An inquiry into the functions of the brain in man, and in the lower order of animals : delivered as a lecture before the Academy of Natural Sciences of Philadelphia / by a physician.

AN INQUIRY

INTO THE

FUNCTIONS OF THE BRAIN

IN MAN,

AND

IN THE LOWER ORDER OF ANIMALS.

DELIVERED AS A LECTURE BEFORE THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,

BY A PHYSICIAN.

"If the science of life, and with it some of the most important departments of human knowledge, be destined to make any decided progress towards perfection; it must be by the road of experience, aided and enlightened by *general philosophy*. The way indeed is in some parts intricate, and its length indefinite, but whether we reach the end or not, our very efforts, and the active state of mind they maintain, will be a sufficient recompense; as the pleasure of the chase, and the healthy vigor it imparts, reward us even when the game escapes." (LAWRENCE.)

"Γνοθι σεαυτον. Strive not God to scan,
The proper study of mankind, is man."

PHILADELPHIA:

April, 1824.

ON THE

CEREBRAL FUNCTIONS,

OR

PHYSIOLOGY OF THE BRAIN.

I PROPOSE, for this evening's lecture, the consideration of the Brain as the organ of intelligence; to treat of it, as of any other viscera, the physical construction of which we are acquainted; for which purpose it is not sufficient to confine ourselves to the human subject, it is absolutely necessary, in order to obtain any accuracy of information, to trace the faculties as they exist, through the whole of the order Vertebralia. To a want of such information, and to a neglect of this mode of proceeding, may be attributed those errors, absurdities, and false inductions, with which metaphysical and psychological works abound.

Of the nature of the soul, the mode of its existence, and connection with the body, I intend in the following investigation purposely to abstain: the almost universal belief of its immortality, being based on an evidence totally dissimilar from the facts and observations of which this essay is composed. Though we are as ignorant of the nature of the soul, as we are of the Deity! yet have we the same proofs of the existence of either. All nature in silent eloquence furnishes indisputable testimony. That it is a principle endowed with immortality, and capable of existing after death, in a state separate from the body, we learn from the *God of nature!* With such conviction we may well rest satisfied, and with suitable modesty direct our investigations to those lower branches of this mysterious subject

that lie within the grasp of reason: otherwise the splendid efforts of genius may in vain waste their strength in the unprofitable pursuit of theoretical speculations, and add little or nothing to the solid and accumulating mass of inductive observations. Ignorance or levity could alone instigate us to pronounce unhesitatingly on a subject, which so intimately concerns the present happiness, and future prospects, of millions of the human family; concerning matters of faith it is in vain to dispute; all that an individual need claim, as a rational, consistent, and dignified being, is the unqualified right to obey the dictates of his own conscience, and firmly and openly to maintain that belief which is the result of unbiassed feeling, reflection, and observation—this surely is an honest zeal, and, whether mistaken or not, should challenge the respect and admiration, and not the odium and persecution of our fellow men. But if the dread of popular prejudice, if the fear of detecting facts which may militate against our pre-conceived notions or antiquated opinions, can prevent us from freely discussing a physiological question so very interesting and important, where shall we seek for the boasted pre-eminence of human reason?

As light and knowledge are extended; as superstition and bigotry, which for ages have swayed their ebon sceptre over the intellectual faculties of man, yield to the empire of reason, and lights of science; the odious epithets of sceptic! infidel! and atheist! will no longer be heaped upon the blameless head of the inquirer after the functions of the brain; whose investigations have, in reality, no more connection with the existence of the soul, than the researches of the anatomist, who treats of the physiology of the liver, the spleen, and the pancreas. He must have *base* and contracted ideas of the majesty of the Great Supreme! who supposes that an honest and sincere search after truth on any subject, can prove offensive to the canons of the Most High! The lively exertions of genius are the most exuberant sources of intellectual delight; the very pursuit of natural science is an exercise of virtue; and has a tendency to advance us, by improving our taste to *higher* degrees of perfection.

The short space of time allotted to these lectures will oblige me to treat of this comprehensive subject in a very cursory manner. I shall not dwell on the physical construction of the brain. To those entirely ignorant of anatomy, it will be sufficient to know, that, like many other glands, it is composed of fibres, cellular membrane, and blood vessels,—and that it is larger in man, in proportion to the nerves which go off from it, than in any other animal.

Two principal ideas have been entertained by philosophers, respecting the nature of the brain and its faculties. The arguments of the first go to prove, that the brain, the seat of the faculties of the mind, is an organ, essentially one and simple in its construction, and producing all its phenomena, by the various actions of the same part.

