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the Old Testament was closed soon after the captivity, because from that time, to use the words of Josephus, "the exact succession of the prophets was wanting."¹ An analogous economy of revelation appears under the New Testament. The gift of the Spirit, in a high and special sense, was imparted to the disciples on the day of Pentecost, and the apostles enjoyed the high prerogative of communicating this gift to others by the laying on of hands.² We have no indications in the New Testament that this power was extended beyond their circle. These men the primitive church acknowledged as having the broad seal of divine authority, and their writings they received as inspired of God. We shall proceed in the next Number to inquire whether their judgment rested on valid grounds.

ARTICLE III.

INSTINCT.

BY REV. JOHN BASCOM, PROFESSOR IN WILLIAMS COLLEGE.

THERE seem to be three forms of nervous and mental phenomena, very distinct in kind, yet easily passing into each other by slight gradations. The first form is purely a vital, nervous fact, and cannot properly be called mental. It is that by which through a nervous centre or centres the present condition and the muscular action of a living body are harmonized. Thus, in man, the lungs, heart, stomach, intestines are subject to a constant play of muscular forces, suited to the passing state of those organs by means of nervous centres, which receive, on the one hand, influences from these seats of activity, and on the other, return to them the impulses of regular, suitable, proportionate muscular effort,

¹ Ἀπὸ δὲ Ἀρταξέρξου μέχρι τοῦ καθ' ἡμᾶς χρόνου γέγραπται μὲν ἕκαστα, πίστεως δὲ οὐχ ὁμοίως ἤλθεται τοῖς πρὸ αὐτῶν, διὰ τὸ μὴ γενέσθαι τὴν τῶν προφητῶν ἐκρίβη διαδοχὴν. — Against Apion, i. 8.

² Acts viii. 17 seq. ; xix. 6.

by which their rhythmic movements are maintained and their functions discharged.

This form of nervous action is not confined to the viscera ; it extends, in a greater or less degree, to all parts of the body, and maintains the voluntary muscles in that general state of tensity which keeps the body charged with life and ready for the immediate handling of the will.

A second class of nervous and mental phenomena is found in the senses, in the memory which retains and restores their impressions, and in the muscular action consequent upon them. The first harmonic effort of the nervous system, by which the constant activities of the living being are made concordant with each other, and with the changing state of each of its parts, and with the most immediate of the forces which act upon it from its environment, does not necessarily enter consciousness, and is for the most part secured in a direct, automatic, unmistakable way. The second class of nervous facts of which we are now speaking appears in consciousness, and these give us rudimentary mental phenomena. The living being is by it adapted to the less immediate and constant of its external conditions ; through it, it is made cognizant of transient circumstances, and suits itself to them. We cannot definitely say how much, but certainly a great deal, can be accomplished with a basis of appetites, by alert, specific senses, a retentive memory, and action that follows instantly on the impulse given by these. In the first place, the special appetites are, by odor, sight, sound, set in speedy pursuit of their appropriate objects, and their search becomes increasingly skilful and successful. The memory rapidly classifies, and thus generalizes, all the experiences for weal and woe to which the living being has been hitherto subjected ; and this it does in so direct, automatic a way as to give the utmost promptness to the actions it controls. The very conditions of effort suggest at once, under accumulated experience, the results ; and the animal acts as if in immediate view of those consequences whose inevitable sequence time has established in the associations of the

mind. Memory may thus oftentimes do the work of judgment in a way more decided and safe than is possible to the higher faculty. A decision resting on the balance of cases is found in the very faculty itself, and with an effect as instant as vision controls the conduct.

The third class of nervous phenomena, or phenomena dependent on the nervous system with its great centres, is still more purely mental; it is that of judgment or thought. In the previous class, we have sensations, the feelings which these directly call forth, whether of appetite, sportiveness, fellowship, hostility, fear, and the inevitable junction of these by memory under the experiences of life in fixed associations, whereby action is suited instantly to the conditions under which it arises. Hence come the tricks of the old dog, the cunning of the fox, the sagacity of the elephant. In the present class, we have the facts of sensation thrown distinctly, consciously, by the mind's own action, into judgments. The mind states to itself the conditions before it, and draws from them in full form certain conclusions. Something more than the associations of memory, restoring things as they have been previously found, is here involved. No judgment, not even the simplest, can be formed without the presence of one or more of those ideas known as intuitive. It is not to our purpose to discuss the origin of these ideas. It is sufficient to say that some one or other of them enters into the most rudimentary thought, if we use this word as an equivalent to judgment. The marble is, involves the idea of existence; the marble is white, this idea and that of resemblance; the marble is now white, these two ideas and that of time; this marble is now white, these three and that of place or space. The direct, conscious union of facts and ideas in judgments is thinking. This is thinking; though thinking includes this and something more.

The three classes we have now defined are typically distinct, though passing easily into each other, and mingling freely with each other in psychological events. The first class hinges on unconscious states, automatic in the series

of actions which, through the nervous system, flows from them; the second class hinges on sensations—conscious states, reached by special organs and general conditions, which in a conscious way secure appropriate action; the third class hinges on ideas which are occasions of judgments, in turn controlling voluntary actions.

All three of these forms are found in man, and mutually modify each other. The complete or highest type of rational action is seen in the third class; though this is supplemented and aided by both the other two. The labor, if it may be so called, of simply living,—of keeping the vital organs in harmonious play, in perfect relation,—is taken off the mind as a conscious activity, and left with the highly organized and organizing nervous centres, which do this work in a comparatively direct, unvarying fashion. Yet over these processes the mind exercises a measure of power, quickening or retarding inspiration, shutting, opening, directing the eyes, relaxing or making more tense muscles already affected by involuntary forces. The lower life is run independently of the higher life, though kept in a state of readiness for it, subject to its influence and use. Much of what is known as skill is but a change of voluntary into involuntary or automatic connections. So long as one is compelled to put a distinct, conscious purpose back of each motion, his movements are slow, perplexed, and awkward. When at length such a union has by repetition been established that the succession of actions in any series can be handed over to the unconscious muscular, nervous system, to the rhythm of its instant and unerring play, then skill appears; the whole movement is rapid, precise, felicitous. Thus the skilful organist, wrapped in the sentiment of the piece, scarcely knows the existence of the keys that are responding so perfectly to his rapid touch.

