sun which produced those results in it.

But the usual mode of scientific expression relating to these various activities of real bodies, as well as the popular way of speaking of light, heat, etc., are, no doubt, convenient; and there can be no objection to their use provided only it be borne in mind that we have no evidence of these energies being themselves substances, instead of only peculiar modes of diverse action in substances which really exist. It is certainly different real *things* which are now and again hot, luminous, sonorous, or moving from place to place.

Such movements are perhaps the commonest of all our experiences, and moving things are constantly said (as we have just remarked) to move from place to place with greater or less rapidity in a longer or shorter space of time.

It seems to us needful, then, to make a few remarks upon those three universally existing and continually employed conceptions—motion, space, and time.

As to motion, our conception of that idea and our intellectual recognition of the motion of moving bodies are both called forth by our sensuous perception of the latter, and mental images of moving objects also sustain that conception after they have been so elicited; just as our idea of extension is elicited and sustained by parallel sensuous perceptions and imaginations. But when once thus called forth, our idea "motion" is a single and primary idea, and cannot be resolved into more fundamental conceptions.

Now there are no facts of experience which have been, and are more frequent with all of us than movements, especially relative changes of place of solid bodies.

We have that experience in every movement of our own frame, either in its change of place as a whole, or in the movements of its various parts. Every breeze which sways the smallest branches of a tree, or but makes its leaves to vibrate, reveals it to us. Every cloud we see blown across the sky and every dust-eddy gives us that experience. By movements, the dawning human intellect is first aroused to activity as the infant notices the movements and gestures of those around it, and the movements it can itself impart to objects it begins to grasp or kick against. In boyhood the throwing of stones or balls, the movements of marbles, the spinning of tops, and all games up to football and cricket, continually reinforce the experiences gained at the dawn of mental life.

Indeed, the motion of solid bodies is the most primitive, most constant, and most universal of all our experiences. Thus the abstract idea "motion" comes most readily before the mind, and at first it seems that nothing can be easier than to understand the movements of bodies, and what is meant by the term denoting that idea. And for most purposes of science an apprehension of that ordinary meaning is amply sufficient; but here, including as we do, and must do, in our purview the science of sciences, we think it incumbent on us to endeavour to draw out more carefully the significance of the idea with which we are now concerned.

When we proceed to study our conception of motion, various difficulties and problems present themselves for solution. Obviously, any given object, *e. g.*, a feather blown by the wind, must be one and the same thing when so propelled as when resting on the ground. Nevertheless, it is no less obviously in a different state when in motion from that in which it is when at rest. What, then, do we really mean by its "motion"? As we have said, that term is abstract, and therefore what it denotes cannot really exist in the concrete; yet there must be some concrete reality which is the foundation of that abstraction.

Now in all our experience, whatever has moved has always moved away from the vicinity of something and in the direction of something else. This uniform experience must of course prevent us from being able to *imagine* motion taking place in any other mode. But can we *conceive* of its taking place otherwise? To us it seems perfectly clear that motion must be, not only in some definite direction at each instant, but also from one entity and towards another.

Some of my readers may think that, were all objects save one annihilated, one might nevertheless traverse space. Now if space were a real, permanent existence, then any object moving through it would of course proceed from the vicinity of one part of it to the vicinity of another portion of space; but if, as we believe to be the case, there is no such thing as "space" at all, then evidently no object could traverse it, for no object could traverse that which has no existence.

But if space does not exist, it is evident that the universe, considered as one whole, must be absolutely incapable of motion, save internally. Such is the case, since the universe must contain everything, or it would not be the universe; and therefore there can be nothing for it to approach or recede from.

Thus motion is, or includes, a relation of one body to another or to other bodies. But can this be all? Can there be nothing more objective in motion?

We have seen the wide-spread tendency which exists to speak of the physical energies as if they were material substances. Is this the result of a pure delusion, or can there be a true and valid objective foundation for it ?

Evidently motion, heat, light, etc., cannot be so many material substances co-existing beside, or within, any moving, hot, or luminous body. The days of "phlogiston" are at an end. But is it possible that they may each severally be a manifestation of some immaterial constituent of bodies ?