They compare the actions of the nervous fibre, to muscular motion; the hand, for instance, is moved by muscular fibres solely; yet how varied and extensive are the applications of this organ. Such analogies are founded in error, and are only calculated to mislead.

To me, nothing is more clearly demonstrated, than that the brain, the material organ of the understanding, is as complex in its composition, and made up of as many distinct and separate organs, as there are *special faculties* of the mind. This position is as clear, as that no two atoms can occupy the same space at the same time. Of the numerous facts upon which my conviction is founded, I beg leave to advance a few of the most prominent, which at the present moment offer themselves to my recollection.

And first, can we conceive of an organ *one* and *simple;* at the same time asleep and awake, or at the same time diseased and healthy? Yet who that lives hath not occasionally experienced periods of *broken* slumber; when some of the mental faculties, no longer restrained by the dictates of reason and judgment, (these for the time being suspended), take their flight into the regions of fancy, and operate with unusual activity,—when "the queen of sleep, Imagination, roves in frantic sorrows, or delirious loves."

The fact is, that sleeping or awake, *all* the mental phenomena occurring in health or disease, prove that the mind is made up of separate faculties; and that these faculties have separate and distinct localities, numerous facts abundantly testify. How otherwise are we to explain the circumstance of several faculties being in operation at one and the same time? Can we not, at once, see, hear, taste, smell, and feel?

The too frequent occurrence of mental alienation, furnishes us with melancholy proofs that the faculties of the mind, like the various organs of the body, are not only subject to disease, but that, like the functions of the body, one or more may be diseased, whilst the others enjoy their healthy operations: hence we have *partial* insanity.

The hospitals are filled with these unfortunate beings, displaying the various grades of derangement, from simple absence of mind, to the total eclipse of the understanding; from the mere obfuscation of intellect, to the entire wreck of all that is noble or dignified in our nature!

Further: accidental injuries of the brain, according to the part affected, have produced sometimes a debility, at others a total destruction of certain faculties; for instance, a blow on that portion of the orbit of the eye within which is located the organ of memory for words or names, has been followed by complete forgetfulness of proper names, whilst the other faculties of the brain remained uninjured.

One of the most celebrated botanists of Europe, whose verbal memory knew no bounds, was afflicted with a stroke of apoplexy. He entirely recovered his intellect, with the exception of his memory for names; with the adjectives, the qualities and characters of plants, he remained familiar; but for ever after was unable to name them.

Again, effusions of serum into the cavities of the brain, produce consequences which vary according to the manner in which the accident occurs; whether the effusion was slow or rapid: whether the pressure it occasions is partial or general.

Instances have occurred of effusion into the anterior ventricles of the brain, obliterating to a considerable degree all the

superior order of faculties, whilst the propensity to procreate the species (or amativeness, as it is called), continued more than usually active—which propensity being seated in the cerebellum, under the tentorium or horizontal process of the dura mater, did not suffer compression from the fluid accumulated in the cerebrum or brain proper.

In certain conditions of the *material* instrument of the mind, minor faculties which have for a long time lain dormant and supposed to have been lost, have been suddenly recalled. Dr. Rush used to mention an instance of one of his fellow students at Edinburgh, who had once possessed some knowledge of the French language so as to speak it indifferently, but who for many years had entirely forgotten it; this gentleman becoming intoxicated in a frolic, spoke the French language with the greatest fluency, to the exclusion of the English; this state continued until he was carried to bed and fell asleep.

A circumstance somewhat similar fell under my own observation in the case of a friend labouring under delirium.

I may here call your attention to a fact which was one of the earliest to impress my mind with the importance of Phrenology in explaining the *animal functions*.

It is a fact well established in Comparative Anatomy, that the vocal organs of all those birds arranged under the extensive order *Passeres*, are constructed precisely on the same principle; that is to say, all are furnished with a double glottis, a superior and inferior, the latter being furnished in every individual with six muscles, &c. Here then we witness a numerous host of individuals, all possessed of similar musical instruments: yet few, very few indeed are capable of displaying a musical talent; not more than one out of fifty is capable of producing a tune; and even of those species which are possessed of the highest musical proficiency, the males alone are capable of exerting it, the females remaining mute. Examples of this are observed in the linnet, the mocking-bird, bull-finch, grossbeak, &c.

Cuvier, who has noticed this circumstance particularly in his "Leçons d'Anatomie Comparée," confessed his inability to

afford any philosophical explanation on the common theories of the operation of the brain, and refers it to the operation of a *particular instinct:* thus acknowledging the existence of a special and distinct faculty; and demonstrating that the faculty of music resides in the brain, and not in the vocal organs.

