

of negro powers before us, is it possible to do otherwise than adopt the very just observation of a very quaint orator, who has told us that the "negro, like the white man, is still God's image, although carved in ebony?"

Nor is it to a few casual individuals among the black tribes, appearing in distant countries, and at distant eras, that we have to look for the clearest proofs of human intelligence. At this moment, scattered like their own oases, their islands of beautiful verdure, over the eastern and western deserts of Africa, multitudes of little principalities of negroes are still existing,—multitudes that have, of late years, been detected and are still detecting, whose national virtues would do honour to the most polished states of Europe: while at Timbuctoo, stretching deepest towards the east of these principalities, from the western coast, we meet, if we may credit the accounts we have received, with one of the wealthiest, perhaps one of the most populous and best governed cities in the world; its sovereign a negro, its army negroes, its people negroes; a city which is the general mart for the commerce of western Africa, and where trade and manufactures seem to be equally esteemed and protected.*

We know not the antiquity of this kingdom: but there can be no doubt of its having a just claim to a very high origin: and it is possible that, at the very period in which our own ancestors, as described by Julius Cæsar, were naked and smeared over with paint, or merely clothed with the skins of wild beasts, living in huts, and worshipping the misletoe, the black kingdom of Bambarra, of which Timbuctoo is the capital, was as completely established and flourishing as at the present moment.

What has produced the difference we now behold? What has kept the Bambareens, like the Chinese, nearly in a stationary state for, perhaps, upwards of two thousand years, and has enabled the rude and painted Britons to become the first people of the world—the most renowned for arts and for arms—for the best virtues of the heart and the best faculties of the understanding? Not a difference in the colour of the skin;—but, first, the peculiar favour of the Almighty: next, a political constitution, which was sighed for, and in some degree prefigured, by Plato and Tully, but regarded as a masterpiece, beyond the power of human accomplishment; and, lastly, a fond and fostering cultivation of science, in every ramification and department.

Amid the uproar and ruin of the world around us, these are blessings which we still possess; and which we possess almost exclusively.† Let us prize them as they deserve; let us endeavour to be worthy of them. To the great benefit resulting from literature and mental cultivation the age is, indeed, thoroughly awake; and it is consolatory to turn from the sickening scenes of the Continent, and fix the eye in this point of view upon our own native spot; to behold the ingenuous minds of multitudes labouring with the desire of useful knowledge; to contemplate the numerous temples that are rising all around us, devoted to taste, to genius, to learning, to the liberal arts; and to mark the generous confederacies, by which they are supported and embellished.

In this little school of philosophy, surrounded by walls that were once en-

* I follow Mr. Jackson's description, which is added to his "Account of the Empire of Morocco," as by far the most circumstantial and authoritative we have hitherto received. According to him, "the city is situated on a plain, surrounded by a sandy eminence, about twelve miles north of the Nile El Abeade, or Nile of the blacks; and three days' journey (erhellat) from the confines of Sahara; about twelve miles in circumference, but without walls. The town of Kabra, situated on the banks of the river, is its commercial depot or port. The king is the sovereign of Bambarra; the name of this potentate, in 1800, was Woolo: he is a black and a native of the country he governs. His usual place of residence is Jimnie, though he has three palaces in Timbuctoo, which are said to contain an immense quantity of gold." The present military appointments are, it seems, entirely from the negroes of Bambarra; the inhabitants are also for the most part negroes, who possess much of the Arab hospitality, and pride themselves on being attentive to strangers. By means of a water-carrage, east and west of Kabra, great facility is given to the trade of Timbuctoo, which is very extensive, as well in European as in Barbary manufactures. The various costumes, indeed, exhibited in the market-places and in the streets, sufficiently indicate this, each individual being habited in the dress of his respective country. There is a perfect toleration in matters of religion, except as to Jews. The police is extolled as surpassing any thing of the kind on this side the Desert: robberies and house-breaking are scarcely known. The government of the city is intrusted to a divan of twelve slemma or magistrates; and the civil jurisprudence superintended by a learned Cadl.

† The Lecture was delivered in 1812.

riched with the choicest collections, and the rarest curiosities of nature,* but which, from a concurrence of adverse circumstances, must have fallen into ruins, had not you, with laudable patronage, interposed, redecored the sinking edifice, and made it once more echo to the voice of instruction and study;—here, where the genius of Science has resumed the possession of his simple throne, and is once more thronged by a numerous train of attentive votaries—here more especially may I address these observations without incurring the charge of rhapsody or extravagance.—Long may so promising an Institution flourish! soundly may it be cultivated! and of sterling value be the harvests that it produces!

LECTURE IV.

ON INSTINCT.

THERE are various actions, and trains of actions, occasionally to be met with among mankind, but more frequently and more strikingly among other animals, which indicate the employment of definite means to obtain a definite end, without the intervention of that chain of thought which characterizes *reason*, and which have hence been ascribed to a distinct principle, that has been distinguished by the name of *instinct*.

Such, in the new-born infant, and, indeed, in the young of all mammalian animals, is the act of hunting out for the mother's milky food, and of sucking with a perfection which can never be acquired in subsequent life. Such is the whole process of nestling or nidification among birds; the periodical change of salt for fresh water among the sturgeon, salmon, and other fishes; and, among insects, the formation of the exquisite decoy-lines of the spider, and the nice masonry of the bee, and of the termes *bellicosus* or white ant.

