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ON THE MEANS WHICH CONDUCE TO TRUE PHILOSOPHY, AND ON THE TRUE PHILOSOPHER.

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IF the mind [*animus*] ¹ be well connected with the organs of the senses, or in other words, if man be truly rational, he is perpetually aspiring after wisdom. The soul is in the desire of being instructed by the senses, and of continually exercising its perception from them, as from a source distinct from itself; while the senses in their turn desire to exercise their perception from the soul, to which they present their several objects for contemplation. Thus each performs and contributes to the same common operation, and tends to one ultimate object, the wisdom of the man. For this purpose there exists a continual connection between the soul and body; for this purpose also reason is added to the senses, and hence the desire after wisdom becomes the peculiar mark and characteristic of man. Unless, however, he desires and attains to a knowledge which lies beyond or above his senses, he is far from being truly rational, nor is there a due connection between the senses and the soul. The senses and their various organs can receive but grossly, and in an imperfect measure, the phenomena of the world. Now there are no animals beside man who

* Reprinted from his *Principia*, Part I, Chapter I. Translated from the Latin by the Rev. Augustus Clissold, M.A., London, 1846, Vol. I, pp. 1-45. A few revisions in spelling and terminology have been made.—*Ed.*

¹ The term *animus* is used to signify the external mind; the term *mens* to signify a more interior mind.—*Translator.*

possess any knowledge beyond that of the mere senses, and of their organs disposed in the pia mater of the brain. They are unable to penetrate further; and, from the want of a more subtle and active power, cannot refer the objects presented to their senses to a higher or more distinct principle. But truly the wisdom of man cannot be said to differ from theirs, if we refer the objects or operations of the world upon our senses, not to the soul and its reason, but to the same principle as they do. The sign that we are willing to be wise, is the desire to know the causes of things, and to investigate the secret and unknown operations of nature. It is for this purpose that each one consults the oracle of the rational mind, and thence awaits his answer; that is, he is eager to acquire a deeper wisdom than merely that which is proffered to him through the medium of the senses.

But he who wishes to attain the end, must wish likewise to attain the means. Now the means which more especially conduce to a knowledge truly philosophical, are three in number,—EXPERIENCE, GEOMETRY, and the FACULTY OF REASONING. First then let us ascertain whether, and in what manner, we have the power, by these three means, to arrive at knowledge *a priori*, or to reach, in natural and physical enquiries, the farthest boundaries of human wisdom.

By philosophy is here understood the knowledge of the mechanism of our world, or of whatever in the world is subject to the laws of geometry; or which it is possible to unfold to view by experience, assisted by geometry and reason. Under the jurisdiction of geometry are the *three kingdoms*, the MINERAL, the VEGETABLE, and the ANIMAL, and, if it be permitted to call it a fourth, the ELEMENTAL. *The mineral kingdom* comprehends everything in the earth of a hard, material, and terrestrial nature, whether it be metallic, stony, or sulphureous; together with every substance, either fixed or fluid, which cannot be classed as vegetable or elemental. *The vegetable kingdom* comprehends everything which owes its origin to the mineral, and which serves to adorn the surface of the earth by its growth and vegetation. *The animal kingdom* comprehends whatever increases by growth, but which lives in virtue of possessing some kind of individual soul. *The elemental kingdom* comprehends all those substances which are of themselves, and by their own nature, fluid; every particle having its own peculiar powers of motion and elasticity. A collected

volume of these constitutes an element, such as air, or ether, or others still more subtle, which we shall hereafter investigate in the course of our PRINCIPIA.

Under the empire of geometry, and under the mechanical laws of motion, we may be allowed to rank the whole mineral as well as vegetable kingdoms, and indeed the animal too in respect to mechanical organs, muscles, fibers, and membranes; or in respect to its anatomical, vegetative, and organic relations. But in respect to the soul and its various faculties, I do not conceive it possible that they can be explained or comprehended by any of the known laws of motion; such indeed is our present state of ignorance, that we know not whether the motions by which the soul operates on the organs of the body be such as to be reducible to any rule or law, either similar or dissimilar to those of mechanism. *The elements* by which the earth is surrounded, and in which it floats, acknowledge mechanism and its laws to be as it were peculiarly their own; so intimately is mechanism united with the elements, as to owe its very existence to them; and indeed, the method by which they are set in motion and actuated, is mechanism itself, which is thus both conceived and born of the elemental kingdom. Since then the elements called air, ether, as well as others of a still more subtle nature, are naturally and peculiarly influenced by geometry and mechanism, we have it in our power to elucidate them by the assistance of experience, the known laws of motion, and geometry united. In this first division of our PRINCIPIA we treat, in part generally, and in part specifically, of the elements; of their progress from the first and most subtle, to the last which is circumfused around the earth; also of the motion of the elemental particles, of their figure, and whatever else may relate to them, either as an attribute or as essential to their nature.

It is an arduous attempt to explain philosophically the hitherto secret operations of elemental nature, far removed as they are, and almost hidden, from our view. In making the attempt, however, I must endeavor to place, as it were, before the eyes, those phenomena which nature herself is careful to conceal, and of which she seems most adverse to the investigation. In such an ocean I should not venture to spread my sail, without having experience and geometry continually present to guide my hand and watch the helm. With these to assist and direct me, I may hope for a prosperous voyage over the trackless deep. Let these be therefore

my two stars to guide and enlighten me on my way ; for of these it is that we stand most in need amid the thick darkness which involves both elemental nature and the human mind.

1. Experience may be defined to be the knowledge of everything in the world of nature, which is capable of being received through the medium of the senses. This definition is calculated to embrace everything, whether in the elementary kingdom, or in metallurgy, chemistry, botany, anatomy, etc., in so far as we can ascertain the manner in which it affects the senses or acts *a posteriori*. These various things may indeed be termed objects of the senses, and phenomena drawn from the great storehouse of natural things.

Let it not however be imagined that any experience, or knowledge derived *a posteriori*, and confined only to one man, or even to one age, is sufficient for exploring the hidden paths of nature. To crown the investigation with success, we require the experience of many ages ; experience which will go on progressively increasing, till such a store of information is amassed as will supply us with phenomena calculated to elucidate any part or any series of the operations of nature.

The sciences, which have now for some thousand years been adding to our experience, may at this day be said to have so far advanced that the enquiry into the secret and invisible operations of nature need no longer be deferred. For an infinity of phenomena are already known which are capable of leading us up to this point ; and besides, there are extant so many writings of so many ages, that they will sufficiently aid us in an *a priori* investigation and deduction from the first principles of things. We possess a considerable body of experiments, illustrative of the elements of ether, air, fire, and water, and also of the magnet ; and if we reckon those also which have been made in metallurgy and chemistry, where nearly all the elements are called forth, and employed for the solution and condensation of bodies, we cannot for a moment doubt that the world is at this day supplied with sufficient means to enable us to pursue our purpose.

Indeed, it does not appear that there is any occasion for that infinite variety of phenomena which some deem necessary, in order to acquire a knowledge of natural things : we have need only of the more important ; of such as bear directly and proximately upon the point, and not diverge too obliquely and remotely from the series

of our mechanical world and its powers. For it is to them we must owe our guidance to the first-compounded, and to us, general principles; thence by means of geometry, and aided by the leading phenomena which lie intermediately between the two, we proceed to particulars; then by a chain of connection, to the more simple; and thus at last to the most simple, to the fountain-head, in proceeding from which they have gradually become more and more modified. The remaining mass of experiments, which are either farther removed from the first source, hence from the first and simple mechanism of the world, or which are merely collateral, and not in the same direct line of descent, may be safely laid aside as not essential; indeed, they would tend rather to divert the mind into a different course, than lead us onward in the great high road of our investigation. For a countless variety of phenomena might be mentioned, which are very remote from their first origin, and which discover no path leading to it but through multiplied and intricate mazes. Nature, branching out into such varieties of modifications, may be compared with the arteries and veins of the animal body; these, when nearest to their common fountain, the heart, possess considerable breadth and magnitude; but become divided in their course into smaller and smaller ramifications, and at last into the finer capillary tubes, whose filaments can scarcely be discerned by the minutest observation. Let us then suppose a person ignorant of the fountain-head and origin of the blood which flows through these arteries and veins, and yet desirous to explore it by means of experiment. Surely in such a case he would scarcely commence with the smaller capillary vessels, and there institute a tedious course of dissection, with a view to trace them upwards in their devious progress; in so laborious a pursuit he would most probably be diverted from his track into other arteries and veins, and thus remain long perplexed and misled by their numberless intricacies, before the great and regal aorta would terminate the search. Nay, by such a plan, a still further source of error, and consequent removal from the heart, might arise in the section through arteries into veins, while aiming at the contrary direction. Nature may be also likened to a labyrinth, whose intricacies you are anxious to explore. Fruitless would be the attempt to wander through all its windings, and take note of all their directions; for in this case the difficulty would only grow the more inextricable, you would only pursue your footsteps in

a circle, and recognize the self-same spot when most elated by the prospect of emerging; so that if you would gain with ease, and possibly by the shortest road, the exit of the labyrinth, you must reject the senseless wish of exploring all its intricacies; rather planting yourself at some intersection of its paths, strive to ascertain somewhat of its general figure from the circuitous route you have already trodden, and retrace if advisable some of your steps. Thus may you easily ascertain the course leading to its outlet, and obtain the clue to direct you through all its mazes; and when you have familiarized yourself with their plan, you may throw aside even the clue itself, and wander about in the labyrinth fearlessly without it. Then, as if seated on an eminence, and at a glance surveying the scene which lies before you, how will you smile in tracing the various sinuosities which had baffled your judgment by multiplied and illusive intersections! But let us return to actual phenomena, and leaving similitudes pass on to the subject itself. By too great an accumulation of phenomena, and especially of those which are very remote from their cause, you not only defeat the desire of scrutinizing the occult operations of nature, but plunge yourself more and more into a maze, where you are perpetually drawn aside from the end in view, and misled into a distant and contrary region. For it is possible that many things of seemingly opposite natures may exist from one and the same first cause; such as fire, and water, and likewise air which absorbs them both. Thus a confusion arises as well from their contrary and heterogeneous natures, as from their endless variety, and a very diffused and indistinct notion becomes presented to the mind. After the experience of so many ages, if a person should be importunate, and desirous for still further knowledge, confessing that in these respects he is still needy and ignorant, it is no wonder that he should be unable to arrive at the knowledge of mundane things so as to reason from principles and causes; for were he possessed of the greatest possible accumulation of facts, they would only serve to increase the difficulty of attaining his end.

