ON THE MOTION OF ANIMALS

by Aristotle

Table of Contents

ON THE MOTION OF ANIMALS

by Aristotle

translated by A. S. L. Farquharson

This page copyright © 2001 Blackmask Online.

http://www.blackmask.com

1

ELSEWHERE we have investigated in detail the movement of animals after their various kinds, the differences between them, and the reasons for their particular characters (for some animals fly, some swim, some walk, others move in various other ways); there remains an investigation of the common ground of any sort of animal movement whatsoever.

Now we have already determined (when we were discussing whether eternal motion exists or not, and its definition, if it does exist) that the origin of all other motions is that which moves itself, and that the origin of this is the immovable, and that the prime mover must of necessity be immovable. And we must grasp this not only generally in theory, but also by reference to individuals in the world of sense, for with these in view we seek general theories, and with these we believe that general theories ought to harmonize. Now in the world of sense too it is plainly impossible for movement to be initiated if there is nothing at rest, and before all else in our present subject− animal life. For if one of the parts of an animal be moved, another must be at rest, and this is the purpose of their joints; animals use joints like a centre, and the whole member, in which the joint is, becomes both one and two, both straight and bent, changing potentially and actually by reason of the joint. And when it is bending and being moved one of the points in the joint is moved and one is at rest, just as if the points A and D of a diameter were at rest, and B were moved, and DAC were generated. However, in the geometrical illustration, the centre is held to be altogether indivisible (for in mathematics motion is a fiction, as the phrase goes, no mathematical entity being really moved), whereas in the case of joints the centres become now one potentially and divided actually, and now one actually and divided potentially. But still the origin of movement, qua origin, always remains at rest when the lower part of a limb is moved; for example, the elbow joint, when the forearm is moved, and the shoulder, when the whole arm; the knee when the tibia is moved, and the hip when the whole leg. Accordingly it is plain that each animal as a whole must have within itself a point at rest, whence will be the origin of that which is moved, and supporting itself upon which it will be moved both as a complete whole and in its members.

2

But the point of rest in the animal is still quite ineffectual unless there be something without which is absolutely at rest and immovable. Now it is worth while to pause and consider what has been said, for it involves a speculation which extends beyond animals even to the motion and march of the universe. For just as there must be something immovable within the animal, if it is to be moved, so even more must there be without it something immovable, by supporting itself upon which that which is moved moves. For were that something always to give way (as it does for mice walking in grain or persons walking in sand) advance would be impossible, and neither would there be any walking unless the ground were to remain still, nor any flying or swimming were not the air and the sea to resist. And this which resists must needs be different from what is moved, the whole of it from the whole of that, and what is thus immovable must be no part of what is moved; otherwise there will be no movement. Evidence of this lies in the problem why it is that a man easily moves a boat from outside, if he push with a pole, putting it against the mast or some other part, but if he tried to do this when in the boat itself he would never move it, no not giant Tityus himself nor Boreas blowing from inside the ship, if he really were blowing in the way painters represent him; for they paint him sending the breath out from the boat. For whether one blew gently or so stoutly as to make a very great wind, and whether what were thrown or pushed were wind or something else, it is necessary in the first place to be supported upon one of one's own members which is at rest and so to push, and in the second place for this member, either itself, or that of which it is a part, to remain at rest, fixing itself against something external to itself. Now the man who is himself in the boat, if he pushes, fixing himself against the boat, very naturally does not move the boat, because what he pushes against should properly remain at rest. Now what he is trying to move, and what he is fixing himself against is in his case the same. If, however, he pushes or pulls from outside he does move it, for the ground is no part of the boat.

3

Here we may ask the difficult question whether if something moves the whole heavens this mover must be immovable, and moreover be no part of the heavens, nor in the heavens. For either it is moved itself and moves the heavens, in which case it must touch something immovable in order to create movement, and then this is no part of that which creates movement; or if the mover is from the first immovable it will equally be no part of that which is moved. In this point at least they argue correctly who say that as the Sphere is carried round in a circle no single part remains still, for then either the whole would necessarily stand still or its continuity be torn asunder; but they argue less well in supposing that the poles have a certain force, though conceived as having no magnitude, but as merely termini or points. For besides the fact that no such things have any substantial existence it is impossible for a single movement to be initiated by what is twofold; and yet they make the poles two. From a review of these difficulties we may conclude that there is something so related to the whole of Nature, as the earth is to animals and things moved by them.

