April 1804

Matter. Nat. Histor. & Medical

In our last Lecture we endeavoured to give you some idea of the primary matter; or to speak more correctly, some notion of the doctrine of Arestotle on this abstruse Subject.

The inquiry after the primary mr. or that element out of wc. all things were made is purely metaphisical; for forms and ~~s~~senses can with difficulty be made ~~it~~ an object for scientific contemplation. To arrest this fleeting being, and make it the object of scientific contemplation, may appear to some, like giving to airy nothing a local habitation and "a name".

We told you that certain internal adjustments, disposition or arrangements was called Organization; and that this accession to matter gave rise to body physical, or body natural; and that it was probable, that from a variation of these internal arrangements, adjustments & dispositions arose most of those Secondary ~~qualities~~ forms called sensible qualities; what the moderns term qualities Arestotle & his followers termed Form. The moderns say that a body consists of matter & qualities. When the Peripatetics, of which Arestotle was the leader, said, that body was composed of matter & form, they meant the same thing.

Over & above

Over & above that arrangement of matter called organization, we are led to enquire after the moving principle, & from the Elements of natural Substances to enquire after the effecient cause, that is after that cause w^c. associates these elements & which employs them when associated, according to their various & peculiar characters.

This motive, animating power [motive, having motion; not that w^c. determines the choice] in a natural body is neither its organization, nor its figure, nor any other of those inferior forms, w^c. make up the system of its visible qualities; but 'tis the power w^c. not being that organization, nor that figure, nor those qualities, is yet able to produce, to preserve and to employ them.

'Tis therefore the power w^c first moves, and then conducts that latent process by which the acorn becomes an Oak; the egg becomes a chicken. 'Tis the power by which the aliment of plants & of animals is digested, & by such digestion transformed into a part of themselves. 'Tis the power w^c. departing the body ceases to live, & the members soon pass into putrefaction & decay!

Matter

Matter in the vulgar acceptation of the word, denotes a body that is tangible, visible and extended: but among philosophers it signifies that substance of which all bodies are composed, and in this sense is synonymous with Element. (encyc 62)

Matter, among philosophers, is the substratum of sensible qualities; so that matter is not that which we immediately see or handle, but the concealed subject, or support of visible and tangible qualities.

In Mechanical philosophy every thing is called a power which is capable of acting on a solid body; and every power w^c^ can act upon matter is supposed to be material. We now therefore for the first time, begin to treat it as an object of our senses.

Philosophers tell us that matter can be infinitely divided. Whether this may not be a mathematical truth & physical falshood I shall not undertake to decide. — Of the divisibility of matter :: we have many curious instances related by Hurgurion, Enfield & others, thus,

(1.) If a ℔ of silver be melted & mixed with a ~~grain~~ single grain of gold, the gold will be equally diffused through the whole silver, so that, taking one grain from any part of the mass (in which there can be no more y^n^ 5760.th part of a grain of gold) and dissolving it in Aqua Regia (Aq. Fortis) the gold will fall to the bottom!

(2.) The Gold-beaters can extend one grain of gold into a leaf containing 50 square inches; & this leaf may be divided in 500,000 parts. For an inch in length can be divided into an 100 parts, every one of which will be visible to the naked eye; consequently a square inch can be divided into 10,000 parts; and 50 square inches into 500,000. And if one of these parts be viewed with a microscope that magnifies the diameter of an object only ten times, it will magnify the area 100 times; and then the 100th part of 500,000, or 50 millionth part will be visible!

Yet all this is nothing in comparison of the length that "wonderworking Nature" goes in the division of living matter in animal bodies; for according to the celebrated Dutch philosopher Leewenhoek, there are more animals in the milt of a single Cod-fish yr. there are men upon the whole face of the earth. When he compared one single grain of sand, by the microscope, he found it bigger than four million of them! It is one of the wonders of modern philosophy to have invented instruments for bringing creatures so imperceptible as the various animalcula under our cognizance & perception. When we are told that there are millions of living creatures in a single drop of water, some of you would be prone to doubt the existence of such diminutive creatures. But you ought to recollect that however essential the distinction of bodies into great & small may appear to us, they are not so to the Deity with an atom is a world, & a world an atom! In the

In the infusion of certain vegetables, especially of the hot spices, the microscope discovers astonishly small animalcula, of different sorts, swimming up & down. Indeed there is scarcely an humor in the body of a man or any other animal, in which our magnifying-glasses do not discover myriads of living creatures. Now each of these animals must have muscles, heart, arteries & veins & nerves, they otherwise could never live or move; and each of their arteries & veins must have arteries & veins & nerves belonging to them as vessels, (vasa vasorum), or they could not subsist, much less act. How inconceivably small must the particles of their blood and fluids be to circulate through the smallest ramifications of such minute arteries & veins?

If it be asked, what brings these animalcula to these spicy infusions? I answer the peculiar odor invites them to deposit their eggs in such liquors. Now how anstonishingly small must the odoriferous particles be that such creatures can smell!