In the state of ignorance in which we are at the present day, we can derive knowledge only through experience; not merely our own individual experience and that of our own age, but the experience of the whole literary world and of numerous ages: for after we have obtained an acquaintance with what the learned world has discovered, we are individually enabled to superadd

experience of our own, and thus continually to become more enlightened. I affirm, therefore, that at this day we are made wise only by means of experience; nor can we arrive at wisdom by any other path. It is impossible to receive knowledge immediately from the soul; man attains it only through the medium of organs and senses. The first fountain of science springs from these sources, and it is by means of the connection existing between these, and the faculties of reason and judgment, that we acquire a perception of objects: that is to say, it is only by means of experience received through the medium of organs, and thence transmitted to the mind, that we are capable of becoming wise. The means therefore of all our wisdom are to be found in experience; without which the human race would be barbarous, merely animal, and irrational. Suppose a person, destitute of education, left wholly to himself with wild beasts and apes, or advancing to manhood without the society of any animal,—What kind of brute would he be? What intelligence would he enjoy from nature? What would be the operation of his higher aura, or mind [*animi*], on the organs of his body; or, at a riper age, what would be the operation of the organs of his body on his mind? Man is made and formed, and distinguished from the brutes, by education alone; in the process of which, the organs that mediate between the mind [*animi*] and the body, being brought into exercise, are as it were cultivated and fashioned; and exercise so arranges the elements enclosed in the small membranes and organs, as to enable the most subtle tremors and motions to pass and repass throughout them, and opens as it were those secret and intricate avenues which lead to the most subtle and active substance of our nature. It is by means of this that the oracles of the rational mind are issued and disclosed. All the sciences we possess, we have received from experience. By experience we know how to discharge the duties of a citizen, and to live with others in moral society; we learn to be prudent, we learn to be philosophers. By experience we acquire the arts of war and fortification; we learn to train soldiers in such a method, that each individual of himself conjointly with the battalion, and the battalion with each individual, is enabled to stand securely against the attack of the enemy. We learn by experience to construct ships, to build houses, to cultivate fields and gardens; arts which first originated from a sense of their necessity, and being thence practiced, attained perfection through

the experience of ages. Let us instance the sciences of metallurgy and chemistry. Metallurgy, which commenced in an experimental knowledge many ages before the flood, continued its progress until it attained the improvement it at present possesses: an improvement which is such, that we now fully understand how the hardest rocks can be penetrated; how shafts of different kinds can be worked through mountains themselves, passages bored to the bowels of the earth, and its metallic veins opened and explored; how laboratories and furnaces should be constructed for the purpose of extracting and smelting the better part of the ore, and how the metal is afterwards to be made into bars and shaped with the file; with many other particulars which relate to the hidden course of the vein, and the formation of the metal itself. These discoveries are all owing to that great instructress experience, who seems to have been the more ingenious in regard to this art, and the more desirous of learning it, because it produces silver and gold; means to which all things are obedient, which procure subsistence and honors for their possessors, and which, upon that account, so greatly interest mankind. From experience we learn the extensive science of chemistry, or the art of separating metals, and all the constituents of vegetable nature, by both the dry and the humid method, as it is called. How sulphur, spirits, oils, and liquids of various kinds, may be elicited by means of fire or a solvent; how the lighter parts, and likewise the heavier, and metallic substances, may be dissolved by the solvent, and made to sink to the bottom, or ascend to the surface; how the flame and fire are to be tempered, and to what degree of heat a body capable of being subdued by it should be subjected; or how a slow fire devours substances, or a stronger and fiercer descends deeper into their compages, penetrates into their inmost principles, and separates them into parts. But this entire science is the offspring of experiment. We are indebted to experience therefore for all our knowledge, while experience itself is indebted to the senses, by means of which objects are subjected to the ratiocination of the mind, and thus we are finally enabled to acquire wisdom. In proportion, therefore, as the supply of experience is the more abundant, and the better disposed and distributed throughout the organs; in proportion as the mediate organs are more exact in their harmony, and better adapted in their figure; and in proportion as a more elevated path is thrown open to the most subtle

principles of things by series and continuity, in the same proportion may many become wise. But, after all, alas! what is our wisdom?—truly such as what is finite is to what is infinite; and in respect therefore to infinite wisdom, nothing.

The reason for which we are to acquire knowledge by means of experience, and to investigate the nature of objects and set them in a distinct point of view, by subjecting them to the operation of the reasoning faculty, is, that we have an active and most subtle principle and soul, to which the subjects of our enquiry can be submitted; whereby we are enabled, through the comparison and series of many phenomena, to form a judgment respecting them; and, by considering their equations, similitudes, analogies, and analyses, to discover their causes by a course of geometrical and rational investigation. Man is distinguished from brutes by reason alone: in other respects we are mere animals and organized forms. Our senses are similar to those of brutes, and we have an interior texture not unlike theirs: our sole distinction consists in that invisible or reasoning faculty, that more subtle active principle, to which we are enabled more inwardly to refer objects, and consequently to perceive them with more distinctiveness. It cannot be denied but that there is a connection between the organs of the senses and the soul, and that the affections of the organs of the senses can be in a moment transmitted to the soul by means of that connection: it is equally certain that those affections thus pass out of a more gross medium into a more subtle one, and that these mediums are contiguous and succeed each other in order. For if the affections impressed on the organs be instantly perceived in the soul, and if the organs of the senses be of a grosser substance than the soul, it follows, that all perception passes out of a grosser into a more refined medium, by means of contiguity and of the connection existing between them, and thus arrives at that most active principle which is the primary and ultimate constituent of man. We can form no idea how this perception is experienced in the soul, but by comparing it with the elements. For there exists a first and a most subtle element, and others that are successively more gross; thus there are air, ether, and others. If the particles of a grosser element should by any means be excited, either individually or collectively, so as to experience either an undulation, or a tremulation, or any other kind of modification, such modification would pass out of this grosser medium

into a more subtle one. If these mediums were in such close contiguity and connection as to form together one volume, then the motion arising in the grosser element or medium would be more sensibly felt in the more subtle one. The tremulation of one particle, or of its surface, in the grosser medium, might cause an undulation among the particles, or in the volume, of the more subtle medium: and if mediums and elements of a still more subtle nature were present and intermixed, the same affection which was tremulous in the first and undulatory in the second, might cause a local motion among the particles of the third. It follows from hence, that when a motion passes from a grosser medium into one that is more subtle, it becomes successively more sensible; and if more sensible, then more distinct. We are distinguished therefore from brutes by this circumstance, that their perceptions do not penetrate to so subtle a medium as they do in man, but that they stop as it were midway, where perception is less sensible and less distinct. Let us suppose the organs of the senses to be mechanical, and formed according to the mechanism of the motions existing in the elements; let us suppose that there are membranes which are acted upon by either the air or the ether undulating; let us suppose also that these membranes are of different kinds, either more gross or more subtle; and that the brain has a hard meninx, a soft one, and one more subtle still; (for it is observable that all things, both in the vegetable and animal kingdom, go out into ramifications, which become more and more subtle till they arrive at the highest degree of fineness, as is the case with the muscles, with the nerves, with the veins, with the membranes;)—if, in this case, a motion arise in a grosser membrane, and pass into one that is more subtle, the effect will be exactly the same as in passing from a more gross into a more subtle medium. If the mediums or membranes be so contiguous and in such mutual connection, that a motion impressed on that which is more gross can be instantly perceived in that which is more subtle, then the least motion in the more gross becomes greater, and of a higher kind, in the more subtle, and consequently more sensible and distinct. That the membranes perceive, is a very common form of speech among anatomists. But let us leave these subjects, from which we only mean to infer that we ought to be instructed by the senses, and that it is only by means of the experience conveyed from them to the mind [*animus*] that we are able to acquire knowledge and wisdom.

I have before observed that man is formed by the education and exercise of his faculties, that the organs which mediate between the senses and the mind are fashioned by continual culture, and that without culture and exercise those organs would be closed, as it were, and man would be like a brute. The slowness of his progress from infancy to manhood contributes in a most important and essential manner to the forming and opening of such organs or motions in the most subtle membranes; not to mention the construction of the brain itself. For we do not arrive at adolescence till after fifteen or twenty years, or more; whilst the larger, more robust, and muscular animals, arrive at maturity in between three and five years. In the meantime, our organs are yielding and soft, like wax, which enables them to receive the natural and simple motion of the elementary world, and to accommodate it to themselves in a gradual and orderly manner; so that whilst they consolidate, the vestiges and elements, or figures and diversities, of the motions they are exposed to, can be fashioned within them; for the reason that, whilst the different parts are fitted to each other and increase in size, they grow hard by degrees. If, therefore, during this interval, the parts which as yet are weak, tender, and easily affected, be agitated by perpetual and long-continued motions, their tender texture being thus constantly in motion and agitation for a long time, and always acquiring form during its growth and expansion, is rendered pliant and yielding to the innumerable different motions of this description. But on the other hand, if an animal arrive sooner at maturity, and its parts receive a fixed arrangement before they are accustomed to such motions, they must be rendered more rigid, and become in a manner callous; whence the more subtle parts, and those which approximate to the most simple, afterwards yield with difficulty to the motions impressed, and afford no passage through themselves but what is gross and obscure, just as if the impressed motion had to pass through a thick coat; for the greater rigidity and thickness of the coats of the organs and membranes renders them less obedient to subtle tremors. The longer, therefore, an animal is in arriving at maturity and the full tension of its parts, the more open may the passage to its most subtle principles or organs be rendered, and the thinner will be the coats of its membranes and parts; the more obedient also to the motions impressed on them, and the more numerous the ramifications into which it will extend; consequently,

the more perfect will the animal become, provided the means be employed which are capable of perfecting him; and which consist, as was before said, in perpetually calling his faculties into use, cultivation, and motion, by means of education.