And the mythologists with their fable of Atlas setting his feet upon the earth appear to have based the fable upon intelligent grounds. They make Atlas a kind of diameter twirling the heavens about the poles. Now as the earth remains still this would be reasonable enough, but their theory involves them in the position that the earth is no part of the universe. And further the force of that which initiates movement must be made equal to the force of that which remains at rest. For there is a definite quantity of force or power by dint of which that which remains at rest does so, just as there is of force by dint of which that which initiates movement does so; and as there is a necessary proportion between opposite motions, so there is between absences of motion. Now equal forces are unaffected by one another, but are overcome by a superiority of force. And so in their theory Atlas, or whatever similar power initiates movement from within, must exert no more force than will exactly balance the stability of the earth− otherwise the earth will be moved out of her place in the centre of things. For as the pusher pushes so is the pushed pushed, and with equal force. But the prime mover moves that which is to begin with at rest, so that the power it exerts is greater, rather than equal and like to the power which produces absence of motion in that which is moved. And similarly also the power of what is moved and so moves must be greater than the power of

that which is moved but does not initiate movement. Therefore the force of the earth in its immobility will have to be as great as the force of the whole heavens, and of that which moves the heavens. But if that is impossible, it follows that the heavens cannot possibly be moved by any force of this kind inside them.

4

There is a further difficulty about the motions of the parts of the heavens which, as akin to what has gone before, may be considered next. For if one could overcome by force of motion the immobility of the earth he would clearly move it away from the centre. And it is plain that the power from which this force would originate will not be infinite, for the earth is not infinite and therefore its weight is not. Now there are more senses than one of the word 'impossible'. When we say it is impossible to see a sound, and when we say it is impossible to see the men in the moon, we use two senses of the word; the former is of necessity, the latter, though their nature is to be seen, cannot as a fact be seen by us. Now we suppose that the heavens are of necessity impossible to destroy and to dissolve, whereas the result of the present argument would be to do away with this necessity. For it is natural and possible for a motion to exist greater than the force by dint of which the earth is at rest, or than that by dint of which Fire and Aether are moved. If then there are superior motions, these will be dissolved in succession by one another: and if there actually are not, but might possibly be (for the earth cannot be infinite because no body can possibly be infinite), there is a possibility of the heavens being dissolved. For what is to prevent this coming to pass, unless it be impossible? And it is not impossible unless the opposite is necessary. This difficulty, however, we will discuss elsewhere.

To resume, must there be something immovable and at rest outside of what is moved, and no part of it, or not? And must this necessarily be so also in the case of the universe? Perhaps it would be thought strange were the origin of movement inside. And to those who so conceive it the word of Homer would appear to have been well spoken:

'Nay, ye would not pull Zeus, highest of all from heaven to the plain, no not even if ye toiled right hard; come, all ye gods and goddesses! Set hands to the chain'; for that which is entirely immovable cannot possibly be moved by anything. And herein lies the solution of the difficulty stated some time back, the possibility or impossibility of dissolving the system of the heavens, in that it depends from an original which is immovable.

Now in the animal world there must be not only an immovable without, but also within those things which move in place, and initiate their own movement. For one part of an animal must be moved, and another be at rest, and against this the part which is moved will support itself and be moved; for example, if it move one of its parts; for one part, as it were, supports itself against another part at rest.

But about things without life which are moved one might ask the question whether all contain in themselves both that which is at rest and that which initiates movement, and whether they also, for instance fire, earth, or any other inanimate thing, must support themselves against something outside which is at rest. Or is this impossible and must it not be looked for rather in those primary causes by which they are set in motion? For all things without life are moved by something other, and the origin of all things so moved are things which move themselves. And out of these we have spoken about animals (for they must all have in themselves that which is at rest, and without them that against which they are supported); but whether there is some higher and prime mover is not clear, and an origin of that kind involves a different discussion. Animals at any rate which move themselves are all moved supporting themselves on what is outside them, even when they inspire and expire; for there is no essential difference between casting a great and a small weight, and this is what men do when they spit and cough and when they breathe in and breathe out.

5

But is it only in that which moves itself in place that there must be a point at rest, or does this hold also of that which causes its own qualitative changes, and its own growth? Now the question of original generation and decay is different; for if there is, as we hold, a primary movement, this would be the cause of generation and decay, and probably of all the secondary movements too. And as in the universe, so in the animal world this is the primary movement, when the creature attains maturity; and therefore it is the cause of growth, when the creature becomes the cause of its own growth, and the cause too of alteration. But if this is not the primary movement then the point at rest is not necessary. However, the earliest growth and alteration in the living creature arise through another and by other channels, nor can anything possibly be the cause of its own generation and decay, for the mover must exist before the moved, the begetter before the begotten, and nothing is prior to itself.

