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Heat or Caloric

There are two original powers, or primitive forces continually operating throughout the vast system of the Universe; the one is that w.c causes weight, & the other is that w.c causes heat. The 1st tends from the circumference to the centre & is called gravitation. The 2d tends or expands from the center to the circumference & is called Fire. (e.g. a body falls, a plant ascends.) Tho' the tendency of these powers is directly opposite, yet they ballance each other without being destroyed; & from the combination & co operation of these two powers, alike active, all the phenomena of the Universe result. When the grauitation prevails, things are in a solid state; when the heat predominates, they are in a state of vapour; and the liquid state is the point of equilibrium between both these powers. Did the power of attraction, or gravitation only prevail, there w.d be none but solid & compact bodies; but fire, or rather heat tends incessantly to diminish the adhesion of the particles of matter.

"The quantity of m.r in all bodies is in exact proportion to their weights, bulk for bulk; therefore heavy bodies are as much more dense or compact y.n light bodies of the same bulk, as they exceed them in weight."

"All bodies are full of pores, or spaces void of m.r. In gold, one of the heaviest of all bodies there is perhaps a greater quantity of space y.n of matter; for the particles of heat & of magnetism

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magnetism find an easy passage through the pores of gold; and even water itself has been forced through a hollow ball of this precious metal. Besides, if we consider how easily the rays of light pass through so solid a body as glass, we shall find reason to believe that bodies are more porous y.n is generally imagined."

The particles of bodies do not touch each other; they only adhere by attraction, or wt is called the attracting of cohesion. Heat seperates them; and cold, or the substraction of heat, allows them to come together again. That heat seperates the particles of the heaviest & hardest of bodies is apparent from its expanding all metallic bodies in length, bredth & thickness. e.g. Take a ring of iron, & then take a rod or cylinder of the same metal, so nicely fitted that it shall slip freely in & out of the ring; then apply heat to this cylinder of iron; but not so as to make it red hot, & then if you try to pass it through the iron-ring, you will not be able to effect it; because the iron rod is expanded & enlarged by having its particles removed at a farther distance from each other, & the more you heat the rod, the larger it will become; & if you continue to urge & encrease the heat — What follows? — Why the iron can no longer hold its hard & heavy particles together, but they seperate at a great distance & the melted iron flows like water.

Now

Now, how are we to account for this? We answer that Fire is a subtle elastic fluid wch fills the immense space of the whole Universe & surrounds every particle of the original & permanent corpuscles of wch bodies are composed. In that operation wch gives the sensation of heat this fiery elastic fluid wch surrounds every particle of matter enlarges its sphere. If in a small degree it gives the sensation of repreeable warmth; & when our bodies are totally deprived of it, they are said to be frozen: when they have a proper quantity, they are in health, & fit to perform all their functions; it is then called natural heat; when two much is forced in, it is called Fever; and when forced into the body in too great a quantity from without, it gives pain by seperating the ~~the~~ particles composing the fibre, & destroying the flesh & then it is called burning.

But the word heat is used to express ~~the~~ sensation, and therefore the more accurate chemists of the present day have adopted the word Calorie to express the cause of this sensation of heat. The Latin word for heat is calor, from whence ~~the~~ is derived the term calorie, wch is thought to be less exceptionable ynr the term heat, or the word fire. The chemists speak of 4 modifications of Fire wch they denominate 1st Free calorie; 2d Specific heat; 3d Latent heat; & Chemical heat*; but we shall have no need to make these critical distinctions at present

* See Chemical Dialogues p. 13. & seq.

Fire or caloric, wc is strictly speaking the cause of heat, is an astonishingly subtle fluid! And if you ask me where is the origin or source of this all powerful agent? I answer the Sun is the efficient cause of the motions of this fluid, & the various phænomena of our system are the effects these motions. But how to run the line between this fiery fluid & other, or the ether medium of Newton — But if you ask me further what is the Sun? I answer that we ignorant of his nature; having nothing here below to which we can liken him. We know his nature only by his effects. He is apparently the source of Light, Life, Health & Joy; for in his absence we blunder in the dark; and life descends in the Thermometer of Vitality till it gets below the freezing point. Impaired health, & dejection of spirits are the certain consequences of dwelling in darkness, as those can testify who have been long immured in Dungeons. The Sun is, to use the expressive words of Thompson

"Soul of surrounding worlds!
"Without whose quickning glance, this cumbrous earth,
"Would be a lifeless mass, inert & dead,
"And not as now the green abode of life."

we know not.

Still you enquire what is this subtle fluid or spirit, wc upholds the Universe & surrounds every particle of mr. in the ~~Universe~~ creation. Can we illustrate it on paper, or make it more evident by an experiment? Fire is every where in us, & around us — e.g. friction — collision of flint & steel concentrating the rays of the Sun by a lense — The gold leaf & agitated glass in

Of Oxygen

As we shall have occasion frequently to speak of oxygen; it is high time that we tell you what we mean by this new fashion'd name. I say new fashioned, because it is a new name for an element, or principle in nature that has been known long before the days of Aristotle. The term oxygen means, acid making; or the acidifying principle, because one of the most general properties of oxygen is to form an acid when combined with many different substances. The union of simple oxygen with caloric forms a gas, w.c was formerly called Dephlogisticated air Vital air or empyreal air; or highly respirable air. The gas opposite to this is the deadly Azote, in w.c nothing can live.

