

18042
April

Recapitulation of the Lecture on the divisibility of mr.
and on fire, & immediately preceding the history of Electricity.

(Worth perusal June 1832)

In our our last Lecture we spoke of the divisibility of dead mr.
and then of the astonishing divisibility of mr. in animal bodies.
We s^d that matter could not move itself. Before we could
treat our subject physiologically, (~~There use that word in its~~
~~original & extensive sense, i.e.~~ the doctrine of the constitution
of Natural bodies) it was absolutely needful to look after
that efficient cause, or spirit (if we may use an abused
term) w^{ch} associates the material elements, & which em-
-ploys them when associated according to their various &
peculiar characters. Here our contemplation is nobler
than that of a passive element. Here the subject assumes the
dignity of a living, moving power; a power destined by its
nature to act & not to be acted upon; (to use & not be used).
One of the most intimate associations of the human
mind is that of cause & effect. In viewing the works of
Creation
~~Nature~~, we naturally become first acquainted with
appearances, (with effects), and then we naturally turn
our thoughts to trace out other circumstances that gave
them birth. It is the most natural curiosity in children - Whence came we? and how?
The origin of motion in Natural bodies has been a
famous

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defideratum from the earliest ages to the present time. A thick cloud still hangs over the origin of motion. We said that the living animal fibre would move & that not by the power of gravitation, nor cohesion, nor crystallization, nor magnetism, nor chemical attraction.

We said that fire, or caloric, seemed to be the cause w^{ch} associated the mere matter, or original element of things. Should we have recourse to the Stories, they would tell us, that ^{the} animating power (we use this word in its strictly literal sense) was a portion of that spirit w^{ch} pervades & animates the Universe, as we related from Plato

In an animal body the origin ^{of motion} (after the animal is born) appears to be something in the air we breathe, for to breathe & to live are synonymous in almost all languages. King David seemed to have an idea corresponding with our doctrine; for when speaking of living creatures, he says "Thou sendest forth thy spirit" and they are created; thou takest away their breath, & they die & return to dust; i. e. to their original matter.

We can trace this animating principle up to fire, w^{ch} we said was the only fluid in creation. We reminded you that fire was totally invisible; for that the space _{between}

between a large glass Lens & a melting bar of iron was filled with the most intense fire that mortals have hitherto been able to excite, yet was the fire totally invisible, the melting bar of iron alone being ~~visible~~ the object of sight.

We remarked that fire becomes ~~invisible~~ visible to us only when it seizes hold of a body. When it does it embraces the particles of that body farther from each other, by enlarging the sphere of the elastic fiery fluid that surrounds every particle of matter in the Universe. If this be done in a moderate degree, it is discoverable to ^{our feelings} the touch, by an agreeable sensation of ~~warmth~~ warmth; if in a greater degree it becomes hot & disagreeable; if it be a piece of iron it grows red hot; if the heat be still increased, the atmosphere around each particle of matter is so expanded, extended & attenuated that the hard metal is converted into a fluid, that runs like water. If the heat be indefinitely increased then the elastic atmosphere surrounding each particle is attenuated to that degree of exility, that it becomes volatile, that is flies off in the air in the form of an elastic vapor.

The various substances that compose the Universe are therefore, subjected, on the one hand, to a general law which ^{tends}

tends to bring their particles (close) together; and on the other hand to a powerful agent, w^c. tends to remove them from each other. It is upon the respective energies of these two forces, that the consistence of all bodies depends. When the affinity, or attraction prevails they are in the solid state; when fire is most powerful they are in a state of vapor; and the liquid state is the point of equilibrium between these two - (see Chapter VI.) ~~And~~ On these original, simple laws or principles rests the whole science of Chemistry.

Yet fire as well as matter is not annihilated, Fire is not destroyed, but only changes its place, and we can at any time fetch it back again. If you ask how this is done, I answer by a smart collision; by pressing together, or concentrating the Sun's rays, by means of a glass lens; and particularly by friction of certain substances on glass; in which case it is called, (tho' ~~with not much propriety~~) Electricity. This modification of fire pervades metals, animals & vegetables with astonishing facility, on which account it is needful that we direct our attention to its powerful agency. The Naturalist cannot pass by this modification of fire, because it is closely connected with vegetation & animation.