We may conceive a particle of inanimate matter so small as to allude the sight through the most powerful magnifying-glass; yet it distresses even the imagination to conceive an organized being, a body with difference, and distinction of parts, fit for life, motion, & doubtless pleasure, wrought up into such narrow bounds! And yet

and yet these particles of odor of which we spake, are probably grofsnefs itself, compared with the infinitefsimally small particles of light! Nay— these particles of light may be as grofs when compared with the animal spirits, the nervous fystem of these diminitive creatures, these outskirts of creation.

We do not mention these things to amaze & confound you, but in order to give you some notion of the Subtilty of Nature, and to remind you how far the Subtilty of Nature exceeds the Subtilty of our senses.

Now the particles of bodies do not, strictly speaking, touch each other, but they adhere by attraction. Every particle is surrounded by an atmosphere of fire, or what modern chemists call caloric, or fluid heat. This accounts for bodies being full of pores, or spaces void of their specific matter. Even in gold one of the heaviest of all bodies there is thought to be a greater quantity of space yn matter. Water can be forced through a sphere of gold & light paffes through the pores of glafs. If it be asked what are these pores, or spaces void of solid matter filled up with? — I answer with fire or calorec — for we find that, all matter is affected by heat, even metals are found to be expanded by it in length, breadth & thickness. Heat causes the particles of metals to recede from each other by enlarging the elastic atmosphere

atmosphere of fire w^c. surrounds each particle. —

— Matter is of itself inert; for any one particle of matter left to itself, will continue always in the same state, with regard to its rest or motion. "Nihil movet non motum" — nothing moveth without being moved.

There are :: certain powers w^c. two particles of m^r. have of acting on one another, viz the attraction of gravitation, and cohesion, by w^c. the particles of m^r. when at a certain distance, come nearer one another & remain in that state. Besides this there is the attraction of chrystallization, by w^c. bodies when fluid become in time solid, (as in the formation of salts) and assume a particular figure.

There is an attraction of magnetism, by which a peice of iron, in certain circumstances, attracts another peice of iron.

There is an attraction of Electricity by which a substance, which is charged with more electric matter, attracts another charged with less.

Then there is chemical attraction, by which two particles of different bodies rush together & form one. — These are all the powers of inanimate m^r. with which we are acquainted.

You will observe that most of these attractions have their opposite repulsions. But there is in animal m^r. or matter to w^c. life, or the effecient cause is superadded, something w^c. is over & above all that we have mentioned; for an animal fibre will contract more

move, and that not by the power of gravitation, cohesion, chrys-
-talization, electricity, magnetism, or chemical attraction. The
object of our present pursuit is this anonymous something.
Phil. ? "Within every animal there is an innate & active power
(imag.)
w.c ceases not its work when sense & appetite are asleep;
which, without any conscious co-operation of the animal itself
carries it from an embryo, to an Animal, or Seed in a
vegetable to its destined magnitude. At maturity it
stops, & from this point it gradually decays." This is that
internal principle, w.c descends in regular gradation from
the noblest to the most inferior animal; and the last link of
the chain of animated nature connects it with the first link
in the most perfect vegetable, perhaps the sensitive plant, and
this passes on through the vegetable natura till it ends in a
shade of ambiguity in the mineral.

Whatever by its contact with an organized body excites in it
a contraction, or oscillation we call a stimulus. Life is caused &
is continued by something, w.c acts from without; and this something
is, as far as we can discover, heat acting upon the seed or egg:
for without heat, as an exciting & preserving stimulus, vegetable
and animal life cannot be supported: thus the hatching of
w.c heat, restores ~~vegetable and~~ the dormant. Oxygen active.
eggs, is the effect of the application of a particular degree of heat,
without which the egg becomes remains inanimate. You see already where,
and to what our Disquisition leads. You perceive that we cannot

Natural things w.ch are common, are disregarded, because they are common, while rare & monstrous productions are gazed at, with idle curiosity, & stupid admiration!

What is more common y.n a seed or egg, grain? Yet how few give themselves the exertion of enquiring what a seed really is? — If a seed or grain answer the whole purpose, for w.ch the farmer supposes it was created, that of fattening his cattle & feeding his family, he neither searches into its curious structure, nor inquires into its physiology. There are however few things in nature more truly surprizing y.n a seed. It is a System, or complete whole, wrought up into a narrow compass, retaining a living principle.

It is gratifying to the pride of man to be able to raise from, ~~from~~ a few organized particles, or a seed, a field of vegetables, a variegated garden, or a forest of trees. He feels flattered with the idea of a partaker being in the power ~~& prerogatives~~ of the Creator, as he seems to participate with the Parent of Nature in the most eminent of his prerogatives!

Altho' there is an astonishing Variety in the productions of Nature, yet there is a remarkable sameness & simplicity as it regards principles. Thus the seed of a plant & the egg of a bird has the same sort of structure & is unfolded & conducted on the same principles.