What is known as instinct falls, at least in part, into this division. Besides the organic and the acquired harmonies of the nervous and muscular systems, there are others which we observe, even in man, without understanding their ground.

One who is in the habit of profound thought will frequently fall into a tendency toward an attitude which he afterwards unconsciously assumes whenever thus engaged. The very state of severe thought acts on remote, disconnected muscles, and secures very soon the habitual position. It is told — is it not — of Sir Walter Scott, that when a lad he was rarely at the head of his class in spelling, but once won that station in this manner. He had observed that his successful competitor was accustomed, when a hard word was put to him, to worry a particular button in his vest as he spelled it. This he succeeded in stealthily removing. The trial came; the difficult word was on the lips of the master, and the hand went to its accustomed place; the button was wanting, and the mind was thrown into confusion; the word was missed, and Walter went to the head. Here was an instinctive, constant connection between things apparently unrelated, yet one of such importance, that on its failure the mind at once lost its cunning.

In certain physical states, we observe a tendency in sleep to throw the arms over the head, and this, too, against the will of the person, and often with real discomfort as its result. Some condition of the general system without obvious reason establishes this wayward tendency, and on each return exhibits this correlation of the nervous and muscular systems. These, and many like examples, as those states which render certain places and positions agreeable, especially to the aged, certain hours and attitudes consonant with certain trains of thought independently of direct suggestion, play, it is true, no very important part in the human constitution, as reason so largely displaces with us blind instinctive connections; yet they may serve as examples of facts which occupy a very important place in other forms of life.

Of the second class of psychological facts, in which the senses in a direct way, with little or no intervention of thought, guide action, we have abundant examples. In working at familiar tasks, the mind is often occupied with

some subject of thought, and is called only now and then to the oversight of the labor of the hands. The shoe-maker at his bench, the farmer at his plow, each pursues his toil, yet directs his mind to some project or favorite topic, and is but slightly interrupted by his well-known task. The merchant, returning from the business of the day, threads his way along the crowded streets, turns the familiar corners, and reaches his own home under the absorbing interest of an important transaction, without any direct attention or effort of thought. One, in reading aloud, finds articulation following in so mechanical a manner the sight of the letters, as to leave the mind wholly attentive to the sentiment; or, failing of interest in this, to be completely occupied by some theme of its own. It is astonishing how easily and perfectly the thoughts slip the drudgery of familiar labor on to the senses and muscles, and then wander at will in pursuit of their own pleasure. The thinking power is thus plainly ruler in the intellectual household, and reserves itself for whatever of variety and exigency may be met with, leaving the daily routine of life to its dependents.

These three classes of facts co-exist in the vital and intellectual constitution of man, in a changeable, fluent, and pervasive form. They interpenetrate each other, replace each other, and unite in the same results. This is especially true in the ease with which the higher sinks into the lower, and rises out of it. Thought can instantly overlook and arrest the mere automatic senses, or send a volition, or the reaction of a moral sentiment down upon the purely vital forces. These last, on the other hand, are the permanent conditions of mental action, and give the basis of force above which and upon which this plays. They limit it, therefore, in the degree and direction of its manifestation, but in no sense rule over it, nor are they able even momentarily to replace it. The relation between the highest and lowest is not perfectly reciprocal. The higher is to the lower what the lower can not be to the higher, and the reverse. Automatic, nervous action can exist apart from thought; thought is

dependent on the structure which, by this means, is built up for it, and placed at its disposal. Thought has an immediate oversight of, and more or less control over, subsidiary powers; these have no control, properly so called, over thought. The lower facts are more independent, more self-sufficient; the higher more free and influential.

The manner in which thoughtful, conscious states of mind are replaced by the unconscious ones of the nervous system, or these suddenly restored to the mind's attention, may be illustrated by the clouds that now pass into invisible vapor, and anon return again to their visible form. The manner in which these three kinds of facts concur in one end finds a resemblance in the interaction of chemical and circulatory forces on the fluids of the body. Transfer and chemical change proceed together, and secure that modification of character in these fluids as they pass their rounds which renders the circulation of the blood, for instance, very different from the churning of a homogeneous liquid through a series of tubes and strainers. Affinity, endosmose, attraction, seize on its particles, modify them, and urge them onward. In a like living, interpenetrable way do the facts of mind transpire.

We have brought forward these divisions, not so much for the light they may bring to psychology, as for the explanation which they seem to us to afford to animal life, and this in two directions: first, as to the mental powers which are to be attributed to animals; second, as to the nature of instinct. But two of these classes of psychological facts, the first and the second, are to be found in the action of brutes. Alert senses, a ready memory, and a varied experience, are sufficient to explain conduct that seems to involve reflection. In handling this question, we are to bear in mind two things: first, that the least sufficient cause for any class of facts is the one to be accepted; second, that the similarity of behavior in the brute to man in given cases does not imply like causes, so long as the *tout ensemble* of action is very diverse. Our conclusions must rest, not on detached and extreme

instances, but on the general appearance and character of the phenomena under discussion. The aspect of animal life, as a whole, should have more weight in forming our opinions than rare cases of sagacity. If the explanation we bring to these seems to any a little forced, this is better than to assign exaggerated and disproportionate causes to the bulk of the facts before us. It is more rational to suppose that a given set of powers should sometimes accomplish what at first sight seems beyond them, than to suppose that another set of powers should habitually do far less than belongs to them; that brute faculties should make an occasional leap, than that human faculties should lie unawakened on the low level of brute achievement. We are to decide this question, not so much by dribblets of evidence as by the bulk and mass of facts before us.

We urge that memory and sensation, the basis of experience, are sufficient to explain the mental phenomena of brute life, from the form which the facts of animal intelligence present. The sagacity of brutes is restricted, disproportionate, rapid, and precise. They know in one direction far more, and in other directions far less, than they should know, if their knowledge were the result of reflection. There is also a readiness and exactness of use which show, that their intelligence is not of a meditative, ratiocinative character. In both of these respects, in its limitations and its completeness, it is more allied to the knowledge of the savage than to that of civilized man. The acquisitions of the savage are the fruits of quick, well-trained senses, and brief, experimental inferences; the information of the civilized man comes from wider observation, more protracted reflection, and a complicated interlock of conclusions. The savage, like the animal, threads the forest with safety and directness, while the reasonings of the enlightened traveller leave him bewildered and uncertain. How often it is said of animals, that they will follow back a road that they have once gone over without hesitation or mistake. This ought to be, if their knowledge is that of memory and the senses;

it ought not to be, if it is that of reflection. Man, because of his reflective faculties, is the more liable to err in affairs of this sort. Other questions have occupied his mind while the objects to be observed were passing before him; he has moved forward in a more or less distracted mood, and when he would retrace his steps he fails to recognize the features of the way. The animal, and the savage allied to the animal in his phases of mental activity, have, while pursuing their course, had their entire life, their entire attention in the senses: a memory exclusively and constantly trained in this direction has stored up impressions, and hence they return with ease along the road by which they came.