The common fact admits of no dispute; the modes of accounting for it have been various, and in the utmost degree unsatisfactory. In a general survey they may be resolved into three classes: first, those hypotheses which ascribe the whole to the operation of body alone; secondly, those which ascribe it to mind alone; and, thirdly, those which derive it from a substance of a mediate nature between the two, or attribute it partly to the one and partly to the other.

In pursuing this highly interesting subject, I shall first briefly notice the principal opinions which have been offered upon it, in the order thus laid down, and point out their irrelevancy: and then propose a new theory, and explain the grounds upon which it is founded.

I. It was the opinion of Des Cartes that brutes are mere mechanical machines: that they have neither ideas nor sensation; neither pain nor pleasure; and that their outcries under punishment, and their alacrity in pursuing an enemy or devouring a meal are produced by the very same sort of force, which, exerted upon the different keys of an organ, compels its respective pipes to give forth different sounds. And a great part of the Cardinal Polignac's very elegant Latin poem, entitled *Anti-Lucretius*, is written in direct support of this most whimsical hypothesis. I shall, perhaps, have occasion to examine it somewhat more at large in a subsequent study: for the present it may be sufficient to observe that, in spite of all the philosophy in the world, the coachman to this hour has whipped, and will yet continue to whip, his horses, the huntsman to halloo his hounds, and the bird-trainer to sing or whistle to his bullfinches; though if the whole were mere mecha-

* Formerly celebrated as the Leverian Museum, and erected for that purpose.

nical machines, they might as well whip the sands, halloo to the waves, and whistle to the winds.

Under this view of the subject all instinctive actions were of course referred to a principle of body, or gross tangible matter, not endowed with peculiar or exclusive properties; and wherever any thing of the same description was to be found among mankind, it was instantly separated from all connexion with intelligence, and referred to the same source.

The incongruities accompanying this hypothesis have not, however, prevented other philosophers from following it to a certain latitude in modern times, although it has been seldom, perhaps never of late days, pursued to the extent contended for by Des Cartes. The ideas of Dr. Reid, who has expressly written upon this subject, do not appear to be very perspicuous: yet he obviously espouses the doctrine of a mechanical principle of animal actions; and the actions which are resolvable into this principle are, in his opinion, of two kinds—those of instinct, and those of habit. Instinct is with him, therefore, as well as with Des Cartes, a property of body or gross matter alone, unendowed with any peculiar powers, and merely operated upon by a combination of mechanical forces.

II. In direct opposition to this corporeal hypothesis, Mr. Smellie and Dr. Darwin have contended that instinct is altogether a mental principle, the brute tribes possessing an intelligent faculty of the very same nature as mankind, though more limited in its range. From this point, however, these two physiologists disagree, and fly off in opposite directions: the former contending that reason is the result of instinct,* and the latter that instinct is the result of reason. In the promptitude and perfection with which the new-born infant seeks out and sucks its mother's breast, Dr. Darwin asserts that, although the chain of thought which directs it to the accomplishment of its object is concealed from the view, it still exists; and he endeavours to follow it up and develop it;† in which, however, it is not worth while to accompany him, for the whole process, even upon his own showing, is so complex, that it would rather require the genius of an adult Newton to unfold it, than yield to the dawning powers of a new-born infant.

I will just observe, that in various cases of the instinctive faculty the most excursive theorist cannot picture to his imagination any thing like a chain of thought, or previous reasoning; any thing like habit or imitation, by which the means and the end are joined together. Let us take, as an example, the very common instance of a brood of young ducks brought up under a hen, and contrary to all the instincts and feelings of the foster-mother, plunging suddenly into the water, while she herself trembles piteously on the brink of the pond, not daring to pursue them, and expecting every moment to see them drowned. By what kind of experience or observation, by what train of thought or reasoning has the scarcely fledged brood been able to discern that a web-foot fits them for swimming, and that a fissured foot would render them incapable?—a knowledge that mankind have only acquired by long and repeated contemplation, and which has never been fully explained to this hour.

* Mr. Smellie defines instinct to be "every original quality of mind which produces feelings or actions, when the proper objects are presented to it."—Philos. of Nat. Hist. vol. i. p. 155. So, p. 159, "From the above facts and reasonings, it seems to be apparent that instincts are original qualities of mind; that every animal is possessed of some of these qualities; that the intelligence and resources of animals are proportioned to the number of instincts with which their minds are endowed; that all animals are, in some measure, rational beings; and that the dignity and superiority of the human intellect are necessary results, not of the conformation of our bodies, but of the great variety of instincts which nature has been pleased to confer on the species."

† In p. 156 he, in like manner, confounds mind with sensation, as he has above confounded instinct with mind. "Sensation," says he, "implies a sentient principle or mind. Whatever feels, therefore, is mind. Of course, the lowest species of animals are endowed with mind." It ought to have been first proved that the lowest species of animals are even endowed with sensation.

‡ "By a due attention to these circumstances, many of the actions, which at first sight seemed only referrible to an inexplicable instinct, will appear to have been acquired, like all other animal actions that are attended with consciousness, by the repeated efforts of our muscles under the conduct of our sensations or desires."—Zoonom. Lect. xvi. 2. 4. "If it should be asked, what induces a bird to sit weeks on its first eggs, unconscious that a brood of young ones will be the product? the answer must be, that it is the same passion that induces the human mother to hold her off-spring whole nights and days in her fond arms, and press it to her bosom, unconscious of its future growth to sense and manhood, till observation or tradition have informed her."—Darwin, sect. xvi. 13, 4.