Every material body known to us we know through some power or quality which we perceive it to possess, whereby we also distinguish it from other bodies. But the active powers which thus pervade material bodies are no more themselves material than are motion, light, and heat.

But what is matter ? It is an entity perceived intellectually by the aid of our sensitivity, and constituting those substantial objects of which our senses take cognisance. Through our sense-perceptions the intellect acquires an intuition, not only of extended bodies, but also of matter, as, at least in part, composing them. Yet though matter is thus constantly and familiarly known as existing in bodies, pure and simple, "matter" itself remains unknown, and has never been revealed to any man, and shows no signs of existing *in rerum naturâ*.

What we always perceive is matter of one or another definite kind. It is always a "sort of matter," and never simply "matter," which we come to know. Matter seems never to exist unmodified, though it abounds in unimaginable transformations of material substances of all kinds.

Thus every material body or substance known to us seems to consist of something corresponding with our idea of matter, and something immaterial—some energy existing with the matter whereby that body or substance comes to possess and exercise those active powers which make it known to us as being whatever kind of body or substance it may happen to be—that immaterial constituent being the active and dominant principle. But we do not by any means intend to assert that this view is an absolutely certain and evident one. We nevertheless regard it as highly probable, and we think it not unlikely that this may be the truth which the system of Monism shadows forth, as it seems to us, imperfectly and irrationally.

We have spoken of any motion of the universe in its entirety as being an impossibility. Some of our readers may exclaim, "This is, indeed, impossible, because the universe is, and must be, infinite." But this is an utter mistake, and one due to that inveterate slavery of the reason to the imagination under which so many persons—even some men of science—seem content to remain.

We have never seen anything with nothing beyond it, and therefore, try as we may, we can never imagine a final limit outside which nothing is or can be. We cannot imagine a boundary line over which no arm could be thrust, and beyond which no glance even could ever be cast. Such being the case, it is, and must be, an utterly futile attempt to imagine the universe as terminated, and without any possibility of existence beyond it. But our impotence to imagine the universe as finite is no reason whatever for thinking that finite it cannot be.

Passing now from the consideration of the extent of the universe, it seems needful to say a few words with respect to prevalent conceptions respecting its composition, what may be the ultimate nature of all the various activities it manifests, and whether they can be resolved into one fundamental activity.

Nothing is more marked, or more remarkable, than the tendency of many scientific men to try to describe all other phenomena in terms of motion, and especially by the motion of minute moving particles. This may be in terms of such moving particles, "molecular motion," or a "dance of atoms," of a differently complex pattern in each case,[1] or it may be in terms of brain waves or thrills traversing the nerves, in the case of feelings or of thoughts. A mechanical explanation of all nature is an avowed ideal with many men, and is felt as a comfort by very many more. So wide-spread a tendency must be due to no less wide-spread a cause, and it is a fact that men do feel a certain satisfaction and mental rest in such an interpretation of phenomena of all orders, from physical energies to feelings and thoughts. What, then, may be the reason for this

[1] A striking example of this tendency has been shown by Professor Haeckel, who ventures to describe atoms as if he had actually seen and handled them. He tells us that (in his *Monism*, pp. 26 and 32 of the English Translation, Adam and Charles Black, 1894): "To these original or mass atoms—the ultimate discrete particles of inert 'ponderable' matter—we can with more or less probability ascribe a number of eternal and inalienable fundamental attributes; they are probably everywhere in space of like magnitude and constitution. Although possessing a very definite finite magnitude, they are, by virtue of their very nature, indivisible. Their shape we may take to be spherical; they are inert (in the physical sense), unchangeable, inelastic, and impenetrable by the ether. Apart from the attribute of inertia, the most important characteristic of these ultimate atoms is their chemical affinity—their tendency to apply themselves to one another and combine in small groups in an orderly fashion. These fixed groups . . . of primitive atoms are the atoms of the elements—the well-known 'indivisible' atoms of chemistry, the qualitative, and, so far as our present empirical knowledge goes, unchangeable distinctions of our chemical elements are therefore solely conditioned by the varying number and disposition of the similar primitive atoms of which they are composed." As to the most remote past, he speaks of "An unbroken series of natural events following an orderly course of evolution according to fixed laws . . . from a primeval chaos to the present 'order of the cosmos.' At the outset, there is nothing in infinite space but mobile elastic ether and innumerable similar separate particles, the primitive atoms, scattered throughout it in the form of dust; perhaps these are themselves originally 'points of condensation' of the vibrating 'substance,' the remainder of which constitute the ether. The atoms of our elements arise from the grouping together in definite numbers of the primitive atoms or atoms of mass."