The same is true in all directions of knowledge. Completeness and readiness, within a narrow circle, belong to information that springs from the senses and memory as opposed to that which is due to reflection. In the one case, the subjects of knowledge are limited to the senses, and further, to those sensible objects in which the appetites and habits of the brute interest it. This leads to the almost perfect exclusion of other subjects of information, and leaves the brute as we find him, with an intellectual outlook exactly suited to his physical necessities. In the other case, reflection may propound subjects of thought in any and all directions, and knowledge rapidly gains in breadth what it lacks in precision. There is the same difference also between the two kinds of knowing as regards quickness in use. That which rests on a limited, exact experience, and is kept perfectly in hand by the memory, evidently affords no ground of hesitation or uncertainty within that restricted range of questions of which it treats; whereas a mind that reaches its conclusions from premises gathered with labor, and interpreted with hesitation, must often, on very simple points fall into uncertainty and occasion delay. We are confident that the more this point of the form of intelligence is considered, the more will it be seen that there is here a radical difference between brute and human intelligence, referable to the manner of acquisition; the one exhibiting the alert-

ness, exactness, and limitation of the senses ; the other, the breadth, slowness, and uncertainty of reflection.

A second ground for the distinction now urged between brute powers and those of men is found in the limits of animal knowledge. These, though occasionally transcended by exceptional sagacity, are fixed and well-defined ; they are those which fit each species to the needs of its own physical life, and include nothing more. We do not find animals, as we constantly find men, possessed of knowledge outside their physical wants, with no immediate reference to them. The cunning of the rat, the sagacity of the beaver, the wisdom of the bee, are all developed under a definite experience that has exclusive reference to their immediate well-being, and at no point transcends it. If these gains were the result of reflection, they ought not to accept these sharp bounds, and to stop short with immediate utilities. There would be a certain momentum gained in their early and complete development, their wonderfully sagacious and exhaustive occupation of a single field, which would inevitably, in some instances at least, carry the mind further, and lead to general intelligence. The savage by no means adapts his life so happily and completely to his conditions as do the bee and beaver to theirs ; yet he ever and anon transcends his limits, these never.

Nor does this fixedness of animal knowledge arise from the lack of external stimulus. This is clearly seen in domestic animals. These are brought into daily contact with a higher order of intelligence. The words and actions of men come under their constant observation. Acts, within and just beyond the scope of simple reflective faculties, are before them, and their own advantage would often be found in the thoughtful apprehension of them. Imagine man so situated in reference to a higher order of beings, and how instant and inevitable would be the progress achieved by him ! Yet domestic animals are scarcely more sagacious or intelligent than wild animals, often less so. The additional knowledge they have, arises simply from a tacit

adjustment of their powers to new conditions of life and new lines of experience. In these they are no more keen or quick than the beasts of the forest in their avocations. Animals learn to use words, never to talk. The parrot-like way in which language is repeated by them is proverbial. They understand words so far as reiteration, action, gesture, voice, have made them intelligible by fixed and inevitable association, and no further. The animals which belong to civilized races are not civilized. Indeed, those of barbarous and nomadic tribes frequently have the advantage in acquisitions, because they have been subjected to a more direct and reiterated discipline. All this is inexplicable on the supposition that animals possess the full circle of reflective powers. Such powers ought to be open to this extraordinary stimulus, and occasionally, at least, to start forward in independent development. If, on the other hand, the senses are the sole avenues and real limits of brute intelligence, these facts are what we should expect them to be. The knowledge of each animal, wild or domestic, would confine itself to its own circle of experiences, and these experiences would depend upon the objects forced on its attention by its own wants. All other objects, actions, relations, would be, as it were, unseen by it; as there is nothing in its circumstances to bring them to its notice, and no curious thought to send its eyes in search of them. Each animal, therefore, would soon reach an equilibrium under any given set of physical conditions forcing development, and there pause till new dangers or varied circumstances pressed upon it.

If it be now urged that there are, nevertheless, very many instances of sagacity on the part of animals which transcend the powers here attributed to them, we make answer, that the objector has probably not duly considered how much is within the scope of acute senses, a retentive memory, protracted experience, hereditary endowments, and transferred habits. A premise and a conclusion can as certainly be united by memory as by judgment, with this advantage in the former case, that the union is instant, and thus in the

best working form. The fact that we habitually employ the one connection, serves to disguise from us the ease and certainty of the other. We behold in a brute an action indicating intelligence, and we can hardly do otherwise than put back of it the state of mind which it would imply in us, yet this plainly is not a safe conclusion, as these actions do many of them, it is evident, arise in a very different way. This fact should prepare us to consider quietly the question, whether they may not all, even the most surprising, be due to simpler forms of mental activity than those of the syllogism.

When several lines of experience meet in one transaction, they present in the animal an appearance of thoughtfulness, tending to a conviction which it is difficult to resist. Yet, when we come to analyze them, and mark the gradual growth of each conclusion, and their fortuitous combination, the difficulty disappears. A horse quietly unties himself, goes to an adjacent bin, lifts the cover, finds it impeded by the measure resting upon the top of the bin, removes this with his teeth, then successfully throws back the lid, and helps himself to the grain. Disturbed by approaching footsteps, he hastens back to the stall. This, or a like transaction, beheld for the first time, brings with it a strong belief in the thoughtful sagacity of the brute achieving so comfortable a trick. Yet, if we have watched him, we know exactly how the animal, by slow experience, has gained this skill. Long since, working uneasily at his halter, at rare intervals he untied it. Taught by this accidental success, he was shortly able to untie himself readily. The bin, whence he daily received his coveted feed, became at once an object of attention. The same blind, tentative effort with his teeth soon taught him to open it. These lessons, extending over some weeks, were varied with another line of experience. Occasionally caught in the theft, a sharp blow impressed the lesson of caution. A third judgment was thus formed. Sometimes, moreover, he failed of success because the shelf made by the top of the bin was occupied by some object, too large to allow the dropping of the open lid in rest against

the wall above. These obstacles, in the violence and worry of repeated failure, were knocked off, and success again achieved. Here was a fourth line of experience, a memoriter judgment confirmed by practice. With this education of his own achievement, the horse fastened in the ordinary way, is ready at once to untie himself, proceed cautiously to the bin, remove all obstacles, open quietly the cover, and take at discretion the reward of talent. Yet, we know exactly how this skill has been reached without one trace of thought in the whole affair.