I have generally found that the best way to communicate to young persons just ideas of any branch of Nat. Philosophy was to give a concise history of the rise, progress & present state of that branch of knowledge; for the right use of instruction by means of lectures, ^{induce the pupil} is not to swallow implicitly every thing that is uttered, so much as to ^{cause you to} think, reflect & compare for yourselves. one thing with another

The commonly known laws of Electricity you will find in every book on Exp.^e Philosophy as well as in every course of lectures on that subject; but you will scarcely find its natural history, unless indeed, you have recourse to the voluminous works of Priestley. We mean therefore to give you its history, ~~its~~ hope that it may open to you some facts respecting its operation in Vegetable & animal bodies; or in other words in organized bodies; then we shall be better prepared to contemplate the subject of our next lecture.

[Here follows the History of Electricity, ending with the extract from my printed discourse on animation before Hum. Society]
w^o lecture preceds the seed & the egg

Vegetable & Animal Molecules

Seeds, organic particles, or Molecules

After speaking of the properties of inanimate matter we were naturally led to speak of the moving cause, or fire. Then we spoke of matter to which life was added; the first example that we gave was the seed of a plant, which we said was an organized being, enveloped by several membranes, and which contained the little plant, in miniature; w^c. only wanted a certain degree of heat to make it expand & gradually develope, & grow up into a plant, similar to its parent, capable of producing its kind forever. We exhibited such a seed to view, as it appears through a microscope. You saw it had veins and arteries like an animal. We told you that every vegetable in Nature arose from a seed; & that every seed is essentially the same. The bud of a vegetable is in fact a seed.

The other example of an organized being, which was gradually converted into a living animal, merely by the application of heat, was that of a hens egg, which we said was an organized body, and which, like the vegetable, contained, under several membranes, the chicken in miniature; which egg only wanted a certain degree of heat

heat to cause the fluid that surrounds the punctum vitee to ex-
-pand, & the fine ramifications of the minute vessels to swell;
and that the motion once begun, the process of developpe-
-ment, or unfolding commenced, & proceeded in a re-
-gular manner untill it became a lively, active
animal. Now as every plant is derived from a seed, so
every animal in the wide circuit of ^{vast} creation, is derived
from an egg.

Now there is a vital something in the atmospheric air, which
we breathe, called "Oxygen". This oxygen combined with caloric,
or the all pervading fluid heat, constitutes that part of the
atmosphere w^c is perpetually necessary to animal life, and we
may add vegetable life also. Now the air w^c we said was
found in the broad end of the egg, oxygenates the fluids
in the terminations of the placental vessels of the embryo
chicken, w^c we should take pains to explain more fully
to you were you medical pupils.

The fluid (matter of) heat is the most extensive agent in
nature, not even excepting that of gravitation. all bodies are
immersed in this fluid matter of heat, and are preserved
in their present state of solidity, or fluidity by the different
attraction of their particles to the matter of heat, which thus
counteracts the power of gravitation, w^c would otherwise
compress them into one solid mass. Since

dephlogesticated air

Since all known bodies in Nature are contracted into less space by depriving them of a portion of their heat, and as there is no part of Nature totally deprived of heat, so we find, that the particles of bodies do not touch each other but are only held toward each other by their self attraction; or they recede from each other, by the expansion of the atmosphere of heat that surrounds them. And thus is an equilibrium preserved between these two potent powers of Nature

of all the modifications of matter, the most excellent is organization. Some of you may wish to know what we mean by that term, which we so often use. We answer, an organ is a system of solids, whose structure, arrangement & action have motion for their ultimate end. The most perfect organization is that which produces most effects with an equal, or smaller number of dissimilar parts, such - e.g. is the hum. body.