feeling of satisfaction in the explanation of matters the most diverse by a conception of solid bodies in motion?

As we have pointed out in preceding chapters, we can imagine nothing except what our senses have previously experienced either as a whole or in its constituent parts. This close connection between experience and imagination has for its consequence the following law of association:

Facts of experience are reproduced in our imagination with the greater ease and readiness the more frequently or continuously they have been experienced by us.

But we have just seen [1] how movements of solid bodies constitute the most constant and universal of all our experiences. What wonder, then, that a sense of ease and pleasurable relief should be felt whenever difficult and puzzling phenomena of any kind can be presented to the intellect in terms and by the aid of mental images of moving solid bodies.

It should also be recollected that few things are more familiar to us than the experience that objects of considerable size can mostly be broken, cut, or crushed by us into smaller portions, and these again similarly further subdivided. It is a most common experience also to see substances crushed into very small particles (sand, dust, or what not)—particles so small that we are unable to subdivide them any further. Hence a vague feeling can be produced of a distinctness in nature between large bodies that we can subdivide and possessing obvious qualities, and minute particles which we cannot so act upon, and of which we can detect hardly any qualities—particles only just within the range of our vision. In this way an imagination easily and spontaneously arises of large bodies being made up of minute solid particles incapable of smaller subdivision which, by their union and coherence, compose such bodies.

[1] See *ante*, p. 300.

Through a combination of these multitudinous and continual experiences, the tendency has arisen (probably ages before Democritus), still exists, and will, most likely, ever exist, to try to represent all the phenomena of the world by mental images of particles in motion, and by dances of atoms.

We do not, of course, for one moment, mean to underrate the enormous value and practical utility of working hypotheses such as the "atomic theory," the "undulatory theory of light," of vibrating ethereal vortex rings, etc., etc. Our only intention is to point out that such theories are to be recognised for what they really are, and not regarded, as is too frequently the case, as absolute truths, really evident, explaining satisfactorily the phenomena of nature, and constituting an important part of the real matter of science, and as truths which have been shown to be finally and absolutely evident. The futility of such explanations may easily be seen by thinking of such ultimate atoms as magnified to inches in diameter. Then all the difficulties which we can feel as to the ultimate composition of larger bodies, will be found to be no less existent as regards the molecules and atoms themselves.

Leaving now the subject of motion, and proceeding to consider the truth as to space and time, we again meet with the deluding consequences of uniform sensuous experience upon the imagination.

Now (as we said when speaking of the supposed necessary infinity of the universe), no man, anywhere or anywhen, has ever met with an object which has not got some other object beyond it. No man, also, has ever found anything to happen without finding that something else happened after it. It results from this constant and invariable experience that it is utterly impossible for us to imagine anything to exist without something beyond it, or to imagine anything to happen without something, sooner or later, happening after it.

Thus it is that men who have not emancipated themselves from the chains of their sense-perceptions, declare, as we above observed, that " space " is, and must be, " infinite." Mistaking the impotence of their imagination for a perception of objective reality, they affirm the real, and even infinite, existence of what has no real being at all, and is nothing in reality beyond a creation of the mind.