Suppose, now, a far more complicated combination of experiences, acquired through a more protracted and varied history entirely unknown to us, and plainly we shall make the hasty inference, Here is reflection, with no more ground for the conclusion than in the simple case before us, whose steps we have known and watched.

Moreover, tales of sagacity in animals are told in a way so inexact and partial as to lead to inferences quite unwarranted. Very much is within the reach of quick, alert senses, cognizant of objects far and near; a strong memory, uniting in permanent associations favorable and unfavorable experiences; habits established by laborious training, or transmitted by descent; and the fierce incentives presented by the appetites, by anger, by fear, by natural affection.

A third reason why we believe the powers of animals to be those now indicated is found in the growth of their intelligence and in the method of its transfer. Animals are undeniably taught what they learn by reiterated association. The first and more difficult task is to establish a connection, through the senses of the horse, dog, pig, parrot, between the voice or gesture of the trainer and the desired action. The attention at length directed to the right connection, this is confirmed by repetition, till the animal responds at once to the signal. Success in the handling of animals turns on skill in preparing the conditions of right action, and in at once recognizing and establishing it. Violence, which alarms and confounds the mind, irregularity, which confuses it

and prevents the formation of fixed association, are especially unfavorable to the training of brutes. Thus it happens that the horse and ox so soon acquire something of the disposition of the driver, and settle down into patient and perfect obedience when a quiet, trusty, and sagacious mood reigns in him. Chastisement disproportioned to the offence, or in the least disconnected from it, makes a horse vicious, because, lacking those rational powers which would enable him to connect the punishment with its ground or reason in his own behavior, he simply associates any exigency with danger to himself, and becomes at once restive and unmanageable through fear. An accident evokes the expectation of a whipping, and the animal is thoroughly unsafe through this false association.

Training is also measurably transmitted in animals, which it ought not to be were it a purely rational process. The acquired powers of men are not thus communicated. The various breeds of dogs, in whom distinct habits have been the subject of protracted training, transmit, in a large degree, their peculiar endowments to their progeny, and pointers, hounds, the dogs of St. Bernard, retain from generation to generation their acquired skill. If this skill has been due to a special discipline of the senses and a correlation of the voluntary powers with them, then the physical constitution may have been so modified in connection with it as to give a reason for this transmission. When we add to this the ease with which the parent animal by direct example would educate its offspring, we have a sufficient explanation of this fact of inheritance — a fact quite exceptional, if the acquired characteristics of brutes are the result of reflection. The great, cardinal features, then, of animal knowledge — its form, its limits, its methods of acquisition and transfer — look to the one conclusion we have urged, — that it is to be found in fixed associations, constructed from the ample material of the senses. All that can be offered against this reasoning are those cases of peculiar sagacity which are thought to transcend the possibilities of such powers as these.

We explain the impression which such cases make upon us, first, by the inevitable tendency to enlarge them, and interpret them by a transfer to them of our own experience and feelings, and secondly, by our oversight of the varied and protracted experiences of which they are the last result. The waves on the beach work out some fine mathematical forms; they are not therefore geometricians.

We now pass to instinct. This has of late called forth much discussion—discussion which has brought to light a tendency to greatly restrict the province of instinct or to banish it altogether. It is said that the word conveys no clear idea, groups in a confused way very diverse facts, and affords them merely a verbal explanation.

There are, we believe, a class of allied facts which may be designated by this word, and which are to be united to our first class of nervous phenomena—those by which in a direct, involuntary way the present condition and muscular action of a living body are harmonized. These phenomena are of two kinds—those which recur stately, and are common to many forms of life, of which breathing and digestion are examples; and those which are irregular in their occurrence, variable in character, and confined to specific forms of life. To this division belong instincts. They are actions which present the form of voluntary, with the characteristics of involuntary, effort. In form they are intermittent, changeable in time and circumstance, and spring from no obvious physical state in the party putting them forth. In character they are exact, complete, and limited, and without essential modification from generation to generation. The changes that are induced in instincts are evidently occasioned by the play upon them of higher powers.

The instinctive act is one, then, which has a basis, more or less obscure, in the physical state of the animal, and which controls by a direct correlation its conduct. An apparently conscious and voluntary connection is really one of an involuntary and unconscious character; that is to say,

facts which in their form belong in one class, are found by intrinsic character to fall into another. Instincts are by no means actions wholly alien to the animal constitution. They are simply a lower form of purely nervous activity, supplementing in a higher field powers not yet sufficiently developed to take possession of the province of effort ultimately falling to them.

This view is urged upon us, first, by the fact that it allies instincts to known forms of vital action. All the internal, vital organism is maintained by a direct correlation through the nervous system of varying conditions with varying muscular effort. Thus the exact state of the lungs is each moment recorded and responded to in exhalation and inhalation. It will be thought, however, that this agreement is more apparent than real; since, in the one case, we have the precise condition of a given organ as the previous ground of muscular effort, while in the other we know not what initiatory states of the system can precede the instinctive action. A little thought reduces this difficulty, if it does not remove it. While we can refer the muscular action of a given organ to the present condition of that organ acting on a nervous centre, we have but slight idea of the manner in which that condition is declared, or of the way in which the declaration of it in the nervous system secures the appropriate activity. We can scarcely be more ignorant of the connection of general physical states, or the condition of specific organs with instinctive action, than we are of the character of this recognized dependence through the nervous system of organic states and activities.