To nourish itself, that is to change into its own substance matters that are foreign to it; ^{that is} to grow, by receiving them inwardly, & to continue its kind are the principal ends of the life of an organized being

A whitish substance, of a delicate & spongy nature forms the chief part of a seed, & is that part in corn or rye which constitutes the meal. Small vessels proceed from the central part

part of every seed, w^c divide & subdivide throughout every
part of the ~~seed~~ white substance. After such a seed
has been ^{deposited} laid in the moist earth, & warmed to a certain
degree, it begins to swell, & gradually to unfold itself.
The moisture w^c has penetrated its outer coats dissolves the
mealy substance & mixes with it. Of this mixture is formed
a milk, w^c being carried to the embryo plant, by the vessels
already mentioned, furnishes it with nourishment adapted
to its extreme delicacy; and thus is the little plant suckled
like a young animal.

The little root or ~~radicle~~ ^{like any first} radicle, as it is called, begins by
these means to unfold itself. It increases in bulk & extent
every hour. In a short time it becomes sensible of too
close confinement, & it makes an effort to come forth.
A small orifice made in the exterior surface of the seed
(as you see here) facilitates its progress. The little root now
insensibly creeps forth & strikes into the earth, and from
thence derives more copious & substantial nourishment.

The little stalk with its leaf, which till this time lay hid
under the covering of the seed, now begin to show them-
selves. The integuments, or membranes now ^{gradually} unfold
themselves, in order to admit the stalk & leaf, for hitherto
the embryo plant was wrapped up like an infant in its
swaddling-clothes. Strengthened by the accession of fresh
juices

juices, the little plant now pierces through the earth, and appears above ground. The oxygen of the atmosphere & the light of the Sun soon changes it from a yellowish white to a green colour. In this curious & wonderful manner, not only the bean but the tall Pine, Oak & Elm grow up from a small organized body or seed! The moment that the seed is lodged in the mother Earth, the vegetative-soul, or spirit (the fire, & oxygen) begins its operations & ceases not its work till the plant has formed its branches, its leaves, its flower, its fruit, and its seed again! And thus by a kind of continued miracle, proves the wisdom & bounty of a creative providence.

It is gratifying to the pride of ^{feeble} little man to be able to create from a few seed, a field of vegetables." The author of Nature reserving to himself alone the knowledge of his general laws, has placed man between Himself & matter, that it may receive these laws from his hands; and that he may apply them with proper modifications & restrictions. Man alone possesses the rare advantage of knowing a part of these laws, of preparing events, & predicting results; of removing what is noxious, of appropriating what is beneficial, and even composing substances w^{ch} Nature herself never forms. In this point of view, man appears to partake with the Supreme Being in the most eminent of his prerogatives, viz that of creation! Chapter Lxvii. N. 1.

The egg of an animal begins its motion & unfolds itself in the same manner as the seed of the vegetable. Like a seed, it is an organized body, w^{ch} under several delicate coats, or membranes inclosed an animal in miniature, a fluid m^r of a glutinous nature (viz the albumen) fills the inside of the egg; a number of very small vessels spread themselves through this substance, and are connected with the germ, or embryo by different branches, just as in the seed.

Being warmed to a sufficient degree, the inside of the egg begins to show signs of life. By means of a gentle heat or to speak more correctly, by the process of oxygenation (w^{ch} is the vital principle of the air combined with heat) the matter surrounding the little germ insinuates itself into the ~~same~~ small ramifications (by an action in these small vessels, similar to a blush), from whence it passes into the heart, or punctum vite, whose motion it augments; and thus the little animal, by degrees, becomes a living creature. It increases in size & strength every day by receiving fresh supplies of more & more perfect juices.

At length, after these juices, w^{ch} nature had provided in the egg, are exhausted, & the animal has acquired all the growth it is capable of in the egg, it endeavours to set

set itself at liberty from its prison; and as Nature has provided it with an easy method of effecting this, the animal is soon produced, and enjoys a new life in the open air, after which life is kept by turning a new wipoff, the Lungs or respiration.

You see that the analogy between the egg of a bird, and the seed of a plant, is so strictly analogous, that we may use the terms indiscriminately when speaking of either; & say the egg of a plant, or the seed of a bird.