Space is but an abstraction from abstractions—a doubly abstract idea. There is, of course, no such thing even as " extension " as such. That is but an abstract idea gained from a perception of that property which every extended thing possesses, and which real objective property is the foundation in the thing itself of the abstract idea—extension. Similarly, " space " is an abstract idea drawn from the different extensions of all the extended things we know, from inter-sidereal ether to the densest mass of metal. It is, as we said, a doubly abstract idea, and is abstracted from, and denotes the extension of, all extended things taken together, and united in one highly abstract idea.

" Time " is, similarly, but another highly abstract idea gained from things which succeed each other, and which are said to follow each other " in succession." But, of course, there is and can be no such thing as " succession " by itself. Succession is but a term expressing our idea of a real condition possessed by each thing which happens after another which occurred before, and which condition is the foundation in the thing itself of that abstract idea. Similarly, " time " is a doubly abstract idea, since it is drawn from the different successions of all the succeeding things we know. It denotes the succession of all succeeding things taken together and united in one highly abstract idea.

Of course, for ordinary scientific work, the common conceptions as to space and time, as well as motion, molar and molecular, ethereal undulations, etc., serve every needful purpose, and are most valuable, just as the commonly used physical hypotheses as to atoms, molecules, etc., serve, as before said, very important ends, and have greatly aided, as they no doubt will continue to be of great service to, scientific progress. But as with respect to these hypotheses, so also with respect to space and time, it seems to us we cannot be dispensed, in a work such as the present one, from an attempt to analyse those common motions as fully as it is within our power to do.

The physical division of the matter of science may, then, be described as follows:

It consists of real, substantial things in themselves, with all their qualities, powers, and energies, inorganic and organic, vegetable, animal, including rational animals (men) as well as the merely sentient portion of animal life. Amongst and between different portions of this physical division of the matter of science, we have recognised various branches of continuity—various new departures. Our confidence in the accuracy of our judgment as to these new departures and their rationality, as well as their possibility in the material universe, are guaranteed and rendered as far as possible intelligible to us by our recognition that the universe is pervaded, as it seems to have been and to be caused, by something which our intellect reveals to us as having necessarily some analogy with our own reason and intelligence, however inconceivably greater it may be.

The second division of the matter of science consists of everything psychical, from the faintest and most obscure feelings, which any animated being can experience, to the most abstract ideas that the human mind can possibly form. These feelings and ideas are not regarded, in the work of science, mainly *as* abstractions, but rather as concrete realities—feelings as being, or having been, actually felt, and ideas as being, or having been, actually thought.

The matter of science must consist of these two divisions, which—to speak most briefly—are composed of things and thoughts.

For all idealists must regard, and do regard, the groups of psychical modifications, which for them make up the external world, as distinguishable from that reflex self-consciousness which reflects upon its own mental experiences, and apprehends knowledge and truth as knowledge and truth. It is unquestionable, therefore, that things and thoughts constitute, and must constitute, the matter of human science in its widest acceptation of that term.

Such, then, being the field of labour wherein all pursuers of science have to work, what are the tools which are absolutely necessary for them that they may accomplish their task ?

Now, obviously, the simplest and earliest used of these tools are our various organs of sense, by the use of which alone we can attain to sense-perceptions, which together form the indispensable starting-point of all our knowledge, and which supply us with materials necessary for the exercise of the imagination, without the presence of which all intellectual activity is impossible.

To these, of course, must be added all those common—those normal—intellectual powers, the due exercise of which constitutes a man a person of ordinary sound judgment and good sense.

Amongst and bound up with these intellectual faculties, however, are certain fundamental principles which constitute our intellectual tools *par excellence*, and which here need distinct recognition. We have seen in our fourth chapter (" The Methods of Science ") how utterly impossible it is not only to cultivate science, but even to make one valid observation, or usefully to carry on the simplest experiment, without the tacit assumption of certain fundamental principles as convictions implicitly accepted. Such convictions were: the existence of certainty [1]; the existence of an external world [2]; our continuous substantial existence [3]; the validity of the process of inference [4]; the self-evidence of some truths [5]; the principle of contradiction [6]; the evidence of axioms [7]; the principle of causation [8]; the uniformity of nature [9]; and the existence of necessity and contingency.[10] After what has been said in Chapter VIII. about these first principles of knowledge of which our highest mental powers take cognisance, we think that we need not occupy much more space concerning them here, but only give once more a brief summary thereof.