Moreover, we can often with plausibility refer the excitation in instinct to specific organs. The young of mammalia have a tendency to suckle so immediate and direct that most recognize it as an instinct. In domestic animals, when it is necessary to substitute at once drinking for sucking, it is accomplished with more or less effort and inconvenience. Though both acts are equally possible, and both reach the end of nourishment, there is so positive a tendency to the

one that the other is substituted for it by degrees and often with considerable difficulty. This instinctive tendency, as we shall venture, therefore, to call it, notwithstanding such objections as those of Mr. Wallace, finds an obvious seat in the nutritive organs, and may as well be the muscular product of their condition as peristaltic motion. The instinct, less or more, connected with nidification and with kindred means of propagation, may find a source in the sexual organism. If we consider how immediately beneficial most instinctive action is to the animal putting it forth, we shall not often miss some general or local uneasiness, some direct or indirect gratification, which may be assigned as the condition of the effort.

Neither would it be altogether strange if instinct should be in many cases attached directly to the senses; certain sights and sounds calling forth the desirable action. If we are threatened with a blow in the face, we instantly close the eyes, avert the head, or raise the hand. These movements outstrip the reflective faculties in rapidity, and, whether instinctive, as they are generally thought to be, or the growth of experience, they illustrate the possibility of a direct attachment of muscular effort to a given state of the senses. The opening of the spring may develop, without reflection or experience, the migratory impulse in birds, to be followed, on the approach of winter, by a reverse movement. The very state of the atmosphere may act directly on the bee, determining whether it shall leave the hive or not. It need not forecast the day as one of clouds and storm, and thus tarry at home; its own delicate barometrical organism may declare the facts in a more unmistakable way. As men have a theology which "they feel in their bones," so may the bee have an equally deep and far more certain domestic economy in its very structure. The same may be true of the spider, proportioning the size of its web to the calmness of the day. A nervous system that forecasts the weather may directly govern the ventures for the morning.

In any case in which we seem to lack all grounds of

reference, as in the one mentioned by Kirby and Spence — the slaughter of the drones by the workers each summer, except in hives destitute of a queen, we still find analogous actions in our own experience. We cannot say what portion of the system, or what want in the whole system, compels one, as he commences a discourse, to twist a watch-chain, crumple a paper, or work with a pencil. What is there in close thought which necessitates a given position of the body or hands, or induces one to choose a given hour of the day or night? Yet these or like habits are matters of constant observation. An obscure, irrational correlation has been established between certain states and acts, and the one induces the other as inevitably and blindly as in the case of any instinct whatever. When, therefore, we refer to instinct actions which have an apparent reflective character beyond the range of powers in the animal performing them, and yet whose excitation cannot be attributed to any obvious local condition of the organization, we do at least put them with phenomena closely analogous, where they can well wait for further explanation.

The present view of instinct is also pressed upon us by the ease with which it unites this form of activity to others. Organic, instinctive, sensitive, reflective action play into each other in a direct, vital way; one often replacing another, and two or more uniting in the same transaction. From that action which within the body maintains the healthy functions of an organ, how easy is the transition to more intermittent and external effort, to instinct, which ministers in a like, though more general, manner to physical well-being. Again, how closely allied is instinct to acquired skill or muscular habit, by which difficult processes are performed in a ready, rote way, entirely beyond reflection. Indeed, it will not be easy always to keep apart these two kinds of facts, and to say positively of given conduct that it is planted instinctively in the constitution, and is not the result of protracted experience. If it should be made out that the difference between instinct and skill is found in the

length of experience from which they spring, the distinction would still hold as between the animal and man. The one would be the working up from below of undesigned connections into habit; and the other, the working down from above of reflective, voluntary associations into automatic, muscular play.

There is also in connection with instinct the largest possible modification of conduct by the senses. Mr. Wallace takes especial offence at the part assigned instinct in nidification. Is there not ground for this? and may not the objection be removed without an entire denial of the direct, instinctive sagacity so many have seen in the construction of nests? We are not to suppose the senses present without constant influence on the work as it proceeds; nor the bird to be uninfluenced in its labor by a feeling of safety or danger. These momentarily modify and govern its effort, but do not entirely explain the ease, uniformity, celerity, and inimitable excellence of the results. The senses give conditions under which the problem is solved, but the solution itself shows that unvarying exactitude of execution which indicates the presence of other powers than those of reflection. The form of the whole life, contrasted with this portion of it, exhibits a range of action too narrow to be attributed to reasoning powers. Faculties of this class, adequate to these results, would totally alter the entire conduct, and make of bird-life a very different thing. If, however, we recognize the presence and modifying power of the senses, and also the instinctive, constructive impulse, both moving toward a common end in an inseparable way, we shall be able readily to include, on the one side, the various material and modifications of the nest; on the other, the certainty and completeness of the general pattern.

Instinct also unites easily with all the knowledge gained by experience. Instinct gives a basis and framework of action which experience can enlarge and confirm; and experience, by its simple, reiterated connections, may often, by protracted influence and inheritance, take the form of

instinct. These two elements it is impossible perfectly to separate; it is sufficient to recognize the presence and need of both: instinct, to explain the rise, direction, exactness, and rigidity of the life developed in animals; and experience, to expound whatever of growth and variation it may be found to exhibit. If we take an example in the higher forms of life, as that of the beaver, we may easily accept any facts which go to show an accumulated experience, leading the animal to fit his conduct to the waters occupied by him, building or omitting the dam, and varying his lodge as the exigencies of the case require. It will inevitably happen, that the final, conjoint product of instinct and experience, in a case like this, will present results which will equal those reached by very considerable reflective powers, and, therefore, will, at once and strongly, suggest such faculties. It is popular, hasty thought which attributes to animals endowments sufficient to accomplish immediately and independently the works wrought by them, and a later and more studious consideration of the subject, that recognizes growth, the imperceptible accumulations of more limited faculties, in the last achievements of brute sagacity. Men are not reluctant, as idolatry too plainly shows, to ascribe superior powers to inferior objects. This is the first easy and usually erroneous judgment which they bring to the explanation of familiar and unfamiliar facts not within their experience.

A third reason for this view of instinct is found in the correspondence of powers implied in it to the serial development of the nervous system in the animal kingdom.