Let us now run over the Anatomy of a bird's egg; but without being very particular, & without running the parellel between the egg & the seed, so closely as we should do were you all students of physic —

The first observation we have to make is, that this neat, and beautifully oval body is not a dead, but in a limited sense a live body; for I have no doubt but what the an occilation, & palpitation has already commenced from only holding it for even so short a time in the warmth of my hand. —

Anatomy of the Hen's Egg —

This outer crust or Sheels, w.c appears to be full of pores, resembles in many respects the thick tough membrane or coat of the Bean - If you carefully break the shell, we shall find a pretty firm membrane or skin that lines it every where on the inside & every where closely adhering to it, excepting at the broad end, where a little cavity or sac is left filled with air, w.c encreases in bulk as the animal within grows larger. Now this air is the oxygenous principle, or ox-ygen in its latent state, until heat combining with it gives a gradual expansion to this vital vapour, w.c is to turn the Wheel of life.

Under this membrane are contained two Whites, though seeming on a superficial view to be only one. Each one of these whites is wraped up in a membrane of its own; one

one white within the other. The white of the egg serves the same purpose as the lobes, or large glandular bodies in the seed, viz it affords the matter for nourishment, of the infantile animal as long as it is an inhabitant of the shell. —

In the midst of all this is that yellow round substance called the vitellus or yolk, w.c is also wapt round by a particular membrane. Upon, or at the end of this round yellow body, we discover two ligaments called chalaza, w.c are white, dense substances, continued from the membranes, & w.c serve to keep the white & the yolk in their natural & proper places, & to steady the whole, & so prevent the bad effects of violent concussion.

There is a little round spot, hardly so big as a pea, laying on one side of the yolk, & inclosed within its membranes. The outer membranes & ligaments, keep all these parts firmly attached, & keep to preserve each part from being confound with that w.c is contiguous to it. This little round spot we spoke of, is the part which first shews signs of life, by a feeble palpitation, not discernible without a magnifying-glass.

This round spot, w.c is the predominant part of the Egg & is called by some the punctum saliens, or palpitating spot; & punctum vitee by or point of life by others, is like the punctum vitee in the seed, the spot w.c first shews signs of life; and which after being six hours under the hen, or in a stove with the same degree of heat, begins to dilate just like the pupil of the eye; and from this small beginning, it goes on

5

developing, every minute, nay every moment during
space of
the 21 days, when the chicken breaks its shell, with its
bill, when the lively, active beautiful bird, exercises its
limbs in the open air.

This is a slight anatomical view of the Hen's egg,
& its description answers to that of all other eggs
however large, or however small, that has ever yet
been examined. The parts are the same in the egg
of the Ostrich, & in the Condor, w.ch is a still larger
bird, & in the egg of the Butterfly & of the smallest
insect that has ever been examined. Whoever
wishes to learn more of this subject, I would refer them
to the writings of D.r Harvey, who was physician to Charles
the 1.st & who discovered the circulation of the blood; and
also to the writings of Malpighius of Italy; and above
all to the learned Baron Haller, late physician to the King
of England in Hanover. In his elaborate work you
may find all the facts & observations that has been
discovered on this curious subject; for this laborious
(German.) pursued this matter for several years of
incubation or hatching of eggs with the patience of
a setting hen!

Before we dismiss this subject of incubation, we
w.d observe that the animal is unfold in the egg by
a certain & uniform degree of warmth: But it is not

absolutely necessary that it should be the warmth of the hen; for in Egypt they hatch out all their chickens in Ovens or Stoves constructed on purpose.

We have not attempted to imitate this Egyptian process of rearing chickens, but we have here an egg which we placed in sand, just as we had placed the seed in the Earth, merely to cause its vessels to expand, (become more conspicuous) We placed this pot of Sand near the fire in the day time, and during the night we put it in an Oven, in such a degree of warmth as we judged proper; but sometimes, I believe it has been rather too hot & sometimes too cold, so that instead of seeing a multiplication of its vessels, it is probable that we shall find it baked or roasted.

"Man cometh forth like a Flower." Illustrated by a Drawing of the growth of a Frog from a Tadpole, & the Pink from a Seed ___

"The primary mr. or that out of which all things are made, is
a being wc flies the perception of every sense, and is at best
even to the intellect a negative object, no otherwise
"comprehensible, than by analogy or abstraction". Harris

" All bodies in nature are imbued, surrounded, & penetrated
in everyway with caloric, wc fill up every interval left between
their particles; ~~and~~ In certain cases caloric becomes fixed in bodies
so as to constitute a part even of their solid substance, though it
more frequently acts upon them with a repulsive force, from
which, or from its accumulation in bodies to a greater or
lesser degree, the transformation of solids into fluids, is
entirely owing. Lavoisier's chem. Vol. 1st. p. 299. —