The fundamental truths, the intellectual perceptions and convictions which must be employed for the cultivation of science may, then, be thus summarised:

(1) The first intellectual tool which must be employed is the principle which affirms that certain things can be perceived with certainty and are evident.

(2) The second principle is that nothing can both exist and not exist at the same time, and this principle serves to test the solidity of the work which the first tool enables the scientific labourer to perform.

(3) Thirdly comes the perception and conviction (for which the second principle vouches) that there are truths which are true, not only here and now, but which must be true ever and always, and that such truths are not merely laws or conditions of our own mind, but are true objectively, being applicable to and valid for all "things in themselves" apart from the existence of any imaginable mind.

[1] See *ante*, p. 98.
[2] See *ante*, p. 101.
[3] See *ante*, p. 101.
[4] See *ante*, p. 102.
[5] See *ante*, p. 103.
[6] See *ante*, p. 105.
[7] See *ante*, p. 105.
[8] See *ante*, p. 105.
[9] See *ante*, p. 106.
[10] See *ante*, p. 106.

(4) Thus it is clear that there are objective relations, corresponding with subjective ones.

(5) The perception and conviction that not only our actions, sensations, imaginations, reminiscences, emotions, perceptions, and conceptions, are known to us, but also our own substantial and continuous personal existence.

(6) The perception and conviction that we have the faculty of knowing not only present external existences but what is external to our present experience, memory showing us such experience and enabling us to recognise it as such, so that in each of us subject and object become identified.

(7) We must also make use of the principle which upholds and supports the process of inference or reasoning, namely, the perception that if certain premisses be true, then whatever logically follows from them must be true likewise.

(8) Finally, there is the principle of causation, which assures us that every new existence, state, or condition, and every existence which does not contain the principle of its being within itself, demands a cause for its existence.

It is these fundamental truths which constitute the intellectual instruments, by the use of which all science that now exists has been elaborated, and which must be employed to develop whatever scientific truths shall hereafter come to be ascertained or established.

The self-evident, fundamental, and ultimate truths which guarantee and support all our knowledge, are not ideas which are innate, but the faculty of apprehending them is innate. They are ideas which our reason has the power of extracting and of perceiving the self-evidence of, just as the faculties of a mere animal enable it to become aware of suitable food through its organs of sense when it meets with such, as the roots of a plant enable it to absorb water by growing towards damp earth in its vicinity, and as the nature of a crystal enables it to refract doubly when the requisite means (certain rays of light) are brought to bear upon it in a suitable manner.

All the phenomena of nature are alike wonderful, and amongst its wonders is to be ranged our faculty of evolving, by abstraction, perceptions of objective, necessary, and self-evident truths *as* objective, necessary, and self-evident, when the requisite means (careful attention, *i. e.*, certain beams of intellectual light) are brought to bear upon it.

As to the eight perceptions and convictions above enumerated, unless we really know and trust them, science is logically impossible. Without them (as we have seen in Chapter IV.) it is impossible to have a complete, harmonious, and stable system of knowledge. If these truths were denied, or even *really* doubted, by anyone, he would necessarily be reduced to a state of mental paralysis and intellectual inanition. His intellect, deprived of their aid, would, indeed, not only be paralysed so that it could no further advance, but it would be entirely disintegrated—like a world in which the force of gravity had been suddenly annihilated. But because we must (to be rational) recognise the self-evidence and absolute certainty of the fundamental principles of all human knowledge, we must always be extremely careful to be guilty of no exaggeration as to the amount of that knowledge, but to keep an open mind as to possibilities concerning which we have no evidence. However improbable any such possibilities may be, we must be scrupulous in not representing any improbability, however great it may be, as an *impossibility*.