It is so well established, that the nervous system is the medium and source of all those influences which control, consciously and unconsciously, our vital powers, that we need not spend a word in confirmation of this conclusion. It follows directly from it, however, that mental power should be proportioned to the development, the force, the harmony, and unity of the nervous system. In the nervous constitution there is a constant though general progress in

development as we pass from the lower to the higher forms of animal life. While we cannot arrange the animal kingdom in regular series, we can easily indicate its higher and lower classes, and those which are, at least in a general way, intermediate. These gradations we find indicated and accompanied by a change in the nervous system, gaining in unity and power as we advance to higher orders. Starting with the Radiata, we meet, according to Owen, with a nervous system, when traces of it are visible, of a radiate, filamentary character, not presenting either a homogangliate or a heterogangliate type. It thus seems fitted rather for local, rhythmical action than for combined control of the entire body. The life is diffused and independent, rather than single and central. In the Articulata, the nerves are united by ganglia which encircle the gullet. From these sub-oesophageal ganglia, two chords are extended along the ventral surface of the abdomen, and are, in most species, united at certain distances by double ganglia which give origin to the nerves of the body segments. "In the class Annulata, the nervous system has reached a higher type and more constant plan of arrangement. It always commences by a symmetrical bi-lobed ganglion, meriting, both by its situation above the mouth and by the parts which it supplies, the name of brain, which it has commonly received. The sub-oesophageal ganglion is, however, the analogue, if not the homologue, of the medulla oblongata, and should be included in the encephalic division of the nervous system in both the articulate and molluscos animals."

In the Mollusca, which are rather co-ordinate with the Articulata than in advance of them, "the centre of the nervous system still bears the form of a ring surrounding the gullet, from which the nerves radiate, often unsymmetrically, to different parts of the body; the brain is represented by ganglia above or at the side, or below the gullet; other ganglia are developed in other parts of the body." There is thus still a want of unity, concentration, control in the nervous system.

In the *Vertebrata*, as obviously the highest sub-kingdom as the *Radiata* are the lowest, "the disposition of the principal mass of the nervous system is in a medium axis, consisting of the brain and spinal chord, situated along the dorsal aspect of the body, behind the heart and digestive system; and enclosed in a bony or cartilaginous case, constituting a vertebral column."

The brain now assumes, both an absolute and relative power not previously present; that is, if size and position are safe indications. In man, the cerebrum, the seat of reflection, overshadows the entire nervous system, and assumes a proportion at once and wholly beyond what we elsewhere meet with even in the *Mammalia*. The *Quadrumana*, which are nearest to man in size and organization, have a volume of brain little more than one third of that which belong to him. A slight falling off—that is, slight in comparison with the difference which separates man from the animals which approach nearest him—in the human brain, occasions idiocy. The rational powers, as they are found in him, cannot be maintained in their normal action with materially less nervous concentration and power.

If there is any significance in these facts, they must indicate a kind and grade of faculties very different in the lowest from those in the highest forms of life; they prepare us to expect diversities which amount to a distinction in kind rather than to one of degree. Such distinction the view we have presented recognizes. From a purely nervous, unconscious, automatic control, we pass up through instinct, the connections of association in the senses and memory, to the truly rational and reflective processes which characterize man, and closely subject the whole physical system to their control. On the view that these reflective activities are shared by animals, and are evinced in part by what is termed instinct, complete confusion is introduced; there is little or no correspondence in powers with the serial development of the nervous system through which these powers are expressed. To make this point plain, it will be necessary to

draw attention to the wonderful instinctive development of the lower animals; a fact not in the least perplexing if instinct is allied to nervous organic action, but one very troublesome if it is at all of the nature of reflection. The lower animals would thus become, in many cases, the most thoughtful and rational of the entire kingdom, and our pyramid would rest as often on its apex as its base.

Our first illustration is the hermit crab and cloak anemone. The habits of the crab are curious and quite to the point, but somewhat less so than the relation of the two animals to each other. The hermit crab avails itself of the shells of other animals, and frequently migrates from one to another as the old home becomes too small for him, or a new one promises more convenience. "A pretty little zoophyte, the cloak anemone, loves to live with the hermit, and exhibits sympathies almost inexplicable. In aquariums, this anemone attaches itself almost always to the shell which serves as the dwelling of the crustacean; and it may be looked upon as certain that where the hermit is there will the anemone be found. These two creatures seem to live in perfect and intelligent harmony together, for Mr. Gosse's observations establish the existence of a cordial and reciprocal affection between them. This learned and intelligent observer describes the proceedings of a hermit which required a new habitation; we saw it detach, in the most delicate but effective manner, its dear companion, the anemone, from the old shell, transport it with every care and precaution, and place it comfortably upon the new shell, and then with its large pincers give to its well-beloved many little taps, as if to fix it there the more quickly."

This account in "The Ocean World" is followed by this observation taken, with evident approval, from Gosse: "Is there not here much more than what our modern physiologists call automatic movements, the results of reflex sensorial action"? "The more I study the lower animals, the more firmly am I persuaded of the existence in them of psychical faculties, such as consciousness, intelligence, skill, and choice;

and that even in those forms in which as yet no nervous centres have been detected." This seems to us well nigh a *reductio ad absurdum*. We are to credit animals with a high type of intelligence which possess no known nervous centres. Brain would seem quite a superfluity on this view.

A second illustration is furnished us by Kirby and Spence from a more advanced form of life: "The web of a house-spider will, with occasional repairs, serve for a considerable period; but the nets of the geometric spiders are, in favorable weather, renewed either wholly, or at least their concentric circles, every twenty-four hours, even when not apparently injured. This difference in the operations of the two tribes depends upon a very remarkable peculiarity in the conformation of their snares. The threads of the house-spider's web are all of the same kind of silk; and flies are caught in them from their claws becoming entangled in the fine meshes which form the texture. On the other hand, the net of the garden spider is composed of two distinct kinds of silk; that of the radii not adhesive, that of the circles extremely viscid. The cause of this difference, which, when it is considered that both sorts of silk proceed from the same instrument, is truly wonderful, may be readily perceived. If you examine a newly formed net with a microscope, you will find that the threads composing the outline and the radii are simple, those of the circles closely studded with minute dew-like globules, which, from the elasticity of the thread, are easily separated from each other. That these are in fact globules of viscid gum is proved by their adhering to the finger and retaining dust thrown upon the net, while the unadhesive radii and exterior threads remain unsoiled. It is these gummed threads alone which retain the insects that fly into the net; and, as they lose their viscid properties by the action of the air, it is necessary that they should be frequently renewed." The account then proceeds to state a fact already referred to, "that if the weather be about to be variable, wet, and stormy, the main threads which support the net will be certainly short; but if fine, settled weather

be on the point of commencing, these threads will be as invariably very long." Here, again, on the view that thoughtful action is involved, we have very high results assigned to a relatively low organization. The difficulty of the theory is increased by two facts: first, that human intelligence does not suffice to predict the weather except within narrow limits, and in a very uncertain way; these little creatures are therefore sharper in their discernment, and more correct in their judgments, in one direction at least, than are men. Human powers handle awkwardly the problem they are said to solve so invariably. We run to our barometer and back again to our observations with great perplexity, and are at last overtaken by a sad mistake. If the spider does this thing by reason, let us do homage to our betters. Again, this instinct or intelligence of the geometric spider would but partially avail without the organic power to provide two kinds of silk. The very fact of such a constitution seems to imply the necessity of an immediate, constitutional use of the power.