Habit, imitation, and instruction would all concur in teaching them to flee from the water, as a source of inevitable destruction: and yet, in opposition to all these influences and premonitions, we see them rush into it, and harmlessly: we see them obeying an irresistible impulse, which directs them to what is fitting, stamped in the interior of their little frames, and which is equally remote from the laws of mind and of mechanism.

In like manner, by what process of imitation, education, or reasoning does the nut-weevil (*curculio nucum*) seek out exclusively, and with the nicest knowledge of the plant, the green hazel in the month of August, while its nut-shell is yet soft and easily penetrable? What past experience or course of argument instructs her that this is the fruit best adapted, or perhaps only adapted, to the digestive powers of her future progeny? With a finished knowledge of her art, as soon as she is prepared to deposit her eggs, she singles out a nut, pierces it with her proboscis, and then, turning round accurately, drops an egg into the minute perforation; having accomplished which, she passes on, pierces another nut, drops another egg, and so continues till she has exhausted her entire stock. The nut, not essentially injured, continues to grow. The egg is soon hatched; the young larve or maggot finds its food already ripened and in waiting for it; and about the time of its full growth, falls with the mature nut to the ground, and at length creeps out by gnawing a circular hole in the side. It then burrows under the surface of the ground, where it continues dormant for eight months, at the termination of which time it casts its skin, commences a chrysalis of the general shape and appearance of the beetle kind, and in the beginning of August throws off the chrysalid investment, creeps to the surface of the ground, finds itself accommodated with wings, becomes an inhabitant of the air, and instantly pursues the very same train of actions to provide for a new progeny which had been pursued by the parent insect of the year before.

In all such cases it is clear that there is a principle implanted in the living form equally distinct from all mechanical, chemical, and rational powers, which directs the agent by an unerring impulse, or, in other words, impels it by a prescribed and unerring law, to accomplish a definite end by a definite means.

Such instinctive powers are not only allowed upon Mr. Smellie's hypothesis, but are conceived to be almost innumerable; and reason, instead of giving birth to them, is, in his opinion, as I have already observed, the general result of them, and consists in the power of comparing one instinct with another, and assenting to those that preponderate. According to this hypothesis, all the actions of the involuntary organs of the body are so many instincts, as pulsation, digestion, secretion; all natural feelings are so many instincts, as love of life, dread of death, and the desire of progeny; all the passions are so many instincts, as fear, hope, envy, benevolence, reverence, superstition, devotion; and hence life is nothing more than a bundle of instincts;* and reason, which is itself founded upon an instinctive principle, consists, as I have just observed, of nothing more than a power or tendency to compare the different strengths of these antagonist forces whenever they are brought into a state of action, and to be guided by those that are prepolent; or that offer what is felt or conceived to be the best means of obtaining a proposed end. The objections to which this hypothesis is exposed, or rather the evils chargeable upon it, are innumerable; but it is sufficient to observe, at present, that it as effectually confounds the separate faculties of instinct and reason as the preceding hypothesis of Dr. Darwin, and, consequently, that neither of the two opinions are in any respect more admissible than those which refer the instinctive faculty to a mechanical principle, or, in other words, to the common properties of unorganized matter.

III. There is a third class of philosophers, who, sensible of the difficulty of the case, have endeavoured to get over it by contending that instincts are of a mixed kind; that they either originate in a power which holds an inter-

* Transact. of the Royal Society of Edinb. vol. v. p. 39.

mediate nature between matter and mind; or else are in some instances simply material, and in others simply mental.

The very excellent and learned Cudworth belonged to the first of these two divisions, and may be regarded as having taken the lead in the scheme which it develops. I have already observed, in a former study, that this profound metaphysician was so strongly attached to the Platonic theory of the creation of the world, that he strove, with the full force of his mighty mind, to restore this theory to general vogue. And as it was one important principle in this theory that incorporeal form, or an active and plastic nature, exists throughout the world independently of pure mind and pure matter, and that the last is solely rendered visible and endowed with manifest properties by a union with this active intermede, Cudworth conceived that all instinctive powers might be satisfactorily resolved into the operation of the same secondary energy in proportion as it pervades the universe.* In opposition to which doctrine, however, it is sufficient to remark, that as the existence of all visible matter, whether organized or unorganized, upon the leading principle of the Platonic theory, is equally the result of this plastic power, and produced by a union with it, it should follow that unorganized matter ought occasionally at least to give proofs of an instinctive faculty, as well as matter in an organized state; proofs of definite means to accomplish a definite end, and that end the general weal, preservation, or reproduction of the body exhibiting it. But as, by the common consent of all mankind, no such faculty is ever to be traced in unorganized matter, it cannot be referred to a principle which is equally common and essential to all visible matter, whether under an organized or an unorganized modification.