Thus as to the structure, composition, or nature of the universe, very divergent conditions are by no means evidently impossible. It is, of course, evident that there is an intelligent energy in the universe, because we are conscious of what exists in ourselves—our own self-conscious intelligence. But it is not impossible (though so improbable that the mere possibility seems hardly worth mentioning) that besides intelligent energy, there may be nothing but one essential kind of matter with intrinsic motion, animals having merely the appearance of being sensitive organisms, while in truth literally nothing more than mere machines.

The possibility of this cannot be denied for two reasons:

(1) We can only know our own sensations and emotions through the intellect, so that we cannot be absolutely sure that our higher estimate of animals (as being really sensitive organisms) may not be due to the fact that we know them only intellectually, and so may unconsciously transfigure them.

(2) We cannot know with certainty what the emotions and sensations of animals really are. They are probably like what our sensations and emotions might be apart from the intellect. But it can never be absolutely evident to us that they are so, or what they are in themselves, or even what our own sensations and emotions may be, apart from our intellect, though, as we have endeavoured to show,[1] our intellect enables us to obtain a high degree of probability in the matter.

Secondly, it is not evident that the universe may not consist of one kind of matter (the parent of all the combinations we know), and one physical energy (the root of the physical energies of our experience), together with an intelligent energy.

Thirdly, it may consist of one matter and several or many energies, essentially distinct from all eternity, together with intelligent energy.

Fourthly, it is not evident that it may not be composed of several, or many, essentially distinct matters (true elements) with a physical energy essentially one, together with intelligent energy.

[1] See *ante*, p. 214.

Fifthly, it may consist of several or a multitude of distinct elements, together with several or a multitude of essentially distinct energies, and also intelligent energy.

But it cannot consist of only one kind of energy, even if that energy were mind, because we have an intuition of something extended, and of three dimensions upon which intuition all mathematics repose.

As to the intelligent energy of the universe, apart from that of its absolute cause, it is conceivable there may be none but what is human; but it is also conceivable that there may be several kinds, or an unimaginable multitude of kinds of intellectual energy, all essentially different from that of man.

But what, in our opinion, is evidently impossible is the evolution of intellect from mere physical force, above all, the origin therefrom of our ethical intuitions and our convictions as to necessities and possibilities.

But for the two reasons given above it cannot be declared absolutely impossible, improbable as it seems to us to be, that life and mere sensitivity should have been evolved from some energy underlying what we know as the physical forces.

Nor, as we before pointed out,[1] is it impossible that the human intellect may have been evolved from the psychical power of animals if their psychical powers be essentially and potentially intelligent. It is possible that intelligent energy may be latent in animals and only able actually to manifest itself in a manner far below its intrinsic power, and, on account of all the conditions present to it, which render it unable to emerge in thought, into which it would emerge if a suitable environment were provided. But, certainly, animals, so far as we have been able to obtain evidence, show no signs of possessing such a latent intellectuality, while

[1] See *ante*, p. 154.

they often show what, did they possess it, would be a perfectly amazing degree of stupidity.

In pursuing our quest of the groundwork of science, if anything is certain, it is that the portion of truth which we are able to attain to in our investigations of the cosmos is but an unimaginably small portion of the whole.

There are two facts which the man of science ought to have frequently and clearly before his mind. The first is the practical infinitude of knowledge, as yet unattained by him, and, probably, beyond all human ken. The second fact, and one no less important, is the absolute certainty of that small portion of knowledge which his intellect is able to attain to and recognise as being self-evident, and evidently of universal and necessary validity. Because the matter for exploration is indefinitely vast and but partially attainable, we have no reason to distrust our knowledge of what we do perceive to be certain, or to undervalue the means at our disposal for obtaining such scientific knowledge and certainty. The means here referred to consist of first principles which have in these pages been drawn out and enumerated—the tools of which the labourers in the field of science are compelled to make use, and which they should rejoice exceedingly in the possession of. It now only remains to notice some facts and make a few remarks concerning the nature of the scientific labourers themselves.