We are led to draw the same conclusions when we extend our observations into the inexhaustible field of Comparative Anatomy. My time will only allow me to adduce one more example.

In our dissections of the anthropomorphous animals, we cannot but be struck with the fact, that the anatomical structure of the organs of voice, in some of these animals, is precisely similar to the same organs in man;—yet, who ever heard of a monkey possessed of the faculty of speech?

I am aware, that it was long ago asserted by Camper, that the throat of the simia satyris or orang outang is furnished with a sac, opening into the glottis, and which was supposed by this author for ever to "spoil him for speaking." But this explanation cannot stand; as most of the other simiæ have, as above stated, the vocal organs similarly constructed to man.

When we reflect on the intimate knowledge which existed relative to the physical structure of the monkey tribe; especially of one of the orangs, (simia troglodytes,) a minute and laboured dissection of which was perfected 125 years ago, by Dr. Edward Tyson; it is somewhat surprising that so much should have been said concerning the discovery by Camper of a sac communicating with the larynx of the *simia satyrus:* which was thought to offer a physical obstruction to the faculty of speech, in this class of animals.

The perfect similarity which obtains between the organs of voice, as they exist in *man*, and in the simiæ generally, was particularly noticed by Tyson; who remarks, (p, 51.) "As to the larynx in our pygmie, unless I enumerate all the cartilages that go to form it, and the muscles which serve to give them their motion, and the vessels which run to and from it, and the membranes and glands; there is nothing that I can further add,

but only say, that I found the whole structure of this part exactly as it is in man: and the same too I must say of the os hyoides. The reflection that the Parisians make on the observation of this, and its neighbouring parts, in the dissection of their monkeys, I think, is *very just* and valuable; and if there was any other advantage for the forming of speech, I cannot but think our pygmie had it: but upon the best inquiry, I was never informed that it attempted any thing of that way. Though birds have been taught to imitate the human voice, and to pronounce words and sentences, yet quadrupeds never; neither has this quadrumanus species of animals, that so nearly approaches the structure of mankind, abating the romances of antiquity concerning them.

"The Parisians therefore tell us, that the muscles of the os hyoides, tongue, larynx, and pharynx, which must serve to articulate a word, were wholly like those of man; and a great deal more than those of the hand, which, nevertheless, the ape, which speaks not, uses almost with as much perfection as a man; which demonstrates that speech is an action more peculiar to man; and which more distinguishes him from brutes, than the hand, which Anaxagoras, Aristotle, and Galen, have thought to be the organ which nature has given to man, as to the wisest of all animals, for want, perhaps, of this reflection. For the ape is found provided by nature, with all those marvelous organs of speech, with so much exactness, that even the three small muscles, which take their rise from the apophyses styloides, are not wanting; although these apophyses are extremely small: this, particularly, does likewise show, that there is no reason to think, that agents do perform such and such actions, because they are found with organs proper thereunto: for according to these philosophers, apes should speak, seeing that they have the instruments necessary for speech."—*Tyson's Anat. of a Pygmy.*

There are some *birds*, on the contrary, whose organs of voice are altogether differently constructed, which are, nevertheless, gifted with the faculty of speech, such as the crow and parrot kind.

The question here arises, does the faculty of speech merit being ranked as a distinct organ, or is it only to be considered as a modification of the organ of music?

Many facts of similar import might be adduced, but I trust I have already advanced enough in order to maintain the truth of our position, viz. that the faculties of the brain are not only distinct, and in a manner independent of each other, but that there does exist separate localities and special organs for the development or manifestations of such faculties, though their names and localities may not as yet be correctly or scientifically disposed.

As far as facts drawn from analogy can influence our opinions, we shall have the strongest reasons to conclude, that the instinctive operations, throughout their very extensive range, the *anima brutorum atque humanorum*, are directed by one universal principle, whether we view its operations in the honey-bee constructing the hexagonal cell, or the reputed lords of the creation elevating the majestic palace. The web spun by the active and cautious spider, and the elegant cocoons wove by many insects, will furnish no mean comparison, and even surpass in delicacy the richest articles of the kind produced by human art and skill; with thousands of other equally interesting phenomena, which testify in the most eloquent manner to the presence and omnipotence of the first Great Architect over all the works of the universe; and may serve to captivate and improve the affections, whilst they convince the understanding!