At the head of the second division of the last class of philosophers to whom I have referred, we may perhaps place M. Buffon; who, incapable of acceding altogether to the mechanical hypothesis of Des Cartes, yet not choosing to allot to animals below the rank of man the possession of an intelligent principle, kindly endowed them with the property of life, which Des Cartes had morosely withheld by contending that they were mechanical machines alone, and very obligingly allowed them to possess a faculty of distinguishing between pleasure and pain, together with a general desire for the former and a general aversion for the latter. And having thus equipped the different tribes of brutes, he conceived that he had sufficiently accounted for the existence of instinctive actions, by leaving them to the operation of this distinguishing faculty upon the mechanical properties of their respective organs. M. Reimar, however, an ingenious German professor, who flourished towards the close of the last century, did not conceive in the same manner: and hence, in a work immediately directed to the instinct of animals, and published at Hamburgh in 1769, he divides the actions which he apprehends ought to pass under this name into three classes—mechanical, representative, and spontaneous: by the first intending all the proper actions of animal organs over which the will has no control, as the pulsation of the heart, the secretion of the various fluids, and the dilatation of the pupil; by the second, those which depend upon an imperfect kind of memory, and which, so far as it is memory, brutes enjoy in common with mankind; and by the third, those which originate from M. Buffon's admitted faculty of distinguishing pleasure from pain, and the desire consequent upon it of possessing the one and avoiding the other.

It is, however, a sufficient answer to both these opinions, which in truth are founded upon one common basis, that, like the theories of Darwin and Smellie, they equally confound, though in a different manner, powers that are essentially distinct. The founders of these opinions may, with Darwin and Smellie, derive the instinctive faculty from a principle of mind, or with Des Cartes and Dr. Reid from a principle of body; but they have no right to derive it from both, or to contend that its different ramifications originate in some instances from the one source, and in others from the other: though, as

* Intellect. Syst. 1743.

I have already observed, if they do derive it from mind alone, they will be compelled to admit its existence in a thousand cases in which not a single attribute of mind can be traced; while, if they derive it from body alone, they offer a cause that is inadequate to the effect produced.

M. Cuvier has taken a ground still different from any of these philosophers. He has not, indeed, expressly written upon the subject, but in a very accurate description of a somewhat singular ourang-outang,* he sufficiently unfolds his opinion, that instinct consists of ideas which do not originate from sensation, but flow immediately from the brain, and are truly innate. His words are as follows: "The understanding may have ideas without the aid of the senses; two-thirds of the brute creation are moved by ideas which they do not owe to their sensations, but which flow immediately from their brain. Instinct constitutes this order of phenomena: it is composed of ideas truly innate, in which the senses have never had the smallest share." There is a perplexity in this passage, which I am surprised at in the writings of so exact a physiologist: it first confounds instincts with ideas, as other philosophers have confounded them with feelings; and next affirms that ideas may flow from the brain without the aid of the external senses. That "the understanding may have ideas without the aid of the senses," I admit; but then it cannot have them from the brain, this being the very foundation and fountain of the senses; that from which they rise, and that in which they terminate. The understanding may, undoubtedly, have ideas from the exercise of its own proper powers alone, but this can only be the case with pure intellectual beings, and to assimilate the faculty of instinct with a faculty of this exalted character, is to clothe brutes with endowments superior to those of mankind; it is to elevate the ourang-outang above an Aristotle or a Bacon.

Hence M. Dupont de Nemours, in an article read before the National Institute in 1807, advises to drop the term instinct altogether, as the only means of avoiding the rocks on some of which every writer has shipwrecked himself. He asserts, that there is in fact no such thing in existence; and that every action which has hitherto been described under such name is the mere result of intelligence, of thought, habit, example, or the association of ideas. But this is only to revive, in a new form, the theory of Darwin or of Smellie; while it is only necessary to advert to the explanatory examples offered by M. Dupont himself, to see that many of them are utterly incapable, by any ingenuity whatever, of being resolved into a principle either of intelligence or of mechanism.†

Nothing, therefore, is clearer than that the principle of instinct has hitherto never been explicitly pointed out, nor even the term itself precisely defined: it has been derived from mechanical powers, from mental powers, from both together, and from an imaginary intermediate essence, supposed equally to pervade all imbodied matter, and to give it form and structure. It has been made sometimes to include the sensations, sometimes the passions, sometimes the reason, and sometimes the ideas: it has sometimes been restricted to animals, and sometimes extended to vegetable life.‡

* Annales du Museum et d'Hist. Nat. tom. xvi. p. 46.

† Magazine Encyclopedique, Feb. 1807, p. 437.

‡ Dr. Hancock has lately published a very elaborate volume upon this subject, in which he takes a just view of the instinctive powers of animals, and is half-disposed to allow the same faculty to plants. But in merely distinguishing this faculty from reason, in the same way in which he distinguishes what have hitherto been called innate principles, a moral sense or faculty, light of nature, divine reason, as contradistinguished from human reason, spiritual power, internal teaching, and even impulse and inspiration of the Holy Spirit, all which he contemplates as *intelligences of a like kind*, or, to adopt his own words, "which we can only regard as an emanation of Divine Wisdom," he has so completely generalized the subject, not to say apparently blended into a common principle powers which have usually been regarded as specifically discrepant from each other,—even allowing the existence of the whole of them, and that they all flow, as in such case they must necessarily do, from the same almighty Source of being,—that the peculiar nature of the instinctive faculty is left in as much obscurity as ever.