Uneducated men are often confident of their knowledge in proportion to their ignorance, while the modesty of the cultured is generally not less noteworthy. But whatever diffidence ordinary persons may feel with respect to deficiencies in their own knowledge of unfamiliar facts, or of matters of science, they are generally confident enough that they have a sufficient acquaintance with their own nature and those mental faculties which common sense assures them they daily exercise. They may, indeed, be aware that it is possible for interest to induce some of their neighbours not only to say, but even to think, that "there is nothing like leather," and they may recognise the fact that an habitual employment of the mind and energies in one special pursuit can prevent men from being able readily to apply themselves to another of a very different kind. Nevertheless, as a rule, they have no proximately correct appreciation either of the wonderfully lofty nature of their mental powers or of the warping and narrowing effect of prejudice in hampering their exercise. As the late Cardinal Newman truly observed many years ago:

"Any one study, of whatever kind, exclusively pursued, deadens in the mind the interest, nay the perception, of any others. Thus Cicero says that Plato and Demosthenes, Aristotle and Isocrates might have respectively excelled in each other's province, but that each was absorbed in his own. Specimens of this peculiarity occur every day. You can hardly persuade some men to talk about anything but their own pursuit; they refer the whole world to their own centre, and measure all matters by their own rule, like the fisherman in the drama, whose eulogy on his deceased lord was, that 'he was so fond of fish.'"

This tendency to mental one-sidedness, arising from the almost exclusive study of one side of nature, has, as experience convinces us, made not a few able men, exclusively devoted to the study of one or more physical sciences, less able, than would have been the case had their culture been wider, to appreciate and assign full weight to the facts of mental and, above all, of metaphysical science. The one great requisite for the study and correct estimate of the nature of things external to ourselves, is true and accurate knowledge of our own. It is necessary for us to recognise that we are not only conscious but conscious of our consciousness; that we not only can make use of and be guided by inference, but that we are capable of analysing the process of inference, and that we can not only act well or ill, but can recognise an ethical ideal. We require to recognise distinctly what our intellect can and does do, in order that we may assign his due part in the groundwork of science to the worker himself.

Now, reflex self-consciousness shows us that the "self" exists continuously, and is conscious of successive objects and events, and can and does recognise them as forming part of a series which it transcends, but which it can contemplate as a whole or in parts and in different orders, according as may be desired. This power or principle it also knows with perfect certainty can not only know itself, but is also aware of the kinds and directions of its activities, and can regard them as a whole, or in groups, or singly. It can, it well knows, perceive its own states, both passive and active, and also external objects and events, and can compare the relations between them, returning upon itself at will along different lines of thought, and also setting forth in various directions at will. Such a power, aware of all these things and present to them all, must itself be our very ideal of unity, and stand in the greatest possible contrast to the material world it is able directly and immediately to apprehend and make present to it. Yet, since each man who reflects can know that it is he who not only thinks but also feels, he must recognise his living body and his thinking principle as constituting, to his experience, one unity. He perceives himself as knowing and recognising the external world as independent of and yet known to him. He thus knows that in his consciousness the external and the internal meet and blend, and that in himself subject and object are, as before said, identified. This is a supreme truth of science, and no certainty we can attain to about any other object is, or can be, so certain as is this truth.

Thus we come to know how it is, and how alone it is, possible for the scientific worker ably and with good effect to wield the wonderful intellectual tools he is supplied with for labouring in that field which constitutes the matter of science.

The labourer thus being replete with conscious reason and labouring with tools which, the more skilfully he uses them, afford him ever better grounds for confiding in his reason, which he also recognises as the basis of all his conclusions and convictions, can it likewise be said that reason is latent and implied also in the very matter of science?

If the reader will recall to mind and weigh with care the facts and considerations which have been again and again brought forward in this book, he will, we venture to think, be convinced that there is much to be said in support of such a latent intelligence.

Let him recollect the phenomena of crystallisation and how a crystal's broken angle can be and will be, the needful conditions being supplied, accurately replaced. Let him remember how different chemical substances possess their own special—and in different mineral species very different—innate laws, and also the inherent tendencies of chemical substances to combine in definite proportions. Let him note well the marvellous processes of individual development from the earliest condition of the germ upwards, and also consider how during the whole life of each it bears a relation both to the past and the future, as does the chrysalis both to the larval and the imago state of its existence.