Although, however, we acquire wisdom by experience alone, it does not therefore follow that they are the wisest who are the most experienced, or who retain a great deal in their memory; I affirm only, that they are capable of becoming wise, and that experience is the medium which leads to wisdom. For experience, considered merely by itself, is science, and not wisdom; it is only the threshold and entrance by which wisdom may be approached. He who is possessed of scientific knowledge, and is merely skilled in experiment, has taken only the first step to wisdom; for such a person is only acquainted with what is posterior, and is ignorant of what is prior; thus his wisdom does not extend beyond the organs of the senses, and is unconnected with reason; when nevertheless true wisdom embraces both. In the state of ignorance in which we live, experiment is but a kind of phantom, a mere effigy which simulates the appearance of wisdom. At this day they are reputed the most wise who are most experienced, or most versed in experiment; by making a display of which they are immediately regarded as persons of acute judgment and refined perception; and the more so, if they are possessed of eloquence and an harmonious series and connection of language; still more so, if they know how to captivate the ears of their auditors by a sweetness and melody of voice and accent. But those alone arrive at the goal of true wisdom, who not only possess the greatest store of experience, but have also their organs so formed and disposed, from the senses even to the soul, by means of exercise, and so well and closely connected and arranged, that they can adduce from their treasures of experience, whenever required, such instances, and such only, as are adapted to the immediate occasion; by the similitude, analysis, and comparison of which, they are enabled to reason distinctly, and to arrive even at the causes of the subject of enquiry, or at the things antecedent and prior to it, by a chain of argument. But experience taken by itself, as was said before, is not wisdom. A painter who is possessed of colors and dyes, and can draw lines with them, is not therefore master of his profession; nor is a mere manufacturer of instruments capable, on that account, of skillfully touching the strings of the harp and educing harmony. He who

possesses an ostentatious number of books is not necessarily a man of learning, nor does he, for that reason, deserve the laurel, for his wit may probably be of the dullest kind. Or, to consider the matter nearer and more interiorly, the historian who has turned over a multitude of books, and has learnt from them the fates and vicissitudes of former ages, and the lives and exploits of all the heroes, is not on that account wise, and worthy of being raised to official eminence; that is, he is not, from that circumstance alone, an able member of the commonwealth, and more deserving than others to be seated at the helm. He ought to have the events and transactions of former times so arranged, by means of his organs and the various chambers of his memory, as to be able, on every occasion, to refer to such historical circumstances as are most similar and analogous to the case in hand; and these and no others ought, as if spontaneously, to offer themselves to his reasoning powers. Nor is he even then wise, unless he has previously penetrated, by means of a rational philosophy, into the causes and principles of things; in order that he may afterwards be able to argue upon the present emergency from causes and principles, or from reason and *a priori*, and to form more certain conclusions by means of a connected chain of inferences; and, having his counsels derived from such a source, may be able, by the timely adoption of proper measures, to provide for the welfare of the state.

Hence it follows, that he who retains all the natural experience of the world laid up in the storehouse of memory, is not on that account a philosopher, and capable of knowing the causes of things, and of reasoning *a priori*; for to do this, he must know moreover how to digest all things analytically by means of geometry and rational philosophy; and must possess the faculty of reasoning philosophically, which consists in a certain situation and figure of the organs, as connected with the rational faculty, produced by continual cultivation and use. It is thus that a man may first become a philosopher, may be enabled to penetrate into the causes of things, and may afterwards from causes speak by means of experience.

Hitherto we have treated of the first medium leading to philosophical wisdom, or the knowledge of the mechanic or organic world: we now proceed to the next.

2. The second medium leading to wisdom, by which the arcana of invisible nature may be unlocked or revealed, is geometry and

rational philosophy ; by means of which we are enabled to compare our experiments, to digest them analytically, to reduce them to laws, rules, and analogies, and thence to arrive at some more remote principle or fact which before was unknown. Mere experience is incapable of unfolding anything, and of reducing it to its more simple parts ; it cannot so arrange facts that bear a resemblance to each other, as to discover what was unknown by observing its similarity to things that are known ; for this is the office of reason. But to retain a great abundance of observations in the memory, and afterwards to form conjectures or conclusions respecting things unknown from their similitudes and analogies to such as are known, and thus to ground our discourse upon a connected chain of experiments, is a method of attaining wisdom at once familiar and natural.

The whole world itself, as consisting of the elements and of the mineral and vegetable kingdoms, is a pure system of mechanism ; and so also is the animal kingdom, as to its anatomical organization. The science of mechanics itself with all its powers, geometry with all its figures and quantities, and philosophy with its comparative and proportional reasoning, sprang solely from the elementary world ; they are the offspring of the elements of which they were conceived and born. The science of mechanics is the law of nature herself as she acts and moves in the elements ; and it is according to this that her parts have their motion both in the simple and compound ; without the elements and their regular disposition and motion, no mechanism could exist. As therefore the science of mechanics is the law of elementary nature, it follows that the world itself is governed by suitable laws and rules, and that the whole is a grand piece of mechanism : a circumstance which becomes the more evident when we observe that nothing is in a state of motion without observing some mechanical law. If motion be supposed, both the figure of that motion must be supposed, and also its space : consequently, if there be figure and space, as well as motion, the whole is mechanical, and is capable of being reduced to the laws of geometry. The very attributes of motion, without which it cannot exist, are geometrical, being figure and space. When we form an idea of any body, however small, as soon as we consider it as limited we regard it as something geometrical, because it possesses figure and quantity according to its peculiar dimensions : it may also be considered as subject to laws of proportion

in itself, because it possesses distance between its limits, and between one point of that distance and another there exists proportion: the case is the same in other instances. Thus not only motion, but every finite thing in a state of rest, possesses attributes which are purely geometrical. Geometry, therefore, accompanies the world from its first origin, or first boundary, to its last, and is inseparable from it: so also do the principles of mechanics, though they might be different in a world differently formed, and in elements differently formed and arranged: and thus, although there may be innumerable finite worlds, nothing can exist in any of them which does not depend upon some mechanical principle, and a like principle of geometry must be common to them all. Whoever supposes the world to be any otherwise constituted, must take refuge in occult qualities, only to conceal his ignorance, and to preserve his reputation as a philosopher in the republic of letters. Every well-formed mind must admit that the world is composed of elements; that elements are composed of particles; that particles are composed of spaces and figures; that figured particles are the result of motion, and of situation or disposition suited to such motion; and that motion and situation have their proportions.

As all things in the world are mechanical, and possess motion and limits, it also follows that the smallest natural things, as well as the largest, flow in a mechanical order, and that the smallest and largest are governed by similar mechanical principles. And though the particles of the elements are invisible, and in a great measure elude the observation of the senses, yet as they are fluent and bounded, they are geometrical, and must flow and subsist in a mechanical manner: the case must be the same both with the objects that are within, and with those that are above, the sphere of our vision. That the equilibrium and motion of the greater bodies follow the common and known laws of mechanics, is certain; we see it to be the case in the vortex of our sun, in the planets, in the earth, in the satellites that revolve within the boundaries of the greater vortex, and move elliptically through their proper orbits with perfect regularity exactly as would smaller bodies if they were made to revolve in a similar figure. These immense masses are governed by the same law, or the same centripetal and centrifugal tendency, which is observable in small bodies that are made in like manner to revolve round their center. A similar proof is afforded by the animal kingdom also;

in which we see the motions of whales, elephants, and other animals, effected by means of tendons, nerves, muscles, and fibers, which move the various members of the body, such as the feet, arms, fingers, etc. In all animals we see the blood and fluids flow and return through the large and small arteries and veins, and through their proper ducts and vessels; and either, as in vegetables, proceed to certain fixed boundaries, or continually retrace their steps and perform the same course over again. We also see how the lungs perform their alternate motions, like a pair of bellows, according to the influx and reflux of the air. That all these motions are mechanically effected, we have ocular testimony, since the nerves, fibers and muscles, all properly configured and adapted to the respective movements, lie open to view: whence we are enabled to investigate these primary mechanical and hydraulic machines, to handle as it were these original motive powers, and to demonstrate that they all depend upon mechanical principles. The same observation is true of the organs of the senses. For it is known that the undulating air flows into the ear, and occasions in its tympanum a motion imitative of itself, that it afterwards continues the same motion throughout its malleus, incus, cochlea, and various channels and instruments of sound, towards the interior parts; so that the undulation of the air seems to have formed a mechanism of its own, with a view to be received and transmitted farther towards membranes of the same kind lying within, for the reception of sensation. What a wonderful mechanism is apparent in the eye, where there are so many coats, so many humors and fibrils, so many nerves leading from them towards the interior parts!—by means of which whatever is received from the ether in the eye, insinuates and propagates itself from thence towards the coats of the same kind in the meninges, and thus more and more deeply: so that the ether seems to have formed in the eye a mechanism of its own, by which its undulations can be received and be farther transferred towards the interior parts, till sensation is experienced. These contrivances and minute machines, most exactly formed, according to the laws of mechanics, for the reception of the modifications of the air and ether, it is in our power to view, examine, and scrutinize in all their parts, and to see how their membranes and coats are prolonged, as it were, from the interior recesses of the head into the light of day, in order that the elements may be able to operate immediately upon them,