Dr. Hancock has trodden over an extensive ground of both physical and metaphysical research, and the excellent spirit with which he writes entitles him to the esteem of every good man. Yet I am at a loss to determine why the principle of reason, or the reasoning soul in man, should not have as fair a claim to originate from the divine energy that pervades every part of nature, from the minutest atom to the highest spiritual affluence, as the faculty of instinct. By throwing, however, the principle of human reason out of the general pale, and by associating instinct with the high alliances just adverted to, the "unconscious intelligence," as Dr. Hancock has denominated it of "the lowest part of the animal creation, even that of insects

Under these circumstances I shall beg your candid attention to a new view of the subject, and a view that may tend to give us a more definite idea of the nature of the action, and consequently of the extent and real meaning of the term.

In an early lecture of the preceding series* I endeavoured to point out the common or essential, and many of the peculiar, properties of inorganic matter; and in a subsequent study† I attempted to lay down the more prominent characters by which inorganic is distinguished from organic matter, as a stone, for example, from a plant or an animal. I observed that, on investigating the history of the stone, it would be found to have been produced fortuitously; to have grown by external accretion, and only to be destructible by chemical or mechanical means: while, on investigating the history of the plant or the animal, it would be found to have been produced by generation; to have grown by nutrition, or internal instead of external accretion; and to be destructible by death; to be actuated by an internal power, and possessed of parts mutually dependent, and contributing to each other's functions. I observed farther, that in what this internal power consists we know not; that in plants and animals it appears to be somewhat differently modified, but that wherever we meet with it we term it the PRINCIPLE OF LIFE, and characterize the individual substance it actuates by the name of an organized being, from its possession of organized parts, in contradistinction to all those substances which are destitute as well of life as of internal organs, and which are hence denominated unorganized.

Upon another occasion I took a brief survey of the chief theories which have been offered upon the nature of this mysterious and fugitive essence:‡ which I observed was altogether a distinct principle from that of thought, and from that of sensation, for both these must also be kept distinguished from each other. I remarked, that in modern times it had at one period been said to be derived from caloric, thermogen, or the elementary matter of heat, as it exists in the organized system, from the well ascertained importance of this substance (if it be a substance) towards the perfection, and even continuance, of all the vital functions: that at another time it was, for the same reason, supposed to consist of oxygen introduced into the system by every act of inspiration; and still more lately of the Voltaic aura, in consequence of those wonderful effects which this aura is now well known to produce on the muscular fibres of animals, not only during life, but often for some hours after death has taken place. I remarked farther, that Mr. John Hunter had traced this living principle to many of the organized fluids, as well as to the solids; and that he had especially developed it in the blood, which, coincidentally with the Mosaic declaration, he believed to be its immediate seat. "The difficulty," observes he, "of conceiving that the blood is endowed with life while circulating, arises merely from its being a fluid; and the mind not being accustomed to the idea of a living fluid."§ And I observed, that by a variety of important and well-defined experiments, this enterprising and indefatigable indagator had succeeded in proving, not only that it contributes in a greater degree to the vital action and to the vital material of the general system than any other constituent part of it, whether solid or fluid, but has all the essential properties of life; that it is capable of being acted upon, and contracting, like the muscular fibre, upon the application of an appropriate stimulus, as atmospheric air, for example; on which occasion it becomes constringed into that cake or coagulum which every one must have beheld in blood drawn from the arm: that in all degrees of atmospheric temperature, of heat or cold, which the body is capable of enduring, it maintains an

and worms, is raised to a loftier and diviner rank than the peculiar principle by which man has hitherto been supposed to exercise a dominion over the rest of creation. "In the lowest order of animals," says Dr. Hancock, "the divine energy seems to act with most unimpeded power. It is less and less concentrated in the successive links of the living chain upward to man.—The lowest animal has this divine power, not of free choice, nor consciously: the highest of men has it also, but consciously and willingly: and it then becomes his ruling principle; his divine counsellor; his never-failing help; a light to his feet, and a lantern to his path."—Essay on Instinct, and its Physical and Moral Relations, p. 170—513

* Series i. Lecture iv.

† Series i. Lecture x.

‡ Series i. Lecture viii.

§ Essay on the Blood, &c. p. 20.

equality in its own temperature with scarcely any variation: that in the case of paralytic limbs it is the only power that continues vitality in them and preserves them from corruption: that though not vascular itself, it is capable by its own energy of producing new vessels out of its own substance, and vessels, too, of every description, lymphatics, arteries, and even nerves; and, finally, that though, like the muscular fibre, it is capable of contracting upon the application of a certain degree of appropriate stimulus, like the muscular fibre, also, it is instantly exhausted of its vital power whenever such stimulus is excessive; and that the stroke of lightning which destroys the muscular fibre and leaves it flaccid and incontractile, destroys likewise the blood, and leaves it loose and incoagulable.