Altho heat and oxygen evolves the seed of a Plant, & causes it to grow up to a large tree; and altho heat unfolds the egg & causes it to grow up to a living and beautiful animal, yet it is natural for you to enquire what the matter, pabulum, or provender is which increases the size and adds to the bulk of the plant, or animal? for altho heat begins & continues the process of life yet it is evident that this vital motion causes only an attraction, absorption, or accretion of some solid matter, food, or pabulum w^c increases the bulk of the vegetable or animal. The answer to this question will lead you to a view of one of the most important as well as curious subjects in the whole circle of Nat^l History, it being nothing less than the primordium, or origin of all organised bodies whatever.

I would apprise you :: not to expect any thing like mathematical demonstration in these recondite operations of Nature. We shall advance a doctrine that is incumbered with the fewest difficulties; a doctrine w^c tho it originated

three thousand years ago, has been adopted by the greatest natural philosophers of modern times; among whom we may enumerate Bacon, Boyle, & Newton; a doctrine w^{ch} the eloquent Buffon has taken great pains to elucidate & exemplify throughout his voluminous productions on Nat^l History

Sir J. Newton says "that it is highly probable that GOD in the beginning formed matter into solid, impenetrable, moveable particles, or atoms; of such sizes & figures, and with such other properties, & in such proportion to space, as most conduce to the end for which he formed them. While these primitive particles continue entire, they may compose bodies of one and the same structure nature & texture in all ages; but should they move, ~~says he~~, the nature of things depending on them may be changed. and \therefore says he, that Nature may be lasting, the changes of corporeal things are to be placed in the various separations, modifications & new associations of these permanent & everlasting particles". These separations, and new associations are exemplified in the art of Chemistry. All this relates, you see, to the primary matter. — But over & above all this, there are primitive particles, or rather bodies of a different nature; and these are organic corpuscles, or seeds, inconceivably small, but capable of growth and reproduction. They are supposed to be almost as subtle as the atoms of the primary matter, and are believed to be dispersed every where, in the air, in the earth, and in the sea.

See thro' this air, this ocean, this earth - all matter quick & bursting into birth! (Pope).

in the Sea. This doctrine of organic vegetable particles, molecules, or infinitesimally small seeds, supposes that a growing vegetable to attract them from the Earth & from the air. Their absorption & accretion is continued till the plant attains its acme or full growth; and when the plant ^{attains} its full maturity, its minute organisation rejects their further admission, and instead of their being distributed all over ^{the plant,} as heretofore, ^{and advancing its perfection} encreasing its growth, they are deposited in a particular part only, viz the seed vessels, & there form the appropriate seed, w^{ch} is only an organic-vegetable-particle of a larger size, having within it the parent plant in miniature; w^{ch} organic body or seed put into the moist ground, & acted upon by warmth, is capable of producing its kind forever.

This theory, in like manner supposes that there exists every where animal molecules, or living organic particles, capable of being assimilated & changed & assimilated into our own nature, into our own blood & flesh. as the vegetable molecules were supposed to be seeds, these animal molecules are supposed to be eggs, but of the simplest form; so simple in their organisation as to be merely susceptible of life by the action of a due degree of heat. aphorism.

This is not a new doctrine, omnia ex ovo is an old axiom. The antient poets tell us that the world itself was produced from a great egg hatched by Nox, i.e. obscurity-darkness. Some philosophers of great repute, in modern times, contend that even metals

are produced from seeds — Boerhaave —

Now it is supposed that a vegetable organic molecule can be converted into an animal molecule; or in other words that the stomach ~~xxx~~ digestive organs can ^{convert} convert a vegetable substance, taken into the stomach, into an animal molecule, w.^c molecule is capable of becoming a part of ourselves; for by feeding on vegetables, part of them is thrown out by perspiration + other outlets, while the nutritive parts are animalised, and soon become a feeling part of our own bodies! Thus says Locke that w.^c was grass to day, is tomorrow the flesh of a sheep, and a few days after becomes part of a man!