6

Now whether the soul is moved or not, and how it is moved if it be moved, has been stated before in our treatise concerning it. And since all inorganic things are moved by some other thing− and the manner of the movement of the first and eternally moved, and how the first mover moves it, has been determined before in our Metaphysics, it remains to inquire how the soul moves the body, and what is the origin of movement in a living creature. For, if we except the movement of the universe, things with life are the causes of the movement of all else, that is of all that are not moved by one another by mutual impact. And so all their motions have a term or limit, inasmuch as the movements of things with life have such. For all living things both move and are moved with some object, so that this is the term of all their movement, the end, that is, in view. Now we see that the living creature is moved by intellect, imagination, purpose, wish, and appetite. And all these are reducible to mind and desire. For both imagination and sensation are on common ground with mind, since all three are faculties of judgement though differing according to distinctions stated elsewhere. Will, however, impulse, and appetite, are all three forms of desire, while purpose belongs both to intellect and to desire. Therefore the object of desire or of intellect first initiates movement, not, that is, every object of intellect, only the end in the domain of conduct. Accordingly among goods that which moves is a practical end, not the good in its whole extent. For it initiates movement only so far as something else is for its sake, or so far as it is the object of that which is for the sake of something else. And we must suppose that a seeming good may take the room of actual good, and so may the pleasant, which is itself a seeming good. From these considerations it is clear that in one regard that which is eternally moved by the eternal mover is moved in the same way as every living creature, in another regard differently, and so while it is moved eternally, the movement of living creatures has a term. Now the eternal beautiful, and the truly and primarily good (which is not at one time good, at another time not good), is too divine and precious to be relative to anything else. The prime mover then moves, itself being unmoved, whereas desire and its faculty are moved and so move. But it is not necessary for the last in the chain of things moved to move something else; wherefore it is plainly reasonable that motion in place should be the last of what happens in the region of things happening, since the living creature is moved and goes forward by reason of desire or purpose, when some alteration has been set going on the occasion of sensation or imagination.

7

But how is it that thought (viz. sense, imagination, and thought proper) is sometimes followed by action, sometimes not; sometimes by movement, sometimes not? What happens seems parallel to the case of thinking and inferring about the immovable objects of science. There the end is the truth seen (for, when one conceives the two premisses, one at once conceives and comprehends the conclusion), but here the two premisses result in a conclusion which is an action− for example, one conceives that every man ought to walk, one is a man oneself: straightway one walks; or that, in this case, no man should walk, one is a man: straightway one remains at rest. And one so acts in the two cases provided that there is nothing in the one case to compel or in the other to prevent. Again, I ought to create a good, a house is good: straightway I make a house. I need a covering, a coat is a

covering: I need a coat. What I need I ought to make, I need a coat: I make a coat. And the conclusion I must make a coat is an action. And the action goes back to the beginning or first step. If there is to be a coat, one must first have B, and if B then A, so one gets A to begin with. Now that the action is the conclusion is clear. But the premisses of action are of two kinds, of the good and of the possible.

And as in some cases of speculative inquiry we suppress one premise so here the mind does not stop to consider at all an obvious minor premise; for example if walking is good for man, one does not dwell upon the minor 'I am a man'. And so what we do without reflection, we do quickly. For when a man actualizes himself in relation to his object either by perceiving, or imagining or conceiving it, what he desires he does at once. For the actualizing of desire is a substitute for inquiry or reflection. I want to drink, says appetite; this is drink, says sense or imagination or mind: straightway I drink. In this way living creatures are impelled to move and to act, and desire is the last or immediate cause of movement, and desire arises after perception or after imagination and conception. And things that desire to act now create and now act under the influence of appetite or impulse or of desire or wish.

The movements of animals may be compared with those of automatic puppets, which are set going on the occasion of a tiny movement; the levers are released, and strike the twisted strings against one another; or with the toy wagon. For the child mounts on it and moves it straight forward, and then again it is moved in a circle owing to its wheels being of unequal diameter (the smaller acts like a centre on the same principle as the cylinders). Animals have parts of a similar kind, their organs, the sinewy tendons to wit and the bones; the bones are like the wooden levers in the automaton, and the iron; the tendons are like the strings, for when these are tightened or leased movement begins. However, in the automata and the toy wagon there is no change of quality, though if the inner wheels became smaller and greater by turns there would be the same circular movement set up. In an animal the same part has the power of becoming now larger and now smaller, and changing its form, as the parts increase by warmth and again contract by cold and change their quality. This change of quality is caused by imaginations and sensations and by ideas. Sensations are obviously a form of change of quality, and imagination and conception have the same effect as the objects so imagined and conceived For in a measure the form conceived be it of hot or cold or pleasant or fearful is like what the actual objects would be, and so we shudder and are frightened at a mere idea. Now all these affections involve changes of quality, and with those changes some parts of the body enlarge, others grow smaller. And it is not hard to see that a small change occurring at the centre makes great and numerous changes at the circumference, just as by shifting the rudder a hair's breadth you get a wide deviation at the prow. And further, when by reason of heat or cold or some kindred affection a change is set up in the region of the heart, even in an imperceptibly small part of the heart, it produces a vast difference in the periphery of the body,− blushing, let us say, or turning white, goose−skin and shivers and their opposites.