In every organized system, then, whether animal or vegetable, and in every part of such system, whether solid or fluid, we trace an evident proof of that controlling and identifying power which physiologists have denominated, and with much propriety, the PRINCIPLE OF LIFE. Of its cause and nature we know no more than we do of the cause and nature of gravitation or magnetism. It is neither essential mind nor essential matter; it is neither passion nor sensation; but, though unquestionably distinct from all these, is capable of combining with any of them: it is possessed of its own book of laws, to which, under the same circumstances, it adheres without the smallest deviation; and its sole and uniform aim, whether acting generally or locally, is that of health, preservation, or reproduction. The agency by which it operates is that which we denominate or should denominate INSTINCT, and the actions by which its sole and uniform aim is accomplished are what we mean or should mean by INSTINCTIVE ACTIONS; or, to speak somewhat more precisely, instinct is the operation of the living principle, whenever manifestly directing its operations to the health, preservation, or reproduction of a living frame, or any part of such frame.*

The law of instinct, then, is the law of the living principle: instinctive actions are the actions of the living principle; and either is that power which characteristically distinguishes organized from unorganized matter, and pervades and regulates the former as gravitation pervades and regulates the latter, uniformly operating by definite means, in definite circumstances, to the general welfare of the individual system or of its separate organs; advancing them to perfection, preserving them in it, or laying a foundation for their reproduction, as the nature of the case may require. It applies equally to plants and to animals, and to every part of the plant as well as to every part of the animal, so long as such part continues alive.† It is this which maintains from age to age, with so much nicety and precision, the distinctive characters of different kinds and species; which, as is noticed in a preceding study, carries off the waste or worn out matter, supplies it with new,‡ and in a thousand instances suggests the mode of cure, or even effects the cure itself, in cases of injury or disease. It is "the divinity that stirs within us" of Stahl; the vis medicatrix nature of Hoffman and Cullen,§ and the physicians of our own day. It is hence the strawberry travels from spot to spot, and the cod or the cuckoo, with a wider range, from shore to shore, or from climate to climate.||

* This Lecture was delivered January, 1813; and Mr. Keith on Tuesday, December 7, 1813, had a valuable paper read before the Linnean Society, in which, like the present system, he opposes Mr. Knight's hypothesis of gravitation as the cause of the peculiar stimulus and action of plants, and conceives that "the direction of the plumule and radicle of plants must be resolved into vegetable instinct, precisely analogous, and equally inexplicable with animal instinct."—See Thompson's Ann. of Philos. vol. iii. p. 71, or No. 13.

† Mr. Knight, while he seems desirous of resolving the principle of vegetable action into centripetal force, has shown that the sap of plants, as it exists in the leaves of potatoes and mint, and the leaves and shoots of the vine, possesses what he calls organizable matter: and when plunged in a moist and warm soil will produce bulbs or roots more or less perfect, or at least preserve and endeavour to extend life.—Phil. Trans. 1816, p. 339. The whole, like the reproduction of polypes and worms from sections, ought rather to be resolved into the common law of instinct, the aim of which is health, preservation, or reproduction: and hence the sap of plants seems as much alive as the blood of animals.

‡ Series i. Lecture xiv.

§ First Lines, vol. i. p. 91. 105.

|| In conformity with the general principles of his system, Dr. Darwin ascribes this extraordinary faculty also to the power of reason. "It is probable," says he, "that emigrations were at first undertaken as accident directed, by the more adventurous of their species, and learned from one another like the discoveries of mankind in navigation."—Zoon. sect. xvi. 12.

In supplying the place of reason, it is perpetually assuming its semblance. Let us take an example or two from both the vegetable and the animal world.

In order that the seeds of plants should produce and perfect their respective kinds, it is necessary that their shoots should rise to the surface of the earth to enjoy the benefit of light and air. Now in whatever direction the eye of a seed, from which germination first radiates, is placed, these shoots ascend equally to the surface, either in curved or straight lines, according as such ascent may be most easily accomplished. Mr. John Hunter sowed a quantity of pease and beans with their eyes placed in different directions, in a tub, which he afterward inverted, so that the bottom was turned uppermost while the mould was prevented from falling out by a fine net. And in order that the under surface might possess a superior stimulus of light and heat to the upper, he placed looking-glasses around the mouth of the tub in such a way that a much stronger light was reflected upon the inverted mould than that of the direct rays of the sun; while at the same time he covered the bottom of the tub with straw and mats to prevent the mould in this direction from being affected by solar influence. Yet the same instinctive law of ascent still prevailed. After waiting a considerable length of time, and perceiving that no shoots had protruded through the lower surface of the mould, he examined the contents of the tub, and found that they had all equally pressed upwards, and were making their way through the long column of mould above them, towards the reversed bottom of the vessel; and that where the eyes had been placed downwards, the young shoots had turned round so as to take the same direction. As one experiment leads on to another, he determined to try the effect of placing other seeds of the same kinds in a tub to which a rotatory motion should be given, so that every part of it might be equally and alternately uppermost, and the seeds should have no advantage in one direction over another. Here, as we often behold in other cases, the instinctive principle of accommodation was baffled by a superior power, and the different shoots instead of ever turning round uniformly adhered to a straight line, except where they met with a pebble or any other resistance, when they made a curve to avoid such obstruction, and then resumed a straight line in the direction into which they were thereby thrown, without ever endeavouring to return to the original path.

Among animals we have various proofs of a like impulse, and we have also proofs of its being occasionally overpowered by a stronger cause. Thus, in cases of eruptive fever, there is an obvious effort of the instinctive principle to throw the morbid matter towards the surface of the body, where it can do least mischief. And where a deep-seated abscess has formed in the immediate neighbourhood of a cavity that cannot be opened into without great danger, as that of the chest or the stomach, the same instinctive principle of preservation leads forward the action in a different direction, though, as in the experiment of the bean-seeds in the inverted tub, with much greater labour and difficulty; and the abscess at length opens externally; and the remedial process of the formation of new living matter which immediately succeeds, commences under the same mysterious guidance. If, in the course of this common tendency to the surface, an obstructive cause be encountered, of superior force to the instinctive principle itself, the latter, as in the experiment of the beans exposed to the action of a rotatory motion, is overpowered, and the result is doubtful, and often fatal.