This genus might afford many like illustrations. We add but one, the construction of her retreat under water by the amphibious spider: "First, she spins loose threads in various directions attached to the leaves of aquatic plants, which may be called the frame-work of her chamber, and over them she spreads a transparent varnish resembling liquid glass, which issues from the middle of her spinners, and which is so elastic that it is capable of great expansion and contraction; and if a hole be made in it, it immediately closes again. Next, she spreads over her belly a pellicle of the same material, and ascends to the surface. The precise mode in which she transfers a bubble of air beneath this pellicle is not accurately known; but from an observation made by the ingenious author of the little work from which this account is abstracted, he concludes that she draws the air into her body by the anus, which she presents to the surface of the pool, and then pumps it out from an opening at the base of the belly between the pellicle and that part

of the body, the hairs of which keep it extended. Clothed with this aerial mantle, which, to the spectator, seems formed of resplendent quicksilver, she plunges to the bottom, and, with as much dexterity as a chemist transfers gas with a gas-holder, introduces her bubble of air beneath the roof prepared for its reception. This manoeuvre she repeats ten or twelve times, until at length in about a quarter of an hour she has transported as much air as suffices to expand her apartment to its intended extent, and now finds herself in possession of a little aerial edifice, I had almost said an enchanted palace, affording her a commodious and dry retreat in the very midst of the water." The same observation again holds. This wonderful skill is developed in connection with peculiar organic powers, without which it would have no basis of operation, and with which it easily becomes a straightforward physical necessity.

Bees, scarcely midway in nervous organization, also exhibit, as we all know, very varied and wonderful instincts. These pertain, not only to individual wants and actions, but to the establishment and orderly maintenance of a large and complex community. Kirby and Spence indicate some sixty instincts as involved in these results. Some of these are of so wonderful a character that we are compelled to choose between a high order of intelligence and a large element of this direct, organic action known as instinct. The mathematical features of the comb, taxing man's later acquisitions for their entire comprehension; the ease with which the irregular conditions incident to a change of direction are met in its structure; the treatment of queens and drones, and the provision made for the production of queens; the orderly performance of labor; the defences against enemies, and the directness with which the bee returns from any point to the hive, exhibit faculties second to none in vigor and precision. If these, therefore, are of a primarily rational order, what are we to think? Certainly, that the highest nervous organizations have but slight advantage over the lowest.

Moreover, we here again meet the two objections: The

knowledge of the bee at certain points transcends that of ordinary reason. Men have no such apprehension of directions as the bee exhibits. They cannot imitate its celerity and certainty of movement. Again, the whole organism of the bee fits it to gather honey, collect pollen, form the comb, varnish it, solder the angles of the cells with propolis, and provide a peculiar food for the grubs. Without certain organic powers, tendencies, the whole domestic economy of these insects would be impossible.

We bring forward one more example, from a much higher form of development, that of the beaver. Among the striking facts on which Mr. Morgan predicates an intelligence in this animal allied to that of man, is its frequent construction of canals hundreds of feet in length for the easy transportation of its stores. Exactly what degree and form of knowing does this author suppose to be involved in this act? Men construct water-channels with every variety of thoughtfulness. The child, playing on the bank of the stream, may form such a channel by simply drawing the hand onward in the sand as the water follows it. Many men construct a ditch with much the same measure of sagacity. Others, with exact estimates and careful measurements lay under contribution the higher mathematics, and, in the instruments used, the best mechanical skill of their times. Which degree of intelligence are we to attribute to the beavers in their canals? Are they to have the benefit of the entire knowledge which men may expend on such constructions, or only of that degree which in cases of least thought they employ? Sound reasoning must say the least sufficient cause is the cause. If, however, another form of knowledge, diverse from that involved in reflection, is adequate to the result, and more in keeping with the entire habit and relations of the animal, we have even better grounds for assigning this as a sufficient explanation of the facts than those which have just led us to refer them to the lowest grade of rational power capable of the achievement. Both views admit intelligence; the difference between them lies in the kind and

grade of intelligence. The same reason which should compel Mr. Morgan to assign to the beaver the least measure of human forethought possible to the result, also leads us to assign another grade of powers, with this additional advantage, that consistency and proportion in the entire life of the beaver are thereby better preserved, and that a "brain without convolutions" is distinguished in its action from one possessing them in the highest degree.

Mr. Morgan, in urging the intelligence of the higher animals, tells a story of a fox to this effect: It found admission by a narrow hole into a hennery. Having there gorged itself to repletion, it was unable to crawl out by the way at which it had entered. It lay down, and feigned death. When the owner entered, it was picked up as dead, carried out, and thrown down. The moment Reynard's heart yearned for had come; and he left at once. This narrative, not vouched for in form or circumstance as one of careful personal observation, is a fair example of many kindred accounts. What are we to think of the reflection of a fox who entered a small hole, by life-long experiences knowing the necessity of a safe retreat, and yet ate to that degree of fulness that he was unable to escape? Was such a fox as that able to anticipate a perfectly new exigency, and provide for it with the steadiness and sagacity indicated? Are we really bound to believe that he did not exercise the foresight that was easy and natural, and did exercise that most strange and anomalous; accomplishing a plan difficult of execution, to say the least, to human intelligence? Who is to assure us that the fox did not fall into a real syncope from which the jar of his fall restored him? The easier supposition should at least have place before the more difficult one.