When the Supreme Creator formed the first individuals of each species of vegetables + animals, He gave says Buffon a certain degree of animation to what is commonly called the dust of the earth, ~~but which we call animal + vegetable molecules~~, by infusing into these individuals a greater or smaller quantity of living organic particles, w.^c are indestructible + common to every organised being*. These particles pass from body to body, and are equally the causes of life, of the continuation of the species, of growth, and of nutrition. Now after the dissolution of the body, after it is reduced to dust, these molecules, or organic particles, survive, for death

* See Ch. vi of 2^d Vol. Smellie's Buffon — and art. Ox Vol. 3^d

has no influence upon them, but they circulate through the Universe, pass into other beings, producing life & nourishment. Hence every production in Nature, every renovation, or growth, is not a new creation, but the conversion of a substance, a translation of organic particles from out of one form into another; by which means Nature is rendered always equally animated, the Earth equally peopled, and equally resplendent with the original glory of that Being by whom it was created". (Buff.)

Taking beings in general, ^{therefore} the total quantity of life, like that of matter remains always the same; and Death w^o: seems to the superficial thinker, to be an universal destroyer annihilates no part of the primitive life, ^{nor here in imitation of the althia of Paradise lost, we must to make ourselves understand perso.} primitive matter. Death attacks individuals

only. His blows are confined to the surface merely. He destroys the form, but has no influence on the matter. ^{hence immortal m^r. Darwin} Death is unable to injure Nature; on the contrary, his strokes, on the contrary make her shine with additional lustre.

Nature permits him not to annihilate the species, but allows him successively, to mow down individuals, as if to demonstrate her independence both of Death & of Time.
Virgil

Virgil most beautifully expresses this doctrine in the VIth Bk. when he says
" Spiritus intus alit, totamque infusa per artus L. 725 -
" Mens agitat molem, et magno se corpore miscet - and soon after adds
" Igneus est ollis vigor, et celestis origo
" Seminibus; - That is From thence arises the race of men & cattle,
and the lives of flying creatures, and the monsters w.^{ch} the Ocean
produces. - These qualities, says he, have a fiery vigor, and
celestial origin.

Thus you see, we go on growing by receiving into our bodies
vegetable matter, w.^{ch} by the curious process of digestion is soon
converted into animal m.^{tr} w.^{ch} our bodies receive & assimilate
untill their acme, or perfection; when that is completed and
the body is entirely evolved, these organic living particles are
thrown back, like the vegetable, & deposited in a particular
part, where they are rendered capable of reproducing their
kind, or species for ever.

On looking back upon our subject you will perceive
that a vegetable, in the state of growing, receives its mo-
lecules, or organic particles from the earth ^{and from the air *} & from the air,
and that these perfects the plant. When this plant is
received into our stomachs as food, the vegetable ~~soon~~
molecules soon become animal molecules, w.^{ch} perfect
the man.

Finally, when an animal dies & putrefies, that is dissolves
* into a fetid vapor, or gas, these animal particles are ab-
-sorbed

Venus arising from the Sea.

absorbed with avidity by a vegetable; and this absorption of ^{animal} ~~vegetable~~ matter causes them to grow, sometimes, surprisingly; and this is the true theory of the operation of manures, and is the foundation of agriculture.

The ancient Roman poet Sucretius, sums up the doctrine we have here advanced in these words

And so each part returns when bodies die,
What came from earth, to Earth; what from the sky }
Dropt down, ascends again, and mounts on high. }

For Death doth not destroy, but disunite

The seeds, and change their order, and their site;

Then make new combinations, whence arise

In bodies all those great varieties

of shape & colour &c

Crech. B. 2^d

And thus you see, Gentlemen an illustration of what we ~~we~~ asserted in one of our past lectures — "that substances of every kind, either immediately, or mediately pass one into another; and that reciprocal deaths, dissolutions & digestions support by turns all such substances out of each other. This is but one instance among a thousand that could be brought to support another of our assertion —" that in this world w^{ch} we inhabit there is an universal change, or mutation of all things into all; that nothing, is in fact, lost, but the sum total of matter in the Universe remains exactly the same so that what some consider as fresh creations, or calling of something out of nothing, is only a change or mutation from something w^{ch} before existed!

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