But these examples are general: let us advert to a few of a more particular nature. All the different species of birds, in constructing their nests, not only adhere to a peculiar plan, but, wherever they can obtain them, to peculiar kinds of materials: but if these materials be not to be procured, the accommodating power of the instinctive principle, as in the cases just related, directs them to others, and suggests the best substitutes. Thus the red-breast uniformly prefers oak-leaves as a lining for her nest, wherever she can acquire them; but if these be not to be had, she supplies the want by moss and hair. So where the bird is of small size, and the eggs are naturally numerous, the nest is always made proportionally warm, that the nestlings may

all equally partake of the vivifying heat. Thus the wren, who lays from ten to eighteen eggs, constructs her little edifice with the greatest care, and of the warmest materials; while the plover and the eagle, whose eggs are so few that the body may easily cover them, build with little solicitude, and sometimes content themselves with the naked cleft of a rock. And thus, too, in very cold winters in Lapland, the fond water-fowl will occasionally strip the down off its breast to line its nest and protect its progeny.

When a wasp, in attempting to transport a dead companion from the nest, finds the load too heavy, he cuts off its head, and carries it out in two portions.*

A strawberry offset planted in a patch of sand will send forth almost the whole of its runners in the direction in which the proper soil lies nearest, and few, and sometimes none, in the line in which it lies most remote.

When a tree which requires much moisture (says Mr. Knight) has sprung up or been planted in a dry soil, in the vicinity of water, it has been observed that a much larger portion of its roots has been directed towards the water; and that when a tree of a different species, and which requires a dry soil, has been placed in a similar situation, it has appeared, in the direction given to its roots, to have avoided the water and moist soil.†

“When a tree (remarks Dr. Smith) happens to grow from seed on a wall (and he particularly alludes to an ash in which the fact actually occurred), it has been observed, on arriving at a certain size, to stop for a while and send down a root to the ground. As soon as this root was established in the soil, the tree continued increasing to a large magnitude.”‡

The best means, perhaps, that a plant can possess of resisting the effects of drought, is a tuberous or bulbous root. The grass called *phleum pratense*, or common cat-tail, when growing in pastures that are uniformly moist, has a fibrous root, for it is locally supplied with a sufficiency of water; but in dry situations, or such as are only occasionally wet, its root acquires a bulbous form, and thus instinctively accommodates the plant with a natural reservoir.

And there are various other grasses, as the *alopecurus geniculatus*, or geniculate foxtail, that exhibit the same curious adaptation.§

There are some philosophers and physiologists who have endeavoured to ascribe the whole of these very extraordinary phenomena to the mechanical powers of gravitation and centrifugal force; among whom I may especially mention Mr. Knight, who has attempted it in a very ingenious paper to which I have just alluded. There are others who ascribe them to the operation of an intelligent principle, among whom, more especially, as I have already observed, is Dr. Darwin. Of these two causes the instances just submitted to you, and thousands more might be added to them, sufficiently prove that the first is inadequate and that the second does not always exist; at least that the phenomena are often found in organized forms in which, to a certainty, the precise organs do not exist which are the only known seats of intelligence and sensation in the visible world. They are hence to be resolved into another cause, equally remote from either, more complex in its operations than that of gravity, but less so, perhaps, than those of intelligence and feeling; embracing a distinct family of well-defined and cognate actions, always aiming at the same common end, the perfection, preservation, or reproduction of the system in which they exist; and constituting what we should denominate instinct, the general property of the living principle or the law of organized life in a state of action.

But the subject is too important to be closed here. It remains yet to point out the difference between instinct and sensation or feeling, as well as between instinct and reason. It remains yet for me to show you that all these are equally distinct principles; that they may exist separately or conjointly;

* Smellie, vol. ii. 151. Reaumur, tom. xi. 241. For an account of other curious instances of instincts, in insects, see the Swedish *Amœnitates Academicae*, vol. iii. art. 45. *Noxa Insectorum*, by M. A. Boelner, 1752; and compare with these the younger Hüber's *Recherches sur les Mœurs des Fourmis Indigènes*.

† Phil. Trans. 1811, p. 210.

‡ *Introductio ad Botanicam*, p. 114.

§ See Smith, *Introductio ad Botanicam*, p. 113, and p. 41.

and it remains also for me to offer examples from among the more curious or striking instances of each of these recondite powers, both under a more simple and a more complicated modification. This shall form the basis of our ensuing study. At present I shall only farther observe that instinct may be defined the operation of the principle of organized life by the exercise of certain natural powers directed to the present or future good of the individual; and reason the operation of the principle of intellectual life, by the exercise of certain acquired powers directed to the same end. Both equally answer their object, are equally perfect in their kind, and equally display their common origin.