and more speedily convey the impressed motions from thence towards the interiors; an operation which is effected gradually, by first affecting the coats of the same kind, and then such as are smaller and possessed of more acute sensibility. From these observations we may conclude that the animal body is governed by mechanical principles; to which conclusion we may add, as will now be demonstrated, that the same kind of mechanism is observable in the smallest animal as in the largest. For there are animalcula so small as to evade the observation of the keenest eye, and to be discoverable only by the aid of the greatest magnifying power: yet these, diminutive as they are, have feet, legs, and other members, which are moved in the same manner as the members of great whales and elephants; they have lungs which inhale and respire the air; they have a heart which circulates some kind of blood through their little frame; they have sight, and probably hearing, consequently they have coats and meninges, which are protracted and expanded from within the head towards the eye and ear till they come in contact with the external element; they have humors, fibers, and vessels receptive of the motion of the elements, by which those motions are transferred towards the membranes and meninges that are contained within this little animated point: they have also their desires, pleasures, gratifications, loves, parturitions, and emotions of their animal spirits. Now as there is the same mechanism, and equally ingenious, in the smallest animal body as in the greatest; and as the former seems, on account of the more subtle texture of its membranes, to possess quicker and more perfect motions than those whose bodies are more gross (for the smaller animalcula are in a manner nearer to the more subtle and simple elements); what other conclusion can be drawn than that nature is the same, is like herself, and is governed by similar mechanical principles, in the smallest finite existences as in the greatest? Thus also in respect to the elements; if they have motion it must be by particles [*particulatim*],² consequently they must have particles of which they are composed; and the particles of one element must have the particles of another element within it and without it, with which it must form equilibrium and contiguity. But this will be explained in the course of the work; I only wish to state here, that in these invisible and smallest elementary figures there is the same kind of mechanism as in the

² *Particulatim posse moveri debent.*

greatest; that it is the same in whales and the smallest insect, in an immense inhabited globe and a little revolving ball. If geometry be considered, it will be found to be always like itself. For if there be space, it is always accompanied by figure; if there be motion, figure too is always inseparable from it; if several spaces and figures be imagined, there will always be a ratio between those spaces and figures; there is the same ratio between the greatest numbers as between the smallest; as for example, there is the same between 100,000,000,000,000 and 500,000,000,000,000 as there is between .000,000,000,000,01 and .000,000,000,000,05. The case is the same with the differences in the infinitesimal or differential calculus; that is, there is the same ratio between (dx) and (dy) as there is between the essential integers (x) and (y) , though (dx) and (dy) are differences nearly equal to nothing. Thus also in occult nature, or the smallest corpuscular existences: there cannot be any other proportion between the smallest elementary particles, than what exists between the greatest bodies of the same figure, unless there be collateral considerations that cause dissimilitude. It is only that which is not finited or bounded that is exempt from the laws of geometry; but as soon as anything is limited by boundaries or motion, or both, it is immediately connected with figure and space, and comes under the empire of geometry, which has for its subject whatever has boundary or figure. The mechanism of minute things is better, purer, and more conformable to rule, than that of things which are large and intricately compounded. For in minute things the weight, circumference, surface, and figure are less; their modification, which is the cause of change, is less; and consequently there is less dissimilitude, fewer points of contact, and less friction: thus in minute things there is nothing to prevent the whole from being geometrically put in motion: a circumstance which cannot be hoped for in great bodies, for the reasons just mentioned.

As nature³ operates in the world in a mechanical manner, and the phenomena which she exhibits to our senses are subject to their proper laws and rules, it follows that nature cannot thus operate except by means of contiguity and connection. Thus the

³ Nature is the first beginning of the mutations which are in the world. This first beginning is a force; hence nature is a force. But since these mutations exist by motion, this force is a motive force. Hence universal nature is a universal active or motive force. (See the *Cosmologia Generalis* of Christian Wolff.)—*Translator*.

mechanism of the world consists in contiguity, without which neither the world nor its mechanism could exist. Unless one particle were to operate both upon another and by means of another, or the whole mass were to operate by all its particles respectively, and at the same time at a distance, nothing elementary, capable of affecting or striking the least organ of sense, could exist. Contiguity is necessary to the production of every operation. Without a perpetual connection between the end and the means the existence of elementary nature, and of the vegetable and animal natures thence originating, would be impossible. The connection between ends and means forms the very life and essence of nature. For nothing can originate from itself; it must originate from some other thing: hence there must be a certain contiguity and connection in the existence of natural things; that is, all things, in regard to their existence, must follow each other in successive order. Thus all things in the world owe their existence to their mutual dependence on each other, there being a connection, by mediums, from ultimate to ultimate, whence all things have respect to their first source from which they derive their existence. For if all things had not respect to their first source, but only to some intermediate link, this intermediate would be their ultimate: but an intermediate cannot exist but from something prior to itself, and whatever exists from something prior to itself cannot be the ultimate, but only an intermediate; or else if it were the ultimate, the world would stop short at this ultimate and perish, because it would have no connection with its proper ultimate by something antecedent. These remarks have reference to the subject of existence. With respect to the subject of contingencies, or modes and modifications, which exist both from ultimate and simple, and from intermediate substances, neither can these be otherwise than continuous and mutually connected, depending successively on each other from one end to the other. Thus must all things, both such as are essential and such as are contingent, necessarily have a connection with their first substantial principle: for they proceed solely from simple or compound substances; and as these substances depend, for their existence, mutually upon each other, it follows that the modifications related to those substances must be dependent on the same connection. We see then that there is contiguity in all things, and that nature produces them by means of the connection, extending from one end to the other, of both substances and causes.

Whatever is first produced by such connection must continue to subsist by the same means. We see in vegetables that there is a connection between the root and the extremities, and every part of the extremities: that there is a connection between the intermediate stem and the little twigs and leaves, by infinite filaments stretching from one shoot, branch, and stalk, into another, and thus affording secret passages for the continual reception of aliment. It is in such a contiguity that vegetation itself consists; and the life of the vegetable afterwards continues in the same contiguity and connection: the part where it ceases no longer grows, but withers and dies, and drops useless from its stem. The case is the same in animals; parts cover over parts, and grow by contiguity. Both the nervous and membranous system is coherent and contiguous. There is no part in the whole animal to which the fibers, muscles, veins, and arteries do not extend; no fiber, which is not derived and ramified from some larger nerve; no nerve, which does not proceed from the medulla spinalis or oblongata and its teguments; and no vein, but what originates from that great one which flows immediately from the heart. The medulla and its teguments, with which the nerves are connected, are in contiguity with the membranes of the whole brain; its grosser coats are contiguous to its more subtle ones; the dura mater to the pia mater; the pia mater to the more subtle parts; and thus the contiguity is continued till it arrives at those simple active substances, from which all motions or affections can afterwards reflect and expand themselves to the most subtle principles of all. Hence it is manifest that there is a continual connection of the whole body with its minutest parts. If the connection with any part were broken, that part would no longer partake of the life of the rest of the body, but would die, having lost its contiguity. If a connecting part, mediating between the grosser and more subtle motions or affections of the body, were to be broken, a resemblance of death would be superinduced upon the part. Hence also the poets have compared the life and fates of man to a continuous thread woven by the Parcæ, and feigned that if this thread were anywhere severed, his life would also be cut off and all the series of his destinies. But to return to our elementary world. If we admit a contiguity, we immediately have a cause for every contingent occurrence; but if there be no contiguity, no contingent circumstance can occur in the world, because there is no cause for

its occurring either in one manner or in another. The cause and reason of all effects and phenomena is to be found in contiguity and connection. If this *contiguum* of nature were to begin to be diminished and rarified, the world, as to the phenomena existing in it and every part, would part as it were for breadth, and be reduced to its last extremity. Thus all things depend on something contiguous to them; as the body depends on life, hearing on the air, sight on the ether. The equilibration of all things in the elements depends also on contiguity. The air itself could not undergo and communicate pressure, according to its altitude, nor could it force up the mercury in the barometer to indicate the approaching weather, unless its particles were contiguous to, and incumbent upon, each other, and unless the pressure and weight of its lowest particles, or those nearest the earth, were balanced with those which are above the clouds: neither could any particle of air expand itself, nor so exact a proportion exist between the degree of its expansion and the superincumbent weight, without the contiguity, continuous action, and consequently equal pressure, of the circumfluent particles. Neither without contiguity could the air undulate so distinctly and harmoniously, or actuate the drum of the ear in a manner conformable to itself, and operate as it does in every direction. Without the existence of other more subtle elements, the particles of which are contiguous to each other, from the sun to our globe, by means of which a contiguity is effected between the sun and the eye, it would be impossible for the eye to behold the sun; there would be no light, and no sight or perception of light: but as the eye enjoys the sight and sensation of objects which are nevertheless at a distance, it is a sign that there is some kind of contiguity between itself and these objects, such as the sun, the stars, and the planets. In short, no reason can be assigned for any phenomenon, unless we admit the existence of contiguity or connection; for no phenomenon can exist, except in something contiguous. The conclusion therefore is, that the mechanical world has its consistence in contiguity and connection.