8

But to return, the object we pursue or avoid in the field of action is, as has been explained, the original of movement, and upon the conception and imagination of this there necessarily follows a change in the temperature of the body. For what is painful we avoid, what is pleasing we pursue. We are, however, unconscious of what happens in the minute parts; still anything painful or pleasing is generally speaking accompanied by a definite change of temperature in the body. One may see this by considering the affections. Blind courage and panic fears, erotic motions, and the rest of the corporeal affections, pleasant and painful, are all accompanied by a change of temperature, some in a particular member, others in the body generally. So, memories and anticipations, using as it were the reflected images of these pleasures and pains, are now more and now less causes of the same changes of temperature. And so we see the reason of nature's handiwork in the inward parts, and in the centres of movement of the organic members; they change from solid to moist, and from moist to solid, from soft to hard and vice versa. And so when these are affected in this way, and when besides the passive and active have the constitution we have many times described, as often as it comes to pass that one is active and the other passive, and neither of them falls short of the elements of its essence, straightway one acts and the other responds. And on

this account thinking that one ought to go and going are virtually simultaneous, unless there be something else to hinder action. The organic parts are suitably prepared by the affections, these again by desire, and desire by imagination. Imagination in its turn depends either upon conception or sense−perception. And the simultaneity and speed are due to the natural correspondence of the active and passive.

However, that which first moves the animal organism must be situate in a definite original. Now we have said that a joint is the beginning of one part of a limb, the end of another. And so nature employs it sometimes as one, sometimes as two. When movement arises from a joint, one of the extreme points must remain at rest, and the other be moved (for as we explained above the mover must support itself against a point at rest); accordingly, in the case of the elbow−joint, the last point of the forearm is moved but does not move anything, while, in the flexion, one point of the elbow, which lies in the whole forearm that is being moved, is moved, but there must also be a point which is unmoved, and this is our meaning when we speak of a point which is in potency one, but which becomes two in actual exercise. Now if the arm were the living animal, somewhere in its elbow−joint would be situate the original seat of the moving soul. Since, however, it is possible for a lifeless thing to be so related to the hand as the forearm is to the upper (for example, when a man moves a stick in his hand), it is evident that the soul, the original of movement, could not lie in either of the two extreme points, neither, that is, in the last point of the stick which is moved, nor in the original point which causes movement. For the stick too has an end point and an originative point by reference to the hand. Accordingly, this example shows that the moving original which derives from the soul is not in the stick and if not, then not in the hand; for a precisely similar relation obtains between the hand and the wrist, as between the wrist and the elbow. In this matter it makes no difference whether the part is a continuous part of the body or not; the stick may be looked at as a detached part of the whole. It follows then of necessity that the original cannot lie in any individual origin which is the end of another member, even though there may lie another part outside the one in question. For example, relatively to the end point of the stick the hand is the original, but the original of the hand's movement is in the wrist. And so if the true original is not in the hand, be−there is still something higher up, neither is the true original in the wrist, for once more if the elbow is at rest the whole part below it can be moved as a continuous whole.

9

Now since the left and the right sides are symmetrical, and these opposites are moved simultaneously, it cannot be that the left is moved by the right remaining stationary, nor vice versa; the original must always be in what lies above both. Therefore, the original seat of the moving soul must be in that which lies in the middle, for of both extremes the middle is the limiting point; and this is similarly related to the movements from above [and below,] those that is from the head, and to the bones which spring from the spinal column, in creatures that have a spinal column.

