An introductory discourse on the phenomena of vitality, or laws of mobility and motion in animal bodies : delivered in the hall of the Exchange Coffee House, 1817, by the request of Dr. Ingalls, professor of anatomy and surgery / by Charles W. Windship, M.D.

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AN

INTRODUCTORY DISCOURSE

ON THE

PHENOMENA OF VITALITY,

OR

LAWS

OF

MOBILITY AND MOTION

IN

Animal Bodies.

DELIVERED IN THE HALL OF THE EXCHANGE COFFEE HOUSE, 1817, BY THE REQUEST OF DR. INGALLS, PROFESSOR OF ANATOMY AND SURGERY.

BY CHARLES W. WINDSHIP, M. D.

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TO DR. SAMUEL DANFORTH.

Dear Sir,

LONG honoured by your friendship, to whom could I with so much pleasure dedicate a production, the original ideas of which were derived from you? You have been my *medical* and *moral* instructor. Deign to accept this little tribute of respect from

Your pupil,

Charles W. Windship.

INTRODUCTORY DISCOURSE.

THE design of this lecture, gentlemen, will be to exhibit a general view of the phenomena, observable in animal bodies, and of such laws of motion as are presumable from reason and the analogies of nature.

At a period like the present, when no medical principles are acknowledged, when Grecian and Roman learning, the writings of the fifteenth and sixteenth centuries, the discoveries of later writers, and the brilliant reflection of all the sciences have dispelled but little of the darkness, that envelopes every inquiry concerning the *laws of motion* in animal bodies, it may seem presumptuous, even in the wisest, to renew the investigation; but the distaste to every thing, that has no principle, the love of truth, that uneasiness of mind, which every one feels, who practises any profession without knowing its principles; the belief, that some principles are already known, and require only some great name to reduce them to system, and, (may I not

add) the solicitations of a friend, have induced me to offer some opinions, not however with the expectation of forming a perfect theory, but with the hope of throwing a ray upon a subject, which time only and persevering genius can completely elucidate. Were there no other reason, however, the state of the medical art might urge this inquiry. We have finished skeletons, wax preparations, magnificent plates of the brain and nerves, chemical apparatus, and a systematic arrangement of animals, plants and minerals; but what have we to explain the *philosophy of motion* in animal bodies? Antiquity solves nothing. Venerable, indeed, appear the temples, in which are engraved the experience of ages; but what tablet explains any law of motion in living matter? The physicians of the middle ages, were they not as barbarous as the divines and philosophers? What medical principles could be established before the discovery of the circulation? And what book or school, at this day, informs us, why the *animal fibre expands*, *contracts*, or *inflames?* How, then, can physiology account for fever, when inflammation in a single point is inexplicable as a sun? How can the motions of a whole body be accounted for when the motions of its parts are unexplained? Some laws, analogies, or philosophic reasoning must be applied to the operations of the human body, or medicine cannot rank as a science. We must still crowd the tem-

ples of Esculapius to gaze at, and copy only the prescriptions of experience. What then are those laws? What are those *medical principles*, which are certain as the falling of bodies and revolutions of the planets? Such is our inquiry; for such we conceive to be the *theory of physic.*

Before, however, we attempt to explain the phenomena in animal bodies, we should first know what these phenomena are. In animal bodies, then, what do we behold? We behold many phenomena, common to all matter, such as mobility, expansion and contraction, heat and cold, combinations and decompositions, to which are superadded the more wonderful operations, sensation and thought. He, then, who studies these phenomena, must not confine his views to man. He must survey the wide field of nature. He must seek the cause of mobility, expansion and contraction, heat and cold, combinations and decompositions in all matter. He must inquire, why the green leaf appears in spring, and withers in autumn? Why the tendril entwines, the animal fibre contracts, and vibration stops from pressure or contact? He must inquire, why temperature varies with the angle of impulse from the equator to the poles. He must look to the heavens, as well as to the earth. Will not a glance persuade him, that the universe contains no privileged atom or world; that all bodies are immersed in the same fluid; that an orb revolves, an atom

moves, a salt crystallizes, the germ expands, the embryo forms in the same medium; that some subtile substance is diffused throughout the universe, in which matter moves, displays its forms, its beauty, its magnificence, its force; and that *motion*, even in a circle, whose circumference is infinite, can result only from *unequal pressure?* Is this a dream of the closet? It is a *dream*, very much like the *creed* of some philosophers. Too often by the proud experimentalist have opinions, supported by reason, observation, and mathematical evidence been called dreams, even by those, who never had curiosity enough to lead them beyond visible fact, or genius enough to grasp a truth beyond the inscription of lines and angles. Temperate spirits never risk a dangerous flight. With experimental steps they creep the heights, to which reasoning soared, though it left no trace of its path.