That there is a contiguity and connection in the elements, appears also in men and animals, who are composed, and in a manner formed, according to that contiguity and connection. In some, the connection of things existing in the elements appears to be natural, for all the harmony in the elements conspires with the connection of their organs, whence a corresponding harmony is

felt in their organs without any assistance from rules: for the mechanism of the world to some men and animals is natural, or is familiar to them by nature, without any other instructor. Thus we find the hearing delighted by harmonious sounds and the concordant vibration of musical strings. Musical harmony has itself also its own rules, its own proper geometry: but this we have no need to learn in order to perceive the harmony; we have it in the ear itself and the organs of hearing, which are in harmonious coherence. By harmonious and accordant sounds we are exhilarated, affected, dissolved away; but discordant sounds give us pain. For sound, when harmonious, glides on to the soul as it were spontaneously by means of the connection between the two, and with a smooth and even stream; but when it is discordant, the connection is immediately disturbed and tortured, and the sound does not arrive at the soul without occasioning pain. It is from the same cause that some persons are musicians by nature, and know how to accompany their voice with an instrument, or an instrument with their voice, immediately, without any master; although music, like all other things, has its own geometrical rules and proportions. The eye, also, is capable of feeling whether anything be harmoniously proportioned or not: and if it be, and its mechanism be well arranged, the soul is immediately delighted through the eye. Thus the eye discerns whether a tree be growing and flourishing in a manner to affect us with a sense of beauty and delight; whether the ornaments of a garden be conformable to the rules of art; whether certain mixtures of colors harmonize together; whether an edifice and its parts be constructed according to rule; whether anything be beautiful and therefore delightful; whether the face of a man or of a virgin be handsome: and all this it does without understanding the rules in conformity with which beauty consists; although nevertheless beauty has its proper rules, and consists in the analogy and harmony of parts. As, too, there is a like connection and harmony between the eye and the mind, therefore whatever is harmonious immediately extends, with uninterrupted course, to the mind [*animus*], which it exhilarates and expands; while all things that are deformed, and not in agreement with analogy, occasion it a certain degree of violence. We have still more striking tokens of harmony in the other senses, as in the smell and the taste, so that by the senses alone we can discover whether the parts of a substance be angular or round, or what is

their form and figure. The mechanism, therefore, of some things is natural to our senses. As brute animals also are formed according to the connection subsisting throughout the world and its elements, so also the organs of their senses are in like manner endowed with a connectedness and harmony similar to that of the elementary world itself: hence we behold indications, in many of them, of a certain natural mechanism. We see the spider construct her webs in a geometrical manner, drawing radii from a center, and connecting them together with polygons and circles; and when it is finished, she places herself in the middle, and lies in ambush for her prey. We see the beaver build himself a house, neatly fitting one beam to another; exactly as would an architect, when proceeding by geometrical principles and rules. We see how birds form their nests, in various ways, of boughs, straw, reeds, earth, and clay, so that it would be scarcely possible to frame them better by the exactest rules of art. They know how to give a round form to their nest, to attach it to the eaves of buildings or boughs of trees, to contrive supports for it, and to unite together its parts so as to leave in the middle a cavity lined with chaff or feathers, within which in soft repose they may lay their eggs, and pass the period of incubation. To say nothing of bees who form to themselves hexagonal hives of wax, and of numberless other instances. These exemplifications may suffice to point out and confirm the existence of a natural mechanism: for the senses are formed in accordance with the mechanism of the elementary world, and everything is in agreement with the senses which is in agreement with the connectedness of their structure.

But though the world is constituted in a mechanical manner, and is composed of a series of finite things which have their origin by means of the most various contingents; and though the world, being of such a nature, may, with the aid of geometry, be explored by means of experiment and the phenomena that exist in it; it does not therefore follow that all things whatsoever that are in the world are subject to the empire of geometry. For there are innumerable things which are not mechanical, nor even geometrical; such as the Infinite, and whatsoever is in the Infinite. Geometry is conversant only with things that are finite and have limits, and with the figures and spaces thence originating, together with their several dimensions; but that which is infinite is without and above the sphere of geometry, being regarded by it as its origin and

first beginning. For the finite has its origin in the infinite, without which it can neither begin nor continue to exist: to this infinite it is that everything finite has reference, not excepting geometry. Geometry, therefore, is itself subservient to that most vast Infinite, from which as from their fountain-head such an infinite number of finite things emanate, and owns that there is nothing in itself either similar or analogous to it. There is then an Infinite, which can by no means be geometrically explored, because its existence is prior to geometry, as being its cause. There are also many other things, the nature of which, though they originated from the Infinite, and began to exist together with the world, has not yet been discovered by any geometry or any reasoning philosophy: for instance, that intelligent principle which exists in animals, or the soul, which, together with the body, constitutes their life. We may perhaps learn the mechanism of the different organs, and may know how they are moved by means of the muscles, tendons, fibers, and nerves,—by the feet, arms, and other members; how the undulating air is received by the membranes and instruments of the ear, and is represented within the mazy chambers of the brain by means of sounds; we may also come to know how the ether exhibits a modification of itself in the eye, and runs through the membranes of its nerves till it arrives at the meninges of the brain; how a motion dissipates and expands itself out of a grosser into a more subtle medium, and thus arrives more distinctly at the most subtle membranes; perhaps too we may know how a motion is received by some subtle active principle, and how it does not and cannot remit its elastic undulation [*elaterem suum non remittat*], till choice has determined it into act by means of the will; we also see every emotion and mode of the soul performed mechanically in the body: still, after all, what that intelligence itself is which is in the soul, which knows and is able to determine, which knows and is able to choose, and to let one thing pass out into act and not another, we are obviously ignorant. For it does not consist merely in the relation or reaction of motions proceeding from grosser mediums, through such as are more subtle, to that contexture of active principles where perception takes place; for this exists in the elements, in vegetables, in all the world, yet there is not, on this account, an intelligent principle in everything belonging to the elementary world. In the souls of brutes, too, there are the marks of a certain intelligence. Birds know how to form their

nests according to harmony and mechanical rule; they know how to deposit their eggs, to sit upon them, to hatch and rear their infant brood; offices which are variously performed by various species according to the difference of nature and disposition in their tender offspring. Other animals are aware of the approach of winter, and make timely provision against it. Ants erect their hills, and diligently carry and store up in them such things as ought to be under shelter during the winter. Bees know to suck honey and wax from flowers; to construct hexagonal cells, and to store them with honey: the elder ones know how to send out their offspring with a view to form new colonies; to kill their useless companions and drones, and to cut off their wings; in a word, they know how to provide for futurity, that they may not perish with hunger in the winter when no sustenance is to be found abroad; not to mention other marks of their prudence and natural intelligence. We behold the spider construct her artful snare with diametrical lines and connecting circles, and then lying in the middle, she so places her feet, as instantly to feel into what part of her web the prisoner has fallen. What marks of prudence excite our wonder in the fox! What artful frauds and cunning tricks does he practice! What wonders of a like nature are observable in innumerable other animals; and all flowing naturally from a grosser kind of soul. But what is the nature of this intelligence, pertaining to the active ens of animals as an inherent quality, geometry has hitherto been unable to discover; and we are yet ignorant whether the laws to which it is subject are similar to those of mechanics; although it cannot be denied to have laws, because it has an orderly connectivity, and is natural. In the soul of brutes there is some idea of this intelligence: in man it is more distinct and rational: in the Infinite it is infinite, and infinitely surpasses the comprehension and sphere of the most rational intelligence. There are also many other things which occur in the world that cannot be called geometrical. Thus there is a Providence respecting all things, which is infinite in the Infinite, or in the Being who is provident in the highest degree; and there follows from hence a connection or series of consequents, according to which all circumstances are determined and arranged, by causes and the causes of causes, toward a certain end. We see from experience, and *a posteriori*, that there is such a connection of contingencies, from causes and their causates, in producing a given end; but to know

the nature of this connection, *a priori*, is not within the province of man or of geometry. There are also innumerable other things which we in vain endeavour to explore by geometry and *a priori*; as, perhaps, the nature of love. We see, *a posteriori*, that it has its consistence in the connection of things; that it exists independently of the organic body; is antecedent to corporeal pleasure; and, being conjoined in the animal with intelligence, produces everything which can conduce to the preservation and continuation of its kind. The ancients regarded love as being of great moment, attributing to it the production of the universe; and many will assert that traces of intelligent love are to be found in vegetable and inanimate subjects. There are probably infinite other things, of which we have no knowledge whatever, that own no obedience to the known laws of mechanics. Hence we may conclude, that there are qualities in the soul that are still very remote from mechanical apprehension: so that, did we even know all the mechanism and geometry of the visible world, of animal organization, vegetation, or any other department of nature, there still are infinite things with which we are unacquainted.

But since the intelligence in the soul is not mechanical, but only the mode in which the soul operates, we next enquire what that is in the soul which is not mechanical, and what its essential rational and intelligent principle which is not subject to known laws. The rational principle [*rationale*] in the soul does not consist in knowing many things which the world naturally exhibits and represents to the senses; for this knowledge refers itself to the world, the senses, and experience. The rational principle does not consist in knowing the figures and spaces in which motions terminate; for this is the province of geometrical science. The rational principle does not consist in knowing the proportion between figures and spaces, and the other rules and proportions of motion, by which the world acts and produces its phenomena; for this belongs to nature, mechanics, science, and philosophy. But the rational principle consists in knowing how, and at the same time being able, to arrange into such order and connection the reasons or proportional facts known from the world, as to view their analogy: yet this presupposes an active principle, or a certain force, impelling into motion all those things which inhere as it were scientifically in its organs; that is, it presupposes a soul. The rational active principle derived from this consists in knowing

how, and in being able, actually to elicit from analogy a third or fourth truth previously unknown. A subsequent rational principle consists in being able to form a certain series and connection of such reasons or proportional facts, consisting of things known and unknown in succession, till it distinctly arrives at the end it has in view: to accomplish which, all the sciences must coöperate with reason; as geometry, mechanics, rational philosophy, and abundant experience. The rational principle in the soul, therefore, is the continual analysis of those things which are scientifically as it were inherent in its organs.⁴

These observations may suffice respecting the second means of arriving at a mechanical knowledge of the secret things of nature; we now come to treat of the third means, or of the faculty of reasoning.