If this be true in theory, how is it in fact? Let us observe for a moment the operations of the brain as we descend the scale of animated existence; do we not find all those instinctive faculties of the brute creation, which assimilate most to human understanding, to be located in that region of the skull marked out in man for the seat of the knowing faculties? We may also remark, that the latter faculties are wonderfully developed at the expense of the higher order or intellectual; this is the case, at least, with very few exceptions, and if we occasionally observe an elevation of the anterior and upper region of the

skull, of either man or brute, without a corresponding pre-eminence of intellect, we can only refer it to the absence of a proper organization. Thus, in order to constitute a Newton, a Franklin, or a Shakspeare, it requires not only "an inch or two of brain in the right place," but "Il faut aussi qu'il soit bien organisée," as some French physiologist has aptly expressed it: at any rate, the difficulties which Phrenology has to encounter from such irregularities, are by no means greater than those which check the career of every metaphysician warm in the pursuit of any favourite system.

"*Deus est anima brutorum*" is the language of an eloquent author; but may I perhaps be allowed to remark, that the exclamation savours more of poetry, than of philosophy: if it were true that the Almighty fiat, had "ab origine" impressed his mandates upon his creatures, and which were to impel them, independent of any sensible or material organization, as the means of acting:—the instinct of all animals of similar species, would, we should suppose, lead to similar results in all animals in every climate, independent of organization: but the contrary of this is the fact. Numerous instances might be produced to shew that instinct alters, as the organization changes, and that it will even lead the animal to change its habits according to necessity or convenience. Thus instinct directs the Asiatic Ostrich to lay her eggs in the sand, and trust to the sun alone, and give herself no trouble about incubation; whilst the same bird, by the same instinct, is led to sit on her eggs day and night in southern Africa. Rabbits dig holes in the ground for warmth and protection, but after continuing long in a domestic state, that resource being unnecessary, they seldom employ this art.

From an examination of the brain of quadrupeds, birds, and fishes, M. Cuvier draws the following conclusions, which mark the peculiar features of each of these classes:

"1st. The character which distinguishes the brain of Mammalia from that of the other red blooded animals consists,

"a. In the existence of the corpus callosum, the fornix, the cornua ammonis, and the pons varolii.

"b. In the tubercula quadrigennia being placed upon the aquæductus sylvii.

"c. In the abscence of ventricles in the optic thalami, and in the position of these thalami within the hemispheres.

"d. In the alternate white and grey lines within the corpora striata.

"2. The character peculiar to the brain of birds consists,

"a. In the thin and radiated septum, which shuts each anterior ventricle on the internal side.

"3. The character of the brain of reptiles depends,

"a. On the position of the thalami behind the hemispheres.

"4. The character belonging to the brain of fishes consists,

"a. In the tubercles of the olfactory nerves, and the tubercles situated behind the cerebellum.

"5. The three last classes have, in common, the following characters, by which they are distinguished from the first:

"a. Neither corpus callosum, nor fornix, nor their dependencies.

"b. Some tubercles more or less numerous, situated between the corpora striata, and the optic thalami.

"c. The thalami containing ventricles, and being distinct from the hemispheres.

"d. The absence of any tubercle between the thalami and the cerebellum, as well as the absence of the pons varolii.

"6. Fishes have certain characters in common with birds, which are not to be found in the other classes. These are,

"a. The position of the optic thalami under the base of the brain.

"b. The number of the tubercles placed before these thalami, which are commonly four.

"7. Fishes and reptiles have, for a common character, distinguishing them from the two first classes, the absence of the arbor vitæ in the cerebellum.

"8. All red-blooded animals have the following characters in common:

"a. The principal division into hemispheres optic thalami and cerebellum.

"b. The anterior ventricles double; the third and fourth single; the aquæductus Sylvii; the infundibulum; and a communication between all their cavities.

"c. The corpora striata, and their appendices, in the form of a vault, called hemispheres.

"d. The anterior and posterior commissures, and the valve of the cerebrum.

"e. The bodies named pineal and pituitary glands.

"f. The union of the great single tubercle or cerebellum, by two transverse crura, with the rest of the brain, which gives origin to the two longitudinal crura of the medulla oblongata.

"9. It appears also, that there exist certain relations between the faculties of animals, and the proportions of their common parts.

If the slightest degree of variation in locality, alteration of structure, or perfection of organization of the brain of different individuals of the same species leads to results of such high import, as we are led by observation to believe is really the case in man—need we be surprised that the perceptible gradation of cerebral structure observed in the inferior orders should be accompanied with a corresponding degradation of intellectual phenomena? need we wonder at the instinctive faculties of brutes, which lead some of them to the performance of actions, which set at defiance the intelligence of man, with all his boasted prerogatives? The instincts of some of the former may be inferior in number, being confined to such only as are immediately necessary to the preservation of the species; but they act in some instances with such inconceivable energy, as to extort from us the confession that they are really something *super-human!*

In a very short time after the brute animal has been ushered into an independent existence, we know that the physical structure has attained its acmè of organization; the brain partaking of this perfection, fits the animal for the performance, at this early period, of all those operations which are for ever after to characterise its species.