And this is a reasonable arrangement. For the sensorium is in our opinion in the centre too; and so, if the region of the original of movement is altered in structure through sense−perception and thus changes, it carries with it the parts that depend upon it and they too are extended or contracted, and in this way the movement of the creature necessarily follows. And the middle of the body must needs be in potency one but in action more than one; for the limbs are moved simultaneously from the original seat of movement, and when one is at rest the other is moved. For example, in the line BAC, B is moved, and A is the mover. There must, however, be a point at rest if one is to move, the other to be moved. A (AE) then being one in potency must be two in action, and so be a definite spatial magnitude not a mathematical point. Again, C may be moved simultaneously with B. Both the originals then in A must move and be, and so there must be something other than them which moves but is not moved. For otherwise, when the movement begins, the extremes, i.e. the originals, in A would rest upon one another, like two men putting themselves back to back and so moving their legs. There must then be some one thing which moves both. This something is the soul, distinct from the spatial magnitude just described and yet located therein.

10

Although from the point of view of the definition of movement− a definition which gives the cause− desire is the middle term or cause, and desire moves being moved, still in the material animated body there must be some material which itself moves being moved. Now that which is moved, but whose nature is not to initiate movement, is capable of being passive to an external force, while that which initiates movement must needs possess a kind of force and power. Now experience shows us that animals do both possess connatural spirit and derive power from this. (How this connatural spirit is maintained in the body is explained in other passages of our works.) And this spirit appears to stand to the soul−centre or original in a relation analogous to that between the point in a joint which moves being moved and the unmoved. Now since this centre is for some animals in the heart, in the rest in a part analogous with the heart, we further see the reason for the connatural spirit being situate where it actually is found. The question whether the spirit remains always the same or constantly changes and is renewed, like the cognate question about the rest of the parts of the body, is better postponed. At all events we see that it is well disposed to excite movement and to exert power; and the functions of movement are thrusting and pulling. Accordingly, the organ of movement must be capable of expanding and contracting; and this is precisely the characteristic of spirit. It contracts and expands naturally, and so is able to pull and to thrust from one and the same cause, exhibiting gravity compared with the fiery element, and levity by comparison with the opposites of fire. Now that which is to initiate movement without change of structure must be of the kind described, for the elementary bodies prevail over one another in a compound body by dint of disproportion; the light is overcome and kept down by the heavier, and the heavy kept up by the lighter.

We have now explained what the part is which is moved when the soul originates movement in the body, and what is the reason for this. And the animal organism must be conceived after the similitude of a well−governed commonwealth. When order is once established in it there is no more need of a separate monarch to preside over each several task. The individuals each play their assigned part as it is ordered, and one thing follows another in its accustomed order. So in animals there is the same orderliness− nature taking the place of custom− and each part naturally doing his own work as nature has composed them. There is no need then of a soul in each part, but she resides in a kind of central governing place of the body, and the remaining parts live by continuity of natural structure, and play the parts Nature would have them play.

11

So much then for the voluntary movements of animal bodies, and the reasons for them. These bodies, however, display in certain members involuntary movements too, but most often non−voluntary movements. By involuntary I mean motions of the heart and of the privy member; for often upon an image arising and without express mandate of the reason these parts are moved. By non−voluntary I mean sleep and waking and respiration, and other similar organic movements. For neither imagination nor desire is properly mistress of any of these; but since the animal body must undergo natural changes of quality, and when the parts are so altered some must increase and other decrease, the body must straightway be moved and change with the changes that nature makes dependent upon one another. Now the causes of the movements are natural changes of temperature, both those coming from outside the body, and those taking place within it. So the involuntary movements which occur in spite of reason in the aforesaid parts occur when a change of quality supervenes. For conception and imagination, as we said above, produce the conditions necessary to affections, since they bring to bear the images or forms which tend to create these states. And the two parts aforesaid display this motion more conspicuously than the rest, because each is in a sense a separate vital organism, the reason being that each contains vital moisture. In the case of the heart the cause is plain, for the heart is the seat of the senses, while an indication that the generative organ too is vital is that there flows from it the seminal potency, itself a kind of organism. Again, it is a reasonable arrangement that the movements arise in the centre upon movements in the parts, and in the parts upon movements in the centre, and so reach one another. Conceive A to be the centre or starting point. The movements then arrive at the centre from each letter in the diagram we have drawn, and flow back again from the centre

which is moved and changes, (for the centre is potentially multiple) the movement of B goes to B, that of C to C, the movement of both to both; but from B to C the movements flow by dint of going from B to A as to a centre, and then from A to C as from a centre.

Moreover a movement contrary to reason sometimes does and sometimes does not arise in the organs on the occasion of the same thoughts; the reason is that sometimes the matter which is passive to the impressions is there in sufficient quantity and of the right quality and sometimes not.

And so we have finished our account of the reasons for the parts of each kind of animal, of the soul, and furthere of sense−perception, of sleep, of memory, and of movement in general; it remains to speak of animal generation.

−THE END−