3. The third means by which we may arrive at a true philosophy in cosmology, and at the knowledge of occult nature, is the faculty of reasoning. Let experience and geometry be given; that is, let a man possess the utmost store of experimental knowledge and be at the same time a complete geometer, and yet suppose him to be deficient in the faculty of just reasoning, or of comparing the several parts of his knowledge and experience, and representing them distinctly to the soul; he can never attain to the mysteries and inward recesses of philosophy. Knowledge without reason,—a heap of many things in the memory without judgment to separate and distinguish them, and without the talent of deducing the unknown object of inquiry from certain known data, by means of the rational or geometrical analysis,—in a word, the possession of the means without the faculty of arriving at the end, do not create a philosopher: nor will any laurel-wreath, plucked from the sacred hill, be entwined by the maids of Parnassus around the brow of him who is destitute of this talent. The faculty of reasoning justly, and of arriving at the end in view by the proper means, which are

⁴ The term "principle" so frequently used in this and other parts of the translation is not always to be found in the original. The expression in the original is *ipsisimum rationale & intelligens—rationale activum*. The word "principle" is used by the translator from not knowing what other to adopt. As commonly employed by others, it conveys no definite idea; the reason is, that no definite idea is commonly entertained of order and series. But the moment a definite idea of order and series in nature is entertained, the term "principle" assumes a fixed and definite meaning: and in this case a principle in its general sense is a first beginning of an order or series.—*Translator*.

experience and geometry, is the characteristic of the rational man. But a like faculty of reasoning is not given, and at this day cannot be given, to all. Some there are who are unable to attain to it from the first moment of their birth by disease or defect derived from their parents. We see children born to the figure and likeness of their parents; with the same face; with the same disposition; with the same situation and arrangement of their organs; with much the same faculty of reasoning as was possessed by their parents; and inheriting their very diseases, which in this case are called hereditary. Some also, by defect, are born blind, or deaf, or idiots, having the brain of improper weight, dimensions, or form, who therefore are able to acquire nothing, or very little, of the faculty of reasoning, by any use or practice; for their organs cannot be so disposed as to afford a distinct communication of motions from the senses to the soul and its reason: they may, indeed, possess a passage to the more subtle interiors, but only such as is irregular, indistinct, obtuse, and obscure. There are others who labor under no natural defect; but who, having been deprived of the advantages of a proper education, and being without experience, have been unable to acquire any talent for reasoning; the way that leads from their senses to the soul may be compared to the passage of rays from the sun to the eye, when they have to make their way through a dense or cloudy medium; their animal motions do not arrive distinctly at their active principles, but stop, as it were, in the middle of their course; the images of the motions, as in mere animals, seemingly scarcely able to travel any further, because the organs are not yet fashioned, as it were, by use and cultivation, that is to say, are not yet rendered contiguous to, and in conjunction with, their more subtle life,—the organs are indeed potentially there, but require exercise to form and fit them for use. But when, by experience and science, they are fitted to motions and tremors of every kind, there are then innumerable things inherent in them, which are capable of being, by some active principle or motive force, produced into act, and so arranged as to give their possessor the capacity of reasoning, or of displaying the operations of his rational faculty. Unless a motion is able to penetrate successively, by means of contiguity, from grosser principles towards such as are more subtle, it either stops in grosser or mediate principles, or passes into a state of obscurity. In proportion, therefore, as a man's store of experience or experiments is greater,

and its disposition and distribution through the organs is more perfect; in proportion, also, as the harmony of his mediate organs is more exact, and their figure better adapted to the conveyance of every kind of tremors or vibrations; and in proportion as the passage is more deeply opened, in series and continuity, to the most subtle principles of all; so much the wiser may the man become.

It was said above, that the faculty of reasoning is acquired by cultivation, or, that we are rendered rational by use and cultivation; and likewise, that we are capable of being rendered more rational in proportion to the length of time through which we advance to maturity, or in proportion to the number of years which are required to form and consolidate the organs.

But that the nature and quality of the faculty itself may be clearly understood, it must be observed that our sciences and experimental knowledge must be so disposed and harmoniously diffused throughout the organs, that immediately on the approach of any active principle or power, all those things so disposed which are of a similar nature, should immediately vibrate and run as it were to meet it, and present themselves to the soul simultaneously; but no others, except obscurely, by virtue of their common connection. This may be illustrated by the comparison of a hundred musical strings of equal length and tension, one of which being moved or struck, all the others vibrate without being touched, run as it were together into the same sound, and present themselves at once in concord to the ear. This being premised, it follows that our wisdom is proportioned to the acquisitions of our memory.

Suppose, then, the means to be in our possession, and that we have acquired the power and faculty of reasoning, and have brought it into actual operation, we may arrive at true philosophy, or may be able to discourse and frame dissertations on the phenomena of nature from their genuine causes, by the aid of experiment: nay, we may arrive at the very fountain-head from which all things that appear mysterious are derived. With respect to the knowledge of the elements, which is the chief subject of discussion in the present volume of our *PRINCIPIA*, I confess that it appears to be of the most occult nature, being remote and imperceptible to the ken of the senses. Nevertheless, the motions of the volumes or bodies contained in the elements are perceptible to our sight and hearing. Thus elementary nature places before our eyes the most

diverse phenomena, by which, as by so many tokens, she seems to reveal herself! now sporting half naked before our view, now concealing herself; yet by her various phenomena ever displaying her image, as in a mirror, to observation. For we see that all things are acted upon and put in motion according to rules; they all flow from the motion and situation of corpuscles of different figures in mutual contact. If, therefore, experiment and geometry be called to our aid, I have no doubt, under the auspices of such leaders, of the possibility of arriving at some knowledge of the things in our world that appear not to our sight; especially since elementary nature, as just observed, is perpetually sporting so beautifully before our senses, and entertaining them with her illusions, to geometers and philosophers always showing her face half unveiled. Let us then call the proper means to our assistance, and we shall probably arrive at the true causes and knowledge of things occult. Unless, however, principles be formed to which experiment, observation, and geometry agree, they are to be regarded as the mere figments and dreams of a delirious mind. But if our principles be agreeable to experience, and are confirmed by the test of geometry, then it may be permitted us to liken them to truths, and to declare them to be a legitimate offspring. How far this may be affirmed of my PRINCIPIA, it is for the reader to decide.

4. By a true philosopher, we understand a man, who, by the means above treated of, is enabled to arrive at the real causes, and the knowledge of those things in the mechanical world which are invisible and remote from the senses; and who is afterwards capable of reasoning *a priori*, or from first principles or causes, concerning the world and its phenomena, both in physics, chemistry, metallurgy, and all other sciences or subjects which are under the empire of mechanical principles; and who can thus, as from a central point, take a survey of the whole mundane system, and of its mechanical and philosophical laws. For the mechanical world of nature is not unlike a spider's web, and natural philosophy may be compared to the spider herself. The spider chooses a situation which will permit her to fasten her threads to the various parts of surrounding objects: the radii which she draws she then makes to meet in a certain center, and these she ties and connects together, at various distances, by circles and polygons; her design in which is to render all the parts of the sphere which she occupies contiguous one to another. Then betaking herself to the middle

or center, she so plants her feet on the threads or radii, as to be able to perceive the smallest particle that may alight on any of the radii at any distance; and whilst thus lying in ambush, she knows immediately whether anything has precipitated itself into her snare, and feels in what part of her web the prey has fallen; for by that very radius and no other, out she rushes instantly and seizes her entangled victim. Now nature herself closely resembles this spider's web; for she consists, as it were, of infinite radii proceeding from a certain center, and connected together, in like manner, by infinite circles and polygons; so that nothing can happen in one of them which does not immediately extend itself to the center, from whence it is reflected and dispersed through a great portion of the fabric. By means of such a contiguity and connection it is that nature is able to perform her operations, and in this her very essence consists; for wherever this contiguity is interrupted, wherever a thread of the web is broken, so as to dissolve the connection between the center and its circumferences, there nature herself ceases and terminates. Natural philosophy is capable of taking her station, with nature herself, near this center to which all natural things have reference, or in which all the motions or affections of all the circumambient parts are concentrated: she is capable of instantly knowing and feeling anything that occurs in the surrounding peripheries, what it is, and whence it comes; and is able to explain the reasons, to her companion nature, why the phenomena occur successively, and by a certain necessity, at such a certain distance, in such a certain manner, and in no other. In a word, she is able, from the center, to take a simultaneous view of her infinite peripheries, and to survey all her mundane system at a glance: thus she does not take up her abode in the mere outward circumference, or entangle herself in the complexity of her operations.

Were it possible, by such means, first to bring to light elemental nature, afterwards the nature of the metallic kingdom, then that of the vegetable, and finally that of the animal, how great would be the advantages which the world would reap from the discovery! For if we knew *a priori* the causes of the things observable in these kingdoms, and were able to dissert upon them, commencing from the same principles and causes from which nature herself brings forth and manifests her phenomena, every one might then know the objects which nature has in view; every one might then give

responses as from the inmost recesses and from behind the veil of nature's temple; every philosopher would be a Themis or Apollo, that is, would be acquainted with all the phenomena that can exist, and would comprise the vastest sciences within the compass of a nut-shell. But if any one is content with devising principles, and is so indulgent to his imagination as not to look for the evidence of them in geometry, nor to concern himself about their agreement with physical facts; or if he forms to himself a distinct theory for every series of phenomena, and for every series of experiments contrives new links of connection, and, when his fragile ties give way, endeavors to restore their coherence with clumsy knots,—can such a one be ever admitted to these oracles? Surely nature will only smite at him: either as a bungler, wasting his time in dreamy toil; or as an infant wishing to build nests in the air, to provide them with eggs and there to hatch young; or as a simpleton employed in making for himself wings of wax, vainly regarding himself, not as Icarus, but as Mercury,—ambitious of directing his flight towards the sun,—and believing, as the poet sings, “That he can unlock the mysteries of Delphos and of heaven, and unfold those great oracles of the August Mind, which have so long lain hid, undiscovered by the genius of any former enquirer.”