Whilst man on the contrary, by that mysterious law of nature, which fixes the *duration* of existence, for the most part, in direct proportion to the length of time necessary for an animal to arrive at *maturity*, is condemned to a long, painful and defenceless infancy! is sent into the world half formed and naked, the mere rudiment of his future greatness! his brain in particular a pulpy inconsistent jelly, a "rudis indigestaque moles." The assimilating function alone enjoying full activity, is it to be wondered that this little parasite should be confined to the single instinct of filling its digestive tubes? its very earliest inclination is for the breast, the nipple is seized with avidity a—vacuum is formed, and the stomach filled, the infant sleeps, is soon awakened to embrace anew the fountain of life—and such is the short history of that animal, whose apprehension is ere long to emulate the God of the universe! As the organization advances, we observe the mind becoming slowly developed: as the former is perfected, so is the latter matured; advancing thus, faculty by faculty, function by function, he has now become capable of estimating the relations of cause and effect; the remotest transactions of his history, far removed into the night of time, are in a moment called up, and arrayed before him, in all the colours of the painted landscape. He no longer confines his observations to the present and the past, but is occupied with the destinies of the future; seduced into the unfathomable abyss of infinity, he visits the luminaries of Heaven--and contemplates detached from his senses the immutable laws of the Universe. He weighs the planets,—measures their distances—and calculates with wonderful accuracy their most complex evolutions—now watching the flights of time—now grasping at eternity! Sensible of his august origin and immortal destiny, he raises his thoughts to the Deity, and may even question the decrees of Omnipotence! From the full blaze of intellectual energy he is soon recalled to mourn over the wreck of departed glory: already has the leaden veil of time obscured his vision; his senses successively decay; the fire of passion is extinguished by the frost of years; the sun of genius no longer disipates the mists of mortality—he

drinks largely from Lethe's stream, and is again the weak, defenceless infant, from which he sprung; he vegetates yet a little longer, then sleeps to wake no more! Here the destinies of the past, the present, and the future, unite in one point; guileless infancy, and hoary age; the sceptred tyrant, and the fettered slave; the idolator and his God! find a common level and mingle their ashes together. "*Sic transit gloria mundi.*"

This is no fancied picture, but a true copy from nature's grand original: it must have been evident to the repeated observations of you all, that the operations of mind and matter are inseparably connected.

I think it could be easily demonstrated that reason is not peculiar to *man;* and that instincts are *common* to all animals, differing only in the energy and number (with possibly some other modifications) respectively assigned to each.*

Although many animals have *some* of the senses more fully developed than man, Comparative Anatomy furnishes a demonstration that there is no animal in which they *all* exist in so great a degree of perfection. Hence we are led to conclude, that man is more intimately acquainted with the properties of the material world in general, than any of the inferior animals.

OF THE MIND OF BRUTES, AS ILLUSTRATED BY THEIR MENTAL PHENOMENA.

We shall divide these into two classes, the INTELLECTUAL and INSTINCTIVE.

1st. *Attention.* In lower animals this faculty not only exists, but displays itself to our observation in various ways. What is it but the exercise of attention, when we see a cat watching for a mouse, or a kestril hovering in the air? In both cases, the

* For the facts which clearly demonstrate that brute animals are possessed of rational faculties, consult Spence and Kirby's beautiful work on Entomology, Dr Fleming's Philosophy of Zoology, Dugald Stewart's Philosophy of the Human Mind, and Smellie's Philosophy of Natural History.

faculty now under consideration is exercising its controul over the organs of sight. When we witness the fox-hound engaged in the chase, we see attention regulating the organs of smell; and, regardless of the other perfumes arising from the ground, permitting only the scent of the cunning fugitive to make a deep impression. The dog who has lost his master in a crowd, practises the same restraint upon his organs of smell, sometimes, also, on his sense of hearing, as he is able to detect his master by his voice, even when others are speaking at the same time.

Reasoning from analogy, we may conclude that the faculty of attention reaches as low in the scale of animal life as the organs of sensation. It is necessary, in the more perfect animals, for the regulation of every impression; hence it is probable that it exists wherever there are organs to receive an impression.