It will be observed that in the defence of this view of instinct and animal powers now presented, we have said nothing of any distinction thereby made between man and the classes below him. We have drawn no argument from this consideration, nor sought by it to elicit any feeling. Indeed, we have more to fear than to hope from considera-

tions of this character in a fair, quiet discussion of the subject. If there are some who are glad of the establishment of such a difference, there are others equally influential who are determined to break it down. We have presented the argument, therefore, on its own merit, without reference to a point liable to disturb the candor of our judgments.

It should also be observed that we have neither in instinct nor its explanation invoked the aid of any supernatural element. This form of action is as normal, as much within the limits of the constitution to which it belongs, as is any portion of vital phenomena. If the connection between states and actions is less fixed in instinct than in organic play, it is not less certain and determinate. Moreover, this view throws all the facts of mental and nervous life into real classes — classes the existence of whose phenomena must, on any theory, be allowed. Whether these cover the exact facts that we have placed under them may be doubted. It can scarcely be doubted that there is, first, a direct dependence through the nervous system of organic conditions and organic play; secondly, a like more general and irregular dependence between certain acts and the physical states that accompany them; thirdly, an immediate control, grounded in appetite, of the muscles through the senses, and, consequent thereon, a like control in connection with the associations of memory; and, fourthly, a higher activity under rational ideas, designated by us as thought. The last of these divisions is, indeed, not made by many. The remaining three hardly admit of denial. But, if the first three are allowed, then this theory evokes no new causes, but classifies all the facts of animal life with admitted facts.

It should not be said that we withhold intelligence from the brute. We grant him intelligence of a given grade and kind, and intelligence, moreover, capable of some results hardly to be reached by reflection, and presenting a certainty and precision of action unknown to tardy thought. When we say that the animal does not think, we use language in a somewhat technical and limited sense. He does

not think, according to our idea and use of the words. Yet we have granted essentially that form of intelligence which is all that a large and increasing class of philosophers are willing to allow to man. If man is destitute of intuitive ideas, then he occupies the exact position we have assigned the brute, and is no better furnished than he. Surely, it should be sufficient to give the animal kingdom all that such men as Mill, Spencer, Bain, are willing to grant to man. If we still withhold the word thought, it is because we do not believe that thought, strictly so called, is possible on this narrow basis. Man possesses what the brute possesses, and in kind it is in the one exactly what it is in the other. The lower powers have not the same scope in human life, because they are in a measure displaced and overshadowed by the higher. This question demands for its discussion as thorough a mastery of psychology as of zoology; and we submit, therefore, what we have said as much to those who know man as to those who know all save man.

This Article had been prepared before the publication of "The Descent of Man," by Darwin. As that work discusses the relation of human and brute powers, expressing the views of a large school of modern scientists, it commands attention. It presents, however, no new grounds, and no sufficient reasons on which to modify the views we have now put forth. Darwin gives the following instance, as striking as any of those offered by him, of the intelligence of brutes: "Mr. Colquhoun winged two wild-ducks, which fell on the opposite side of a stream; his retriever tried to bring over both at once, but could not succeed; he then, though never known before to ruffle a feather, deliberately killed one, brought over the other, and returned for the dead bird." The question in this and like cases is, what is the character of the mental phenomena that accompanies the action: are they reflective—linked by thought; or are they associative—linked by experience? We think the last. Darwin must, to make them examples in point, affirm the first. We do

not believe that the retriever reflected: "I cannot carry over both birds, I must therefore kill one, and then return for it." This rather was the form of the facts: it tried to bring both, found itself unable, and, with the force of life-long associations, as the bird was ready to escape, closed its jaws upon it rather than lose it. What we deny to the state of mind in this dog, and in other like cases, is what may be termed thoughtful perspective; we substitute for it immediate association, as the entire form of life in brutes is more consistent with this view; and, moreover, we are not to attribute higher powers as long as those more primitive and simple can explain the facts. Suppose a carpenter, perfectly conversant with the business, to be engaged in sorting mixed lumber, laying it aside for various purposes. The labor would proceed for the most part without definite consideration, under fixed automatic associations, leaving the mind in a large measure vacant for thought proper. The requisite conclusions follow instantly on vision, having been made familiar by long practice. Deliberate thought arises only now and then, made requisite by some piece less obviously apt for any purpose. Thus the brute, by the established connections of his past experience, unites appropriate action to given conditions, without halting for the distinct recognition of either, or reflection upon them. His states and actions lie together, like colors on the canvass, and it is only the rational mind in looking upon them that interjects the perspective spaces of thought.

That the mental state of the mere animal is expressed by these direct connections is shown by its inability to acquire or use language. Language springs from a perception of relations, and is made necessary by the effort to distinguish and retain them. No brute can be produced that uses language in this its thoughtful aspect; and for the simple reason, that brutes are without thoughts, in this strict sense. The brute is not held back from expression by the want of vocal organs. These, in some cases, could be cultivated, and in other cases this want might be supplied. He does not speak,

because the subjective ground and occasion of speech are lacking. The feelings of the brute are called forth by objects of sense, and find expression in the presence of those objects; but not discerning relations, possessed of no abstract ideas, it finds no occasion for an arbitrary sign with which to designate them. The simplest sentences at once involve these, and therefore are never constructed by the brute. The dog is emotionally cognizant of the absence of his master, and sends up the wailing howl; but he does not say to himself, My master is absent, and thus has no occasion to say it to another. If he did, recognizing the relations of time and space, utter the thought to himself, he would certainly find the need and the method of uttering it to another. We help the brute in vain to language, because in his use of vocal sounds he is stepping into the air: no idea steadies the mind for a second stride.

What Darwin says of the moral nature discloses in the clearest light the wide chasm between the two views. His purpose is to show, that the rudiments of all rational powers are found in the highest classes of the animal kingdom—that the faculties of brutes are in kind those of men. He establishes his conclusion, however, not by elevating the brute, but by degrading man; not by disclosing the truly rational element in those powers, but by hiding it in these. If our moral nature is nothing more than the present and hereditary force of conventional views of private and public utility, then certainly we are content to find its rudiments in the dog. We disagree with Darwin, not in making brutes lower than he does, but in making men much higher. His philosophy is Spencerian, and, with due deference to the talent expended upon it, we believe radically wrong. With the exception of a brief space devoted to it, Darwin assumes the essential unity of faculties in man and the brute; and his theory of the origin of species postulates a oneness in kind of their endowments. This conclusion, a careful examination of all the facts, we believe, will more and more discredit. To this result a clear recognition of instinct as a normal, constitutional force decidedly tends.