No man seems to have been capable of arriving at true philosophy, since the age of that first mortal, who is said to have been in a state of the most perfect integrity, that is to say, who was formed and made according to all the art, image, and connection of the world, before the existence of vice. All who are governed by a right mind aspire after, nay, are intensely desirous of arriving at, the same degree of wisdom, as at a something which we have lost: but how far it is possible to succeed, none but the true philosopher can see; he who is only in part a philosopher, or who wishes to be reputed one, may suppose himself to have arrived at the goal, and even to have proceeded beyond it; while his fancied wisdom is after all mere hallucination. The reason why man in a state of integrity was made a complete philosopher, was, that he might the better know how to venerate the Deity—the Origin of all things,—that Being who is all in all. For without the utmost devotion to the Supreme Being, no one can be a complete and truly learned philosopher. True philosophy and contempt of the Deity are two opposites. Veneration for the Infinite Being can never be separated from philosophy; for he who fancies himself

wise, whilst his wisdom does not teach him to acknowledge a Divine and Infinite Being, that is, he who thinks he can possess any wisdom without a knowledge and veneration of the Deity, has not even a particle of wisdom. The philosopher sees, indeed, that God governs his creation by rules and mechanical laws, and that the soul governs the body in a similar manner; he may even know what rules and mechanical laws are; but to know the nature of that Infinite Being, from whom, as from their fountain, all things in the world derive their existence and subsistence,—to know, I say, the nature of that Supreme Intelligence with its infinite arcana.—this is an attainment beyond the sphere of his limited capacity. When, therefore, the philosopher has arrived at the end of his studies, even supposing him to have acquired so complete a knowledge of all mundane things that nothing more remains for him to learn, he must there stop; for he can never know the nature of the Infinite Being, of His Supreme Intelligence, Supreme Providence, Supreme Love, Supreme Justice, and other infinite attributes. He will therefore acknowledge that, in respect to this supremely intelligent and wise Being, his knowledge is nothing: he will hence most profoundly venerate Him with the utmost devotion of soul; so that at the mere thought of Him, his whole frame, or membranous and sensitive system, will awfully, yet sweetly tremble, from the inmost to the outermost principles of its being.

As nature is the first beginning of the changes that occur in the world or mundane system, or as nature is the motive or active force, or collection of forces, by which those changes are occasioned, it follows that the world is dependent on nature and inseparable from it; and that the world is nothing without nature, and nature is nothing without the world. But the Infinite is still Infinite independently of the world; while, on the other hand, no conception can be formed of a world independent of the Infinite. We see then that nature cannot be without the world, but that the Infinite can, and that He may be a Being capable of being separated from the world: we see also that all things were produced by Him, that the world was created by Him, and with the world nature herself. Nature is only a word which expresses all the motive forces proceeding from the first motion of the Infinite till the world is completed; with this first motion it begins; and as this is produced by the Infinite, so also must nature: they, therefore, are mere children, and have reached scarcely the first threshold

of true philosophy, who ascribe to nature the origin of all things, to the exclusion of the Infinite; or who confound the Infinite and nature together; when yet the latter is only an effect, a *causate* or thing caused, the Infinite being its efficient and cause. Nature, however, when once produced, may be called the efficient and cause of the world, in so far as all things afterwards successively exist by derivative motive forces and modifications; but it cannot be called the first cause: for no other idea can be conceived of the first motion or mode, than that of an immediate production of the Infinite; whence this mode cannot be called an attribute or the essence of the Infinite; the essence of the Infinite consisting in itself alone: and it cannot be denied that the Infinite existed before the world, (which will be the subject of our second chapter:) neither can this mode be a mode of the Infinite; for no such thing can be said or predicated of the Infinite except by way of eminence: but it is an immediate product from the Infinite. Hence it follows, that nature, beginning from such motion or mode, is a *causate* and effect.

Now as all nature—the whole mundane system—is the work of God; as all contingent circumstances, before the world was produced and completed, are to be ascribed solely to His wisdom: so also, in case He should be pleased to display by other contingent causes new phenomena, whether foreign and contrary to the nature of our world, or agreeable to it, yet such as cannot be produced by any other active principle than the Deity,—to the same Infinite Wisdom must these also be ascribed. Thus true philosophy leads to the most profound admiration and adoration of the Deity; nor can anything be found to diminish, but infinite things to increase, this admiration: as when a man sees that all things are of the Infinite, and that in respect to the Infinite he himself, as a finite being, is nothing: when also he sees that all his own wisdom and philosophy are, in respect to the divine, in the same proportion as the finite to the Infinite,—that is, as nothing.

Neither does true philosophy detract at all from the credibility of miracles; all things being ascribed to the divine omnipotence, as the origin of the world, and its formation by various contingent means and successive mutations. No contingent mean, tending to the perfection of the world, can exist, which is not a miracle. The world itself is a miracle; whatever exists in any of its kingdoms, whether in the animal, the mineral, or the vegetable, exists by a

miracle, because it exists by a contingent mean, which, by a series of others, is terminated in the Infinite itself, as in the first cause of all contingent means. For it cannot be denied that intermediate causes and changes proceed successively from the Supreme Being, who produces all things in the most perfect manner, and conducts them to their destined end. Now what He thus produces, by contingent means and causes, cannot be said to be contrary to the order of universal nature, but according to it; and although there should appear some things that are not in conformity with the nature of our world, or not agreeable to the mechanism of our mundane system, yet even in this case they must exist from certain causes, which, like the world itself, derive their origin from the Infinite alone. And relatively to the mechanism of our world, it is a series of mere miracles that could produce one such phenomenon; in like manner when returning to its first origin and cause by contrary contingent means, it would be by a series of mere miracles; that is, supposing our world to remain the same as before the miracles took place. All things which exist in any other world, were they to occur in our own, would be miracles, as being contrary to its laws of motion—to its order of succession and modification; notwithstanding their being produced according to the order of nature, and being in their own world perfectly natural. In short, if a miracle exists, it exists from the Infinite; if from the Infinite, it exists by means of causes. Miracles may also exist which are agreeable to the mechanism of our world, and others which are contrary to it; but neither can be produced but by some one or other active infinite principle, of which we can form no idea, and, consequently, cannot understand its cause.

But the reader may probably wonder why I affirmed, at the beginning of this chapter, that all our wisdom or true philosophy must be acquired by the use of means; and that the way to reason and things prior is to be opened by experience or *a posteriori*: thus, that our body and external senses are our only teachers and leaders, leaving but little to the mind, from which, nevertheless, as its fountain, all reasoning must proceed, or to which all things must have reference; consequently, that the mind [*animus*] of itself, without the use of means, is unable to give any instruction or direction to its body. I will therefore draw a picture of the two states of man; first of his state of integrity, which was most perfect, and then of that perverted and imperfect state, in which,

as degenerate mortals, we live at this day. From such a comparison it will probably appear that it is only by the use of the means above mentioned that the way to the most subtle active principle of our nature can be opened, and that this way must be prepared by mere experiments.

To begin, then, with man in his state of integrity and complete perfection: In such a man we may conceive to have existed such a complete contiguity throughout the parts of his system, that every motion proceeding with a free course from his grosser parts or principles, could arrive, through an uninterrupted connection, at his most subtle substance or active principle, there being nothing in the way which could cause the least obstruction. Such a man may be compared to the world itself, in which all things are contiguous from the sun to the bottom of our atmosphere: thus the solar rays proceed with an uninterrupted course, and almost instantaneously, by means of the contiguity of the more subtle or grosser elements through which they pass, through the ether into the air, till they arrive at the eye and operate upon it, by virtue of such connection, as if they were present; for contiguity occasions the appearance of presence. When, therefore, the most subtle active principle of man, by the providence of God, clothed itself with a body, and added, by degrees, parts upon parts, all the motions in the most subtle elements which were present would necessarily move or affect that most yielding and tender substance, and would gradually impress themselves and their own mechanism upon it. So also would the motions in the grosser elements, such as the air; for the air, always moving and undulating around it, and perpetually acting upon the same substance, would also form to itself something similar, and, by its continual motion, cause itself as in the case of the other elements, to be received within. The like would occur in regard to whatever was fluent in the air with a more unequal motion, for the atmosphere is always stored with the effluvium of vegetables, etc.; this, therefore, by its continual contact, would form its own mechanism in the sense of smell. In a word, during the growth of the tender parts possessing motion and life, every motion that was perpetually present must necessarily have left vestiges of itself, and must consequently have naturally formed its own mechanism, so as afterwards to be received still more interiorly, but in the same manner as in the yet tender substances. The man thus formed, in whom all the parts con-

spired to receive the motions of all the elements, and to convey them successively, when received, through a contiguous medium. to the most subtle active principle, must be deemed the most perfect and the first of all men, being one in whom the connection of ends and means is continuous and unbroken. Such a most perfect material and acting being would in a short time acquire, by the aid of the senses alone, all the philosophy and experimental science natural to him: for whatever could present itself to his senses, would immediately flow, by connection and contiguity, to his most subtle and active first principle. Thus whatever presented itself to the eye would immediately flow, through the little membranes put in motion by its undulations, to those successively more subtle, till it arrived at the most subtle principle. The case would be the same with motions occurring in the ear, smell, and taste; which phenomena would also be most easily transmitted to the most subtle principle, through the medium of the sight, and the harmony of the several senses. As, therefore, the whole man was constructed according to the motions of the elements, and those motions were capable of arriving, without interruption, through a medium so contiguous and tense, at the most subtle active principle,—what conclusion can we draw but that such a man must have enjoyed the most complete, perfect, and distinct faculty of reasoning; that all the mundane system or motions of the elements, must have been familiar to him after a little contemplation and custom; that every relation of their motions, being impressed upon all his organs as it were naturally and from his tender infancy, would be felt with perfect regularity from his external parts or senses to his soul; and that the soul, being furnished with such a body, would naturally be so well acquainted with geometry, mechanics, and the mundane system, as to be able to instruct herself without a master, from the simple contemplation of the phenomena of nature and the objects of sense. Such a man would be capable of taking his station as it were in the center; and surveying from thence the whole circumference of his system at a single glance, he would be able to make himself acquainted with things present, past, and future, from a knowledge of their causes, and of their contingent given or supposed.