2. *Memory.* The existence of the faculty of memory in the lower animals can scarcely be doubted, as instances daily occur of its display in our domestic quadrupeds, as the elephant, horse, and dog.* It is likewise exhibited by birds. We have

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* In illustration of the extent of the memory of the elephant, Mr. Corse, in his valuable observations on the natural history of that animal, states the following circumstances, to which he was an eye-witness:—"In June, 1787, Fâttra Mungul, a male elephant taken the year before, was travelling in company with other elephants towards Chittegong, laden with a tent and some baggage for our accommodation on the journey. Having come upon a tiger's track, which elephants discover readily by the smell, he took fright, and ran off to the woods, in spite of the efforts of his driver. On entering the wood, the driver saved himself by springing from the elephant and clinging to the branch of a tree under which he was passing. When the elephant had got rid of his driver, he soon contrived to shake off his load. As soon as he ran away, a trained female was dispatched after him, but could not get up in time to prevent his escape. She, however, brought back his driver and the load he had thrown off, and we proceeded without any hope of ever seeing him again. Eighteen months after this, when a herd of elephants had been taken, and had remained several days in the enclosure, till they were enticed into the outlet, there tied, and led out in the usual manner, one of the drivers, viewing a male

evidence of a peregrine falcon, which was lost in the month of March, recognising its master, when retaken in the end of September. Indeed, in all those animals which are capable of being tamed, there must exist this faculty to enable them to recognise former sensations.

The memory, in the lower animals, likewise performs its operations in the same manner as with us, by the help of what is termed the *Association of Ideas*. Thus we have seen a spaniel exhibit all the ecstacy of joy when he observed his master put on any article of dress which he was accustomed to wear during the hours of sport. These things recalled to him the enjoyments of the field, as distinctly as the sight of the gun. We see the same animal practising an attempt at recollection by smelling at a stranger, and, at last, after many efforts, recognising him as an old friend.

3. *Imagination.* In the lower animals the faculty of the imagination certainly exists, although, from the imperfect

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elephant very attentively, declared he resembled the one which had run away. This excited the curiosity of every one to go and look at him; but, when any person came near, the animal struck at him with his trunk; and, in every respect, appeared as wild and outrageous as any of the other elephants. At length, an old hunter coming up and examining him narrowly, declared he was the very elephant that had made his escape about eighteen months before. Confident of this he boldly rode up to him on a tame elephant, and ordered him to lie down, pulling him by the ear at the same time. The animal seemed quite taken by surprize, and instantly obeyed the word of command with as much quickness as the ropes with which he was tied permitted, uttering, at the same time, a peculiar shrill squeak through his trunk, as he had formerly been known to do; by which he was immediately recognised by every person who had ever been acquainted with this peculiarity." Phil. Trans. 1799, p. 40. The same observer furnishes satisfactory evidence that another elephant, a female taken in 1765, and which was turned loose in 1767, when retaken in 1782, recollected the customs of her former bondage, and lay down at the command of her driver. "He fed her from his seat, gave her his stick to hold, which she took with her trunk, and put into her mouth, kept and returned it as she was directed, and as she formerly had been accustomed to do."—Ibid.

communication which subsists between us and them, its operations, as distinct from memory, cannot be traced with any degree of certainty. The pointer, who exhibits impatience to travel when his master takes his gun in his hand, recollects the pleasure of his former sports and wishes to have them renewed. What is it but imagination that persuades him that they may return, and even points out the channel of their course? A dog howls when his master is absent, and will anxiously look for his return in particular directions. Here is anticipation of a future event, and action founded on the certainty of its occurrence. We have seen a dog evidently entertaining suspicions that his master would prevent his being a companion in his journey, steal away unobserved, and wait on the road at a considerable distance from the house. Here we have the anticipation of the master's going from home, apprehension of being detained, the prospect of gratification from the journey, an expectation of his master's road, and the success which would crown the plan; all of these efforts of the imagination. As we descend in the scale, these displays of the imagination can scarcely be perceived, unless in actions which suppose a succession of events similar to those which have occurred.

There is one very striking difference between this faculty as it exists in man and in the lower animals. With us, it is frequently exerted on speculative truths: in them, on present, or future sensations. With us, sometimes on things which we know will never happen: with them, on things which the probabilities of experience warrant.

PART SECOND.

IDEAS OF REFLECTION.

1. *Personality.* Uncultivated minds have not very correct notions of these ideas of reflection: but, still they do arise even in such, and, in various ways, influence their future operations.