Having surveyed the analogies of nature, the inquirer stops to reflect upon his observations, and to adopt principles. Mobility, expansion and contraction, heat and cold, combinations and decompositions, sensation and thought are, then, the particular subjects of our inquiry. *Mobility* first presents itself to our notice.

That there is but *one cause of mobility*, in all matter is presumable from the regular changes, produced on this earth by its annual or diurnal revolutions. The sun rises, and all bodies expand.

It declines, and they contract. As it retires to the southern tropic, the earth hardens, water freezes, the leaf withers, the insect grows torpid, and expansion, heat and animation, throughout our hemisphere, are diminished. As it returns to our northern tropic, the glebe softens, ice melts, the germ expands, the embryo quickens, and *mobility* in all matter is increased. The expansion of bodies by the solar rays, by common fire, by the electric or galvanic matter; the changes of solid to fluid, vapour, or gas; the solution, combination and decomposition of bodies; the crystallization of minerals; the organization of plants and animals; the reflection and refraction of light, and its action from bodies beyond our system, and the variation of temperature in all matter, demonstrate the existence of some very minute substance, which, pressed or impelled from one portion of matter to another, varies the mobility, density, temperature, equilibrium, and action of all bodies. Experiment, likewise, supports this principle. Touch the thermometer, and the mercury expands. The sun, fire, air, water, and every other substance produce similar effects. Something, therefore, comes from the finger, that comes from the sun, fire, air, water, and every other substance; and this something is subtile enough to pervade glass and expand the mineral. Reason, too, confirms this principle. The solvent of all matter must be universal as its motion, and mobili-

ty can be only in proportion to the surface of contact and quantity of matter; hence, if a square foot of this substance, condensed, exceed not the eighteen hundred millionth part of a grain, as experiment calculates,* and if the corpuscles touch only in a point, then their resistance, being only as the surface of contact and quantity of matter in each corpuscle, must be eighteen hundred million times less than a grain, and their facility of motion must be proportional. From such facts it has been presumed, that, wherever matter moves, there is *caloric*. Where, then, is the space it must not fill? What body so solid, it must not pervade? What system, planet, or atom moves without it? In light, in sound, in taste, in smell, in touch, must we not witness its influence? A substance, then, that fills every visible point, that warms the cold, illumines the dark, softens the hard, liquifies the congealed, animates the inanimate, reaches the fixed star, and is the cause of mobility in air, water, the plant, animal, and mineral, and in all other matter; must it not be in *man, in every fibre, around every corpuscle, and be the cause of mobility in the human body?* The cause of the same phenomena must be the same in all matter, or all reasoning is useless. We, therefore, assume it as a *principle, that caloric is the cause of mobility in animate as well as inanimate matter.*

* Vide Priestley's Optics.

The *laws of expansion and contraction* we next consider.—That all bodies expand, as they receive caloric; and contract, as they lose it, has been long established as a *physical*, but rather unwillingly admitted as a *medical* axiom. That it is admissible, however, as a *universal* principle is presumable from observation and reasoning. The earth, the atmosphere, and the ocean vary their expansion with the obliquity of the sun. The bud shoots in spring, and withers in autumn. Myriads of beings quicken in the vernal ray, and die in the first northern breeze. The bird seeks a warmer sky, the inhabitants of the water a warmer sea, the insect and reptile creep under ground, the quadruped seeks his den or shelter, and man his dwelling, as winter approaches; but all animals, not protected from the cold, contract and grow torpid, and are revived only by artificial heat or a vernal sun. Animal bodies, indeed, do not expand and contract in exact proportion to the angle of the solar ray. Life, like chemic action, preserves the same temperature in different latitudes; but in a polar atmosphere life ceases. Withdraw but his covering, and shelter, and artificial fire, and man, like other animals, would grow torpid in winter, and assume the temperature of the surrounding atmosphere. What, then, can we conclude but that the *human fibre*, like other matter, expands and contracts, as the caloric atmospheres of its corpuscles increase or diminish?

The reverse, viz. that all bodies receive caloric, as they expand; and lose it, as they contract, seems equally obvious, and strengthens the principle. *Impulse* must produce a *reaction* among the corpuscles of all bodies. This reaction must increase their distances. If their distances increase, their caloric atmospheres must increase, or void spaces must be left; but void spaces cannot be left; for the pressure of the universe is upon the point, where there is no resistance. Caloric, therefore, must intervene, as the corpuscles recede; and, since two substances cannot occupy the same space at the same time, it must be pressed out, as they approximate. That all bodies, then, *expand as they receive caloric;* and *contract as they lose it;* and, the reverse, that they *receive caloric as they expand;* and *lose it as they contract;* may it not be admitted as a *medical* as well as a *physical* axiom?