Let us now consider the perverted and imperfect state of man, or that into which we are born at this day. In this state we see that no complete knowledge of anything can be acquired without

the use of means : we see that nothing can penetrate to the ultimate active principle, or to the soul, except by means of continual experiments, by the assistance of geometry, and by the faculty of reasoning to be thus acquired : we see that the way which leads to this most subtle and intelligent ens is almost entirely closed, and capable of being opened only by continual cultivation and exercise, that is, by perpetual experiments and the practice of philosophizing, and by the faculty of reasoning thence acquired : we see that even then the way is not, as it was in a state of integrity, so open as to preclude the necessity of continual experiments and practice, by means of which, as things constantly present in the memory, all motions or affections may be remitted to the most subtle principles of our organization, and the passages thus kept as it were constantly permeable and open. For the nature of man's state at this day, and its dissimilitude from his former state, is well known ; how possessed he is by motions or affections quite foreign to rationality ; how continually agitated thereby are his organs ; how his interior texture has suffered violence from different vices, by which the connection between his more subtle and grosser principles is drawn asunder, distorted, and rendered less contiguous than before. What power the emotions or affections of the body, as pleasures and cupidities, have over the fine membranes of his frame, is sufficiently known from experience : for they are able to induce on the fibers, muscles, and nerves, both the more subtle and the more gross, their own emotions or affections. They are able to distort them ; their impression appears in the grosser and external coats of the face, since we often see the countenance disfigured by them and totally changed in a moment. What then must be their effect on the meninges and more subtle parts, or on those mediate membranes and fibers through which a motion or affection is gradually transmitted to the most subtle active principle ? In these parts are the organs leading to the most subtle principle. If then these are continually disturbed, they are totally disfigured and distorted ; consequently, the natural connection, which before was perfectly regular, is distracted or broken. Now corporeal pleasures, cupidities, desires, and vices of this kind have almost filled the whole man ; increasing with time, they pass from practice into habit, and from habit become completely spontaneous, so as to govern the will itself ; in other words, cupidities at length take possession of the will, and withdraw it from the governance

of the reasoning soul, so that man at length is capable of scarcely any voluntary action but what proceeds from these emotions and desires, and is frequently without the consciousness of his rational principle. When the will is thus agitated by innumerable allurements and blandishments almost wholly of this description, the consequence is, that it arranges all the organs that mediate between the body and the mind [*animus*], with their series and contexture, into the similitude of its own emotions, or into the effigy of itself; and when their contexture is thus rendered wholly obsequious to the seductions of the senses, it can no longer be inclined and moved, by the mind, except with difficulty and imperfectly. Such an organization, acquired by the indulgence of pleasures and depraved emotions or appetites, is also left by the parent as an inheritance to his children: for we often see children resemble their parents in their countenance and external form, and it is equally common to observe in them a similarity of mind, that is, a disposition more prone to certain cupidities than to others. Children, therefore, are also born and formed after the interior countenance and image of their parents; and thus the whole assemblage of the organs that mediate between the outward man and the mind, is, from its rudiments, or from the womb and the cradle, fashioned after that of the parents, tarnished with the same stains, replete with the same corruption, and rendered naturally, and as it were radically, disobedient and unadapted to the most subtle modes or modifications, and tremors or vibrations of the mind [*animi*], and hence slow to receive them. As then these disorderly emotions of the body have occupied almost the whole man, and have also taken possession of the meninges, in which the mediate motions take place, it is no wonder that at this day the faculty of reasoning is only to be acquired by the use of means, and that it is not possible to arrive by reasoning at the most subtle substance or principle, without the aid of analytical rules, to be taught us by a master, similar to those of geometry. These corporeal emotions and vices, which seem to have done such injury to the mediating organs, are not unlike those dense and dark clouds, which, interposing between the sun and the eye, deprive it of the use of light; though some rays still penetrate through the cloud, not in regular order, but with confused refraction; hence, when the sky is thus overcast, we are deprived of the natural contiguity of the radiant particles, and are unable to discern the azure firmament

and the sun itself. Such a cloud, as it always overshadows our little heaven, so it can be dissipated only by proper means; but as some traces of it, either inherited or acquired, will always remain, so must our use of the means for its dispersion be indefatigable and constant. That vices and cupidities not only disturb, but also destroy, the natural connection of the organs and modifications that lead to the reasoning faculty of the soul, may be illustrated by example. Anger and an intemperate heat of the body so dissolve this connection as to render a man wholly incapable of reasoning, insane, and more like an animal than a rational being. Look at the effects of intoxication! How it takes away from the soul all use of reason,—all power of analysis! Thus the connection is broken, so that nothing but a confused object is presented by the organs; no difference is discerned between things like and unlike; but all, both similar and dissimilar, rush on with the activity given them in one confused medley to the soul. The case is similar with all the passions, when they exceed the bounds of moderation.

I have affirmed that, in his state of integrity, man was master of all philosophy, or mundane science, and this too of himself, by virtue of the perfect mechanism of his organization, that is, by nature; and that, being furnished with such excellent senses, he could have nothing concealed from him, because he was formed according to all the motions and operations of the world and nature. I have said further, that nothing could exist in the world from the regular connection of causes, which would not instantly flow, as through a most clear and pellucid medium, with a certain sensation, to the mind: that is, that all the sensations of each of his organs would penetrate to their most subtle principle, without retardation, confusion, or obscurity. But when every modification in the world, of whatsoever nature, had thus arrived at its ultimate, or at his soul, it necessarily follows that his knowledge and attainments would there stop, and that he would regard and venerate, with a most profound admiration, those other and infinite things that exceeded the bounds of his intelligence; that is to say, that most vast Infinite,—infinitely intelligent, infinitely provident,—which begins where man, and his finite faculties, intelligence, and providence, terminate: he would see that in this Infinite all things have their being, and that from it all things have their existence. As, therefore, all his sensations thus necessarily penetrated to their ultimate seat without any intervening obstacle, and there subsided

into a most profound veneration, it follows that this perfect man's veneration of the Deity was of equal extent with his wisdom, and as constant as the operation of his senses; we may therefore conclude that the more profound is any man's wisdom, the more profound will be his veneration of the Deity. No one, also, could be better acquainted than that first and wisest of men with the infinite grace of the Deity: whence it follows, in the same manner, that the Deity must also have been the supreme object of his love; for when we greatly respect any one, acknowledging at the same time the benefits and favors received from him, especially when we are intimately connected with him, we are secretly impelled also to love him: we may therefore conclude again, that the wiser a man is, the greater are his veneration and love of the Deity. Primarily his delights wholly terminated in the love of God,—a love which exhausts and replenishes all sense of delight. All the delights of the world, resulting from its variety, are nothing unless the mind also partakes of them; for no human delights, or such as are proper to man, can be real, without the participation of the soul, since they are destitute of the more refined delightsomeness: and the delights which the body and soul are capable of enjoying together, are not genuine and true unless they have some further connection, and terminate in the veneration and love of God, that is, unless they have reference to this love and ultimate end, in a connection with which the sense of delight most essentially consists. It may therefore be most reasonably inferred that the delights of the first man consisted in this; that the end of the delights which he derived from the contemplation of a world so perfect and pleasing, and from the agreeable perception, by means of his senses and organs, of the motions existing in all the elements, was the love of the Deity. Supreme veneration and supreme love of the Deity could not exist without the supreme worship of Him. What we venerate and love, this we worship; for the utmost degree of veneration conjoined with love must needs be active and operative, and must extend to the will and actions. As no other desires occupied the whole man when in such a state, no others could influence his will; for the will is guided by the inclinations and desires of the soul and body: neither could he induce anything into the will, nor could the will bring anything into act, but what was applicable to the supreme adoration of the Deity, and to the giving Him thanks full of veneration and love: for these are the

delights to which the man who was master of himself and of all his delights and desires would wholly devote and apply himself. For what could be more delightful and voluntary, in such a state of mind, than to ascribe perpetual honours to a Being, supreme, incomprehensible, and so closely bound to him by love,—to pay to Him unceasing vows, to worship Him with constant praise, secure always of His favor and acceptance? We therefore conclude again that the wiser a man is, the more will he be a worshipper of the Deity. From the same reasoning it follows, that such a man must have been the object of God's supreme love; for love is not only reciprocal, and according to connection, but is also greater in its prior degree, and becomes less in the derivative.

But the contrary to all this must necessarily take place in a man not in a state of integrity, and in whom the connection above mentioned is disrupted. Such a man has not the wisdom, the veneration and adoration of the Deity we have described: and as his knowledge of the Divine benefits and grace is also imperfect in proportion to his deficiency in wisdom, so neither can he have such love: in a word, he cannot have any such veneration, adoration, and love of the Deity, as was entertained by the wise first man, unless he receives them from another source, that is, immediately from grace. But whatever veneration, worship, and love, may exist in a man so changed, and in whom the connection is broken by vices and cupidities, they can never be unaccompanied by fear, because he never can be without cause of fear. Neither can love be supposed to exist in God towards man, after the connection is broken, but, instead of love, justice. Man's having cause for fear implies justice in God. It is therefore agreeable to reason to conclude, that there would have been no love in God towards man in his unconnected and discontinuous state, but only justice, had not the Infinite and Only Begotten for this cause been made man, that in Himself as a man, and consequently through a certain connection with Himself, He might restore a connection with the Infinite in those who are like Him.