The inferior animals likewise possess similar ideas of reflection. It is true, that they appear to be equally acted upon by the impressions produced by the secondary as well as the primary qualities of matter: nor have we any evidence that they act upon distinction, but they know that there is a difference among the qualities. They are, to a variable extent, acquainted with them, and regulate their conduct by this knowledge which they possess. They readily perceive changes in the objects with which they are familiar. They are acquainted with individuals, or their identity, as the dog is acquainted with his master—with groups, as in the case of the shepherd's dog, who is capable of marking the individual of a flock pointed out to him by his master, and steadily pursuing it. Even the notion of number is not unknown, as appears from the wolf uniting in bands in the chase,—and, while afraid of attacking men in company, appearing fearless of the resistance of a straggler.

2. *Time.* The inferior animals evidently have a knowledge of time. Those which leave a particular dwelling at stated intervals, measure the distance they ought to travel, and return with regularity to their home. The sun appears to be their great regulator, as they are influenced by the changes which take place with his light and heat. Fishes, and other animals which live in the sea, or search for food on its shores, appear to regulate themselves by the motions of the tide. The regularity of the crowing of the cock has been long admired,—but it appears difficult to point out the measure of time by which it is governed.

3. *Power.* That the lower animals possess some notions of power, and of cause and effect, may be inferred from various actions which they perform. Thus, for example, we have seen the hooded-crow (corvus cornix,) in Zetland, when feeding on the testaceous mollusca, able to break some of the tenderer kinds by means of its bill, aided, in some cases, by beating them against a stone; but as some of the larger shells such as the buckie, (Buccinum nudatum,) and the wilk, cannot be broken by such means, it employs another method, by which, in consequence of applying foreign power, it accomplishes its object. Seizing the shell with its claws, it mounts up into the air, and then losing its hold, causes the shell to fall among stones, (in preference to the sand, the water, or the soil on the ground,) that it may be broken and give easier access to the contained animal. Should the first attempt fail, a second or a third are tried, with this difference, that the crow rises higher in the air in order to increase the power of the fall, and more effectually remove the barrier to the contained morsel. On such occasions, we have seen a stronger bird remain an apparently inattentive spectator of the process of breaking the shell, but coming to the spot with astonishing keenness, when the efforts of its neighbour had been successful, in order to share in the spoil.* Animals, in general, seem to have a tolerably correct notion of their own powers, as we do not often see them attempting to accomplish objects for which their strength is inadequate. Thus, we have seen a pointer, which, if a hare was wounded, would pursue with the utmost keenness, but if otherwise would witness her escape without exertion. It is the knowledge of the variety of power which sometimes makes a horse run away with a bad rider, when he would not make the attempt with a good one.

A wasp was observed to light on a gravel walk, and seize a large fly and endeavour to carry it off—a great inconvenience was experienced from the wind, which impeded the flight of

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* Pennant Brit. Zool. iv. p, 114, mentions similar operations performed by crows on muscles.

the wasp: it accordingly alighted, cut off both wings of the fly, which offered the greatest obstruction, and renewed the attempt at flight; the load was still too heavy—the animal alighted a second time and lopped off the head of the fly, and eventually regained the nest.

In countries infested with monkeys, many birds, which in other climates build in bushes and clefts of trees, suspend their nest upon slender twigs, and, by this ingenious device, elude the rapacity of their enemies.

The nymphs of water-moths, commonly called codbait, cover themselves, by means of gluten, with pieces of wood, straw, small shells, or gravel. It is necessary that they should always be in equilibrium with the water in which they live. To accomplish this purpose, when their habitations are too heavy, they add a piece of wood; when too light a bit of gravel.

A cat was known to frequent a closet, the door of which was fastened by a common iron latch, a window was situated near the door, when the door was shut she gave herself no uneasiness, as soon as she was tired of her confinement, she mounted on the sole of the window, and with her paw dexterously lifted the latch, and came out.

A black-snake was seen climbing up a tree, eveidently with the view of procuring the young birds in the nest of a Baltimore bird. This bird, it has already been observed, suspends its nest at the extremity of the branch of a tree. The branch to which the bird of which I am now speaking had affixed its nest being very slender, the serpent found it impossible to come at the nest by crawling along it: he therefore took the advantage of another branch which hung above the nest, and twisting a small portion of his tail around it, he was enabled, by stretching the remainder of his body, to reach the nest, into which he insinuated his head, and thus glutted his appetite with the young birds.—*B. S. Barton's Tracts*, vol. 1st, p. 68.