Another part of this principle I would submit to your notice. If bodies expand, as their action is increased, will they not contract, if their action be stopped? And will not action in a plant, animal, or mineral be stopped by *pressure* or *contact?* Does not, then, the *human fibre* contract when *touched*, because its vital action is *checked;* and does it not expand from muscular motion, heat, or even cold, because its vital action is *increased?* Stop motion, and life ceases. Renew the motion, and life re-

turns. Were all motion stopped, would not universal darkness, silence, apathy, and congelation ensue? But let the planets roll, and a *centre* shines, illumines, warms, and animates surrounding worlds. To your notice only I submit these speculations.

We next consider the *laws of heat and cold.*— That *heat* begins in the point of resistance, and continues only so long as *impulse* and *resistance* last, appears presumable as a principle from many operations around us. A solid is heated by impulse, sooner than a fluid. The earth is first heated by the solar rays, and warms its contiguous fluids, air and water. Vapours ascend from the terraqueous surface, condense as they rise, form the cloud, crystallize into snow or hail, or fall in rain drops. Similar operations appear in an animal body. A pimple rises from a closed pore, inflammation follows from cold, and fever from a chilled surface; but the pimple, inflammation, and fever vanish, when the pore opens and resistance is removed. That animal bodies are warmed by *motion*, as well as by *heat;* and cooled by *rest* as well as by *cold*, follows as a *corollary* from this principle. Familiar instances appear in the common walks of life. The bird on the *wing* is warmer than at *rest.* The foot, that *walks*, is warmer than the foot, that is *still.* The boy, who plays in frosty air, and frolics in the snow, has a rosier cheek and warmer

fingers, than when he sits by the fireside. The invalid, who creeps from his chamber with cold feet and pale cheeks, returns, after *exercise*, with greater warmth and bloom. The hypochondriac, who shivers by the fire, is warmed by a *walk*, the *cold bath*, or an *emetic*. The merchant, the husbandman, and the artist, have more glowing features than the sedentary philosopher or cloistered divine. The sportsman grows ruddy on the *chase*, and feels a glow of animation, as he climbs the precipice in a winter morning, that is never felt in the *warm parlour*, in the *bower of ease*, or under the *canopy of indulgence*.

We next examine the *laws of combination and decomposition*.—Insulated facts, that cannot be reduced to any general principle, are all that can be offered upon this subject in the present state of science. The laws of motion in the great bodies of the universe are demonstrable by the agreement of mathematical calculation with the physical result; but the laws of motion in small bodies or single atoms have not yet this precision. The facts, however, are numerous and may throw a gleam of light upon the obscurity of the subject. *Affinities* are different at *different* temperatures. *Polarities*, likewise, change at *different* distances. The *position* of a particle alters with its *size*. *Positive* electricity repels *positive*, and *negative* electricity repels *negative*; while bodies, electrified

at different conductors, approximate. The voltaic pile *oxidates* at one pole, and *deoxidates* at the other. The quantity of matter in any spherical particle diminishes as the cube of its diameter; while its surface diminishes only as its square. The specific gravity, therefore, of all particles must be as the cube of their diameters. Is it possible, that animal combinations and decompositions are effected by any of these principles? We do not presume to determine. One principle, however, appears certain, viz. that all the phenomena of life are produced or suppressed by the simple alteration *only of temperature.*

Sensation and *thought* are the last subjects, to which I would solicit your attention, and only for a moment. Why organized matter feels and thinks; or why different mechanism differently feels, no one presumes to explain; but this we know that matter *feels* only from *impulse*, and *thinks* only of what it *feels.*

Permit me to conclude this theory of animal motions with a summary view of the analogies between the plant and animal. The plant *lives* in the sunbeams, and *dies* in the cold. It droops, when vital action is *interrupted*, and lifts its foliage, when vital action *returns.* It decomposes foreign matter, combines some of its principles with its system, circulates and secretes fluids, and preserves its form of organization, while vital action

lasts, and ceases to perform these operations, when vital action ceases; and, when dead, is decomposed into substances, which form various combinations, which sublime into the atmosphere, or precipitate to the earth, and renew the circle of magnificent change. *Man*, in all these respects, resembles the *plant*. He *lives* under temperate skies, and *dies* at the pole. He *sickens*, when vital action is *interrupted*, and *revives* when it *returns*. He decomposes foreign matter, combines some of its principles with his system, circulates and secretes fluids, and preserves his form of organization, while vital action lasts, and ceases to perform these operations, when vital action ceases; and, when dead, appears in air or water, acid or salt, earth or mineral, nourishes the worm on his dust, circulates in the blossom on his grave, and thus, in his turn, renews the same circle of eternal change. Such, gentleman, are some of the views of the phenomena of *vitality*, or *laws of mobility and motion*, presumed worthy the notice of those who study life as a science. I submit them to your speculations.