Whether with Reason or with Instinct blest,
Thus all enjoy the power which suits them best;
To bliss alike by that direction tend,
And find the means proportion'd to their end.
Say, where full Instinct is th' unerring guide,
What Pope or Council can they need beside?
Reason, however able, cool at best,
Cares not for service, or but serves when press'd;
Stays till we call, and then not often near;
But honest Instinct comes a volunteer:
Sure never to o'ershoot, but just to hit,
While still too wide or short is human wit;
Sure, by quick nature, happiness to gain,
Which heavier Reason labours at in vain.
This, too, serves always, Reason never long,
One must go right, the other may go wrong;
See then the acting and comparing powers,
One in their nature, which are two in ours;
And Reason raise o'er Instinct as you can,
In this 't is God directs, in that 't is man.—POPE.

LECTURE V.

ON THE DISTINCTIVE CHARACTERS OF INSTINCT, SENSATION, AND INTELLIGENCE.

We closed our last study by observing that instinct is the operation of the principle of organized life by the exercise of certain natural powers directed to the present or future good of the individual, while reason is the operation of the principle of intellectual life by the exercise of certain acquired powers directed to the same end. Hence reason demands discipline and attains maturity; instinct, on the contrary, neither demands the one nor is capable of attaining the other; it is disciplined and mature from the first, and is as perfect in the infant as in the man.

Instinct, however, has as often been confounded with FEELING OR SENSATION as it has with PERCEPTION, which is the outline or foundation of reason: and hence another source of those perplexities and errors in distinguishing between animal and vegetable life which we noticed in the preceding lecture: perplexities and errors which have been productive of the most absurd and disgusting consequences, and especially in regard to the delicate and elegant science of botany.

Instinct, sensation, and perception are all principles essentially different; they may, indeed, exist conjointly, but each of them is capable of existing separately. Instinct is the common law or property of organized matter, as gravitation is of unorganized; and the former bears the same analogy to sensation and perception as the latter does to crystallization and chemical affinity. Instinct is the general faculty of the organized mass, as gravitation is of the unorganized mass; sensation and perception are peculiar powers or faculties appertaining to the first, as crystallization and affinity are appertaining to the second: they can only exist under certain circumstances of the organized or unorganized matter to which they respectively belong.

This parallel, indeed, may be carried much farther. Gravitation discovers itself under different modifications, different degrees of power, and, conse-

quently, different effects. Instinct evinces an equal diversity in all these instances. Gravitation belongs equally to the smallest and to the largest portions of unorganized matter: instinct, in like manner, belongs equally to the smallest and to the largest portions of organized matter; it exists alike in solids and in fluids; in the whole frame and in every part of the frame; in every organ, and in every part of every organ, so long as the principle of life continues. Sir Isaac Newton established the doctrine of gravitation, and overcame all objections to it chiefly by the modesty with which he propounded and illustrated it. Without inquiring into the nature of its essence, he contented himself with recognising it by its operations and laws. It is the aim of the present study to follow this great example; and leaving all discussions concerning the essence of instinct or of organized life, on which instinct is dependent, and which constitutes its sphere, as matter constitutes the sphere of gravitation, to point out nothing more than the nature of its action, and occasionally to catch a glance at the laws by which it is regulated.

From what has been already said, we see clearly that the power of instinct runs equally through the limits of vegetable and animal life, and consequently, that instinct, sensation and perception, whatever they consist in, are powers or principles essentially different. Instinct is the common property of organized life in all its forms, but life itself is not necessarily connected either with reason or sensation; and it is of no small consequence that we attend to this curious and extraordinary fact, the proofs of which are abundantly in our own possession. The blood is alive, and has all the common properties of life, as was very satisfactorily shown in an antecedent lecture, from the experiments of Mr. John Hunter; but we all know that it possesses neither feeling nor intelligence: the bones, the cartilages, the cellular membrane, and the cuticle are alive; but, in a state of health, they are equally destitute of both these properties, and whether in health or disease, are always destitute of the latter.

Sensation and perception, so far as we are capable of witnessing, can only exist in appropriate organs, as nerves, or modifications of nerves, which are the only known seat of the one, and the brain, or some modification of brain, which is the only known seat of the other. In the higher classes of animals, as mammals, birds, amphibials, and fishes, the nerves take their rise from the brain, or rather from some particular part of it. But this is not an indispensable law of life; for, in insects, we meet with nerves, but no brain; and in most zoophytic and many other tribes of worms, with neither brain nor nerves. And hence, wherever these organs or either of them are discoverable, it is consistent with right reason to infer, that the faculty also exists to which they respectively give rise. But, on the contrary, where neither of these organs exists, as in plants, and a multitude of the lowest tribes of animals, which in the zoological system of Lamarek are on this account denominated *apathic* or insentient,* we have the same reason for inferring that, though life is present, and, indeed, in many instances, peculiarly tenacious and vigorous, there is neither intelligence nor sensation; and that the whole of the vital functions and operations are performed, like the semblances of intelligence in the preceding case, by the common law of instinct; which, operating in different ways, in different organs, and beings of different structures, appertains to living matter of every kind.

These observations will apply to the vegetable as well as to the animal kingdom; for plants have a close analogy to the senseless tribes, the tubipores, madrepores, sponges, and infusory worms, we are now contemplating in their structure and origin, as well as in the limited range of their powers; these animals being in many instances equally simple in their make, and equally destitute of locomotion, and equally propagating their kinds by the generation of buds or bulbs, instead of by that of seeds or eggs. Like these low kinds of animals, plants, moreover, are altogether without organs either of sense or intelligence; and it is consequently correct to infer, that they are

* Philosophie Zoologique.