One of my friends possessed a very intelligent monkey; the animal being very fond of nuts, he used to amuse himself by placing them beyond the reach of his chain; after many useless efforts, which only served to stimulate invention, the monkey, see-

ing a servant passing by with a towel under his arm, seized the towel, and made use of it to bring the nut within his reach—after having thus obtained the nut, he used to crack it with a stone—one day after a hard rain, the earth being softened, the nut was driven in, so as to prevent him cracking it,—sensible of the cause, he placed a stone beneath, and thus readily obtained his ends.—*Discours et Memoires par l'auteur de l'Histoire de l'Astronomie.*

4. *Truth.* The inferior animals possess a knowledge of truth, but in a more limited degree than man. They do not direct their organs of perception to so many objects, or examine the same object under such variety of aspects. But that they possess much knowledge derived from experience, all will be ready to admit, who have traced the operations of memory which they exhibit. Besides, we witness its display in the caution of an old horse, in comparison with a young one,—and of the older animals which we wish to ensnare, compared with the more ignorant ones, which more easily fall into our hands. The absence of experience enables us to deceive the latter, its presence in the former teaches them to avoid the error.

b. *Testimony.* Among the inferior animals, there are some species which, during life, are solitary and fixed to the same spot, as the common oyster. These can derive no information from the testimony of others. Their knowledge of external objects must be limited to the results of their own sensations. But in the case of all monogamous or polygamous animals, whether gregarious or otherwise, a considerable dependence is placed on the testimony of others in a variety of circumstances. Thus, in the case of wild geese, or crows feeding in a field, the knowledge of approaching danger observed by one, is speedily communicated to the whole, who immediately act upon the information.

Errors in testimony, among the lower animals, are frequently committed, as the result of erroneous information or experience. Thus, a cock will often give warning of danger to the hens under his charge, if a pigeon flies rapidly over his head, mistaking it for a rapacious bird. In other cases, the

sentinel may be deceived by false appearances, and, considering that there is no danger approaching, fail to do his duty.*

There are few instances of attempts to give false testimony among the inferior animals, which do not appear to arise from the impulse of the instinctive rather than the intellectual powers. The fox, however, in a tamed state, will often scatter food within the reach of his chain, and then remain motionless until an unwary chicken approaches the cunning observer. This is an attempt to deceive, not so much by scattering about food, as by lulling asleep all suspicion by his quietness.

5. *Duty.* Among the lower animals, we do not observe any instance of their acting contrary to their experience. In a domesticated state, where laws have been imposed upon them, they obey from various motives; the prospect of reward, the dread of punishment, and ultimately habit. They are aware of the conformity or disagreement of their actions, to the standard by which they are tried. Examples of this kind are daily exhibited in the ox, horse, and dog.

6. *Deity.* There is no evidence to prove that the brutes have any idea of a Supreme Being. Our notions of a Deity are not referable to any particular intellectual faculty; but are solely

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* Dr. Edmonston in his "View of the Zetland Island," gives a very striking illustration of this neglect of the sentinel in his remarks on the shag. "Great numbers of this species of the cormorant are sometimes taken during the night while asleep on the rocks, and the mode of accomplishing it is very ingenious. Large flocks sit, during the night, on projecting rocks of easy access, but, before they commit themselves to sleep, one or two of the number are appointed to watch. Until these sentinels are secured, it is impossible to make a successful impression on the main body; and to surprise them, is therefore the first object. With this view, the leader of the expedition creeps cautiously and imperceptibly along the rock, until he gets within a short distance of the watch. He then dips a worsted glove in the sea, and gently throws water in the face of the guard. The unsuspecting bird, either disliking the impression, or fancying from what he conceives to be a disagreeable state of the weather, that all is quiet and safe, puts his head also under his wing, and soon falls asleep. His neck is then immediately broken, and the party dispatch as many as they choose." Vol. ii. p. 253.

the result of a greater perfection of all the mental faculties; hence all our ideas of reflection are more perfect and extensive; if the facts which I have adduced in support of the statements be admitted, it follows that the intellectual powers of man differ, not in kind, but only in degree from those of brutes.

In the examination of the *active powers* or *instincts*, it has been demonstrated, that man and brutes possess appetites, desires, and affections regulated by the same laws, and destined to accomplish the same objects in the animal economy, exhibiting, however, slight shades of difference, according to the species. The superiority of man over the brutes in reference to the *active powers* (except perhaps some of the desires) is so small, that doubts may be entertained respecting his claims of supremacy.

Man, therefore, is far exalted above the brutes by a superior degree of perfection in his intellectual faculties; by a greater power of restraint over his instincts; and by readier methods of communicating his ideas and feelings, rather than by a difference in the nature of his mental constitution!

April 6th, 1824.