Moreover, if the repair of a crystal is wonderful, how much more so those which take place in animal and even in human[1] life. How wonderful is the transition[2] from vital activities which are utterly unconscious to actions which are present to consentience and ultimately can be recognised

[1] See *ante*, pp. 124, 125. [2] See *ante*, p. 136.

by reflex consciousness. Yet, perhaps, above all other wonders is the wonder of instinct, the significance of which Schelling so truly appreciated.

There is, indeed, a latent logic in the actions of the beast which hunts its prey; in the nesting bird; the bee, the ant, the climbing plant—with its marvellous tendrils—and even in the mathematical regularities of crystallisation! But such logic is not the logic of the crystal, nor of the plant, nor of the bird, nor of the beast. It is, in a sense, truly *in* them, but it is no less certainly not of them, nor is it merely even of ourselves. Mankind did not always inhabit this planet, and when the first animals possessed of self-consciousness and rationality first appeared here, they were not and could not have been the causes of their own advent, but, as new existences, must have been effects of a greater cause.

He who with an unprejudiced mind ponders over the phenomena which the universe lays open to his gaze can hardly, we think, fail to discover immanent therein an activity the results of which harmonise with man's reason: an activity which is orderly and disaccords with blind chance, or "a fortuitous concourse of atoms," but which, nevertheless, is not an intelligent activity such as is our own, but one which acts in modes which are different from those we should adopt in order to attain similar ends. It is sometimes objected against reason as latent in nature, that we see in all directions so much waste, and that of so great a multitude of organic germs, very few attain maturity. But this objection is indeed an anthropomorphic one, and would imply that the cause of all things is a contriving human mind! But the non-human rationality of which nature affords so many hints and glimpses as everywhere pervading it, is a universal cause and reason, and, if we may speak of "purpose" in this connection, its purpose is fulfilled by every event, and thus no waste is possible. Every seemingly "wasted" germ fulfils other purposes of nature, as the spores of our ancient coal-fields now help the man of science to cross oceans in quest of fresh material for study.

But though the reason which pervades nature is not that of a human intellect, yet the fact that it has a certain, however remote, analogy therewith is shown us by our own minds. For to it, as a cause, we must ascribe our power of knowing first principles and ethical laws [1] and of recognising fundamental truths as being what they are. To it must be due that marvellous light shed upon our intelligence which enables us to know that such truths are absolute, universal, and necessary, objectively as well as subjectively.

Thus our answer to the question, "What is the groundwork of science?" may be thus expressed: It is the work of self-conscious, material organisms, making use of the marvellous intellectual first principles which they possess in exploring all the physical and psychical phenomena of the universe, which sense, intuition, and ratiocination can anyhow reveal to them as real existences whether actual or only possible. Such being the groundwork of science, what may, nay, what must, be said to be its foundation—what the support and guarantee alike of the workers, the principles, and the objects of science?

It appears to us impossible rationally to deny that such a foundation can only be sought in that reason which evidently, to us, pervades the universe, and is that by which our intellect has been both produced and illumined.

We must admit that the principle of causation and the uniformity of nature are truths which our minds apprehend from sources which are mainly not sensuous but intellectual. These principles, when we apply them to the world of experience, reveal an orderly universe. By them we are forced to read an order and a reason into the profoundest

[1] See *ante*, p. 170.

depths of the essence and being of the universe, nor can we forget that in those depths there must repose the ultimate cause of all that we recognise as beautiful and good, as well as true.

In concluding, we feel bound to confess that the more we study nature the more profoundly convinced do we become that the action of an all-pervading but unimaginable intelligence alone affords us any satisfactory conception of the universe, as a whole, or of any single portion of the cosmos which may be selected for exclusive study.

Unless we are profoundly mistaken, it is only through the conception of such an energy, as an active causative principle, underlying and pervading the material cosmos, together with the recognition of the dignity of human reason, empowered as it is to perceive self-evident, universal, and objective truths, that we can understand the groundwork of science and attain to a final and satisfactory Epistemology.

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