The antients were led to suppose ~~that~~ by the heat of the blood, that there resided in the heart a vital spark or flame. They were confirmed in this error by observing the appearance of smoke in the breath we breathe. And by noticing that fire was extinguished when deprived of air, they very naturally inferred that the use of respiration, or breathing was to fan, or blow up this internal spark, ~~or flame~~ + keep alive this vital flame; for as soon as the bellows ceased blowing, i.e when the Lungs ceased to draw in air the person died.

N. Some Philosophers of ab.t 2 centuries ago observed that those

those animals w.c respire most have warmest bloods & vice versa
and some of the Anatomists of that day, who exercised
themselves in the cruel experiments of opening brute
animals while alive, observed that the blood every
time it passed through the Lungs acquired a bright
vermilion colour; and Signior Borelli proved
that the air lost something, when it passed into the
Lungs; and there the matter rested for several years,
until Dr Mayow, who lived in the reign of K. Charles
the 1st shewed that this anonymous something which
the air imparted to the Lungs, was contained in Nitre;
and those who were employed in making Salt Petre had
learnt that this something was absorbed from the com-
-mon air. But they went no farther. The ap-
-plication of these detached facts, & the full dis-
-covery & explanation of this vital principle was
reserved for the celebrated Dr Priestley —

As it requires a considerable knowledge of che-
-mistry to understand the extent & the application
of his famous discovery, I shall for the present pass
over all the facts & reasonings, excepting so much
as is absolutely necessary to understand the first
principles of vegetation & animation.

This Oxygen, or oxygenous gaz is procured from Salt
Petre, or Nitre, by means of heat, or distillation. It is also procured
from many of the metals especially manganese mixed with the strong Spirits of Nitre,

Dr Priestley called this dephlogisticated air; some called it vital air, & some empyreal air, and others highly respirable air; but the new name for it is oxygen: or oxygenous gas. In this gas or air a candle burns with the most vivid flame; & an iron rod kindles like a match; & it is highly salutary to animal life; whereas the opposite principle, azote, extinguishes flame & destroys life.

Oxygen combined wth fire or caloric, is in short, the grand, efficacious & necessary instrument wch Nature principally makes use of in almost all the operations she is engaged in. So necessary is this vital air to the existence of, not only animals, but vegetables, that no eggs of animals, or seeds of plants be they ever so ripe & pregnant & the best of their kind, & cherished with ever so kindly a warmth, will ever bring forth the embryos contained in them, but will remain effete & inactive, if they be deprived of this oxygenous principle.

But all that is needful for our purpose at present is, to remark, that Nature has placed, in the first instance a portion of this oxygen, in the punctum vitæ of a seed, & in the punctum vitæ of a hen's egg. & a due degree of heat operating on & with this oxygen gives the first pulsation of life, & a sufficient portion of it is given to every animal, until it can breathe the common air of the atmosphere —

We have seen already that the seed of a plant is a completely organized body, or system, envelloped by several membranes, containing within it the future plant in miniature; for it is that part alone w^c grows into a large plant, an Elm or an Oak, forming a new progeny; for we shewed you that the other parts of the seed are entirely subservient to this; and are employed in converting the farina or mealy substance of the seed into a milky fluid, w^c is conveyed by the Lactiferous-vessels to the embryo-plant, until such time as it is able to stand alone in the earth & help itself.

There is no seed hitherto examined that is destitute of this supply of milk. The <u>Cocoa Nut</u> is a seed of a peculiar kind. It is not formed into lobes like the bean, the Hazel nut, Chesnut ~~& others~~. The farinaceous part, or meat lines this hard shell; and as it has not a glandular structure by w^c it gradually secretes milk for the nourishment of the infantile plant, nature has supplied a quantity of that nutritious fluid, in a large cavity in the center of the nut —

Now the bean, or any other seed w^d remain in its dormant state tho^t alive [convegetated after 70 years] unless some agent, or stimulus from without excited, or began a motion in it. Now, whatever by its contact with an organized body, excites in it a contraction,

oscillatio

oscillation, or motion we call a stimulus. Life is caused & continued by something that acts from without; and this something is, as far as we can discover, caloric combined with oxygen, acting upon the seed.

Now if a seed, wch is furnished wth vessels, like an animal, be put into the moist Earth, & a certain degree of heat applied, not equal to the heat of animals, these vessels, wth their containing fluid expand, & those wch surrounds the germ or punctum vitae insinuate into the little ramifications, & the motion once begun, it developes by degrees & slowly grows up into a Plant, the utmost effort of which is, to produce another seed, similar to that it sprung from; & which is capable of producing its kind through the endless ages of the world!

As the structure of all the seeds in Nature is essentially the same, so their incipient vegetation & growth proceeds exactly on the same principles. The grass of the field & the Oak of the forest obey the same laws. And when we consider that their structure throughout is essentially the same, it simplifies the science & Art of Agriculture greatly.

But before we can have a just idea of the operation of the vegetative spirit, or its organized mr. it is needful that we attend a little to the astonishing diversity of mr in organised bodies.