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# Evaporation from the Ocean

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Some are surprized when told that all the fresh water on the Earth is made out of the salt ocean. Every link in the process of this natural distillation is not clearly understood. In order to understand it, it is necessary to bear in mind that there is a transparent elastic fluid wc. everywhere surrounds this Earth, & wc is in the closes contact with the waters of the ocean; and that water is a compounded body, composed of two principles, & may be converted into air, & air into water again. This elastic fluid wc surrounds & embraces closely the Earth is called the Atmosphere, or Vapour sphere; and it is, if we may so speak a mighty watering Engine, & the Ocean is its fountain. The water of the Ocean is drawn freshened through the air to the tops of the highest mountains, when they begin to return over the face of the Earth in the form of rivulets; then inosculating with other kindred streams they form rivers & so run on to the sea. But sometimes the water drawn from the ocean does not reach the mountains, but floats in the air in the form of clouds, wc coalescing into drops, fall to the Earth as in rain. Thus you see the whole ~~Earth~~ terraqueous globe, the sea as well as land, & taking in the whole region of the Atmosphere is happily contrived to produce not only fresh, but running waters.

These running waters called Rivers are not merely necessary as conveying the element of water; but are highly beneficial in civilizing man, by aiding commerce; for while they seem to disjoin the world, & to seperate its inhabitants, they in fact, are its bonds, that connect & bind the great family of mankind together. — For want of commodious rivers the interior parts of Asia, Siberia and Tartary, are at this moment, rendered not only uncomfortable habitations, but still remain, in a great degree barbarous; and all because they cannot have their prejudices rubbed off by a commercial acquaintance with other nations. For want of commodious rivers communicating with the ocean, they are in the very back-ground of the picture of Europe & Asia.

That vast body of water wc covers nearly 2 thirds of the globe, has a two-fold motion: the 1st is that of the Tides wc is a swell, or rising up of the water against the shore. This swell of the ocean lasts for six hours; & then it rests for a 1/4 of an hour, & then it begins to retire from the shore; wc retreat takes up just 6 hours more; and then after a pause of a 1/4 of an hour, the sea begins to flow again as before —

The 2d motion natural to the sea is a progressive current, from E. to West, whereas the first was merely backwards and forwards. This current comes in the course of the Trade winds

w.c blow everlastingly from E. to W. in certain latitudes, runs down the West India Islands; pours into the bay of Hondoras, & rushes out of that great bay forming what is called the Gulph-Stream (from its rushing out of the gulph of Florida) sweeps across the Atlantic parellel with the American shore, and is finally spent in the North sea. And thus is the immense salt Ocean carried, with a never ceasing circulation around the world!

The water, or Ocean covers by far the greatest part of our globe (see Globe). The seas & unknown parts of the Earth by a measurement of the best maps contain mil. thous. hund 100, 522, 026 square miles. Europe contains mil th. hund 4, 450, 065. Asia mil th. hund 10, 760, 829. Africa mil th. h. 9, 564, 807, & America mil th. hund 14, 110, 874. This great proportion of water, w.c some have thought to be a waste, is doubtless dealt out with exact weight & measure, in order to preserve & keep up that evaporation w.c supplies the ground with rain & the world with rivers.

The learned Dr Halley computed the surface of the Mediterranean sea; & then determined by a satisfactory exp.t how much was evaporated from a foot square of salt-water, in a summer's day, in 24 hours; & so he easily ascertained how much w.d evaporate from the whole of that sea; and from the exp.t he concluded

that the Mediterranean afforded in one summer's day five thousand two hundred & eighty millions of tons of water in the form of vapour, w.ch he estimated the whole surface of all the water on the globe, he calculated that it would be amply sufficient to supply all the rivers of the world with ~~them~~ water, without having ~~many~~ recourse to any other cause. This theory supposes that the water is raised from the Ocean into the Atmosphere solely by the power of heat; & that the source of this heat is the Sun; in a word, that it was a distillation; where the Ocean & the air composed the Still, & the Sun the fire place. — Now if you put salt water into a still; and distill it by a gentle heat, you will bring the water over fresh & leave the salt behind in the bottom of the vessel. Just so it is in Nature, the water that is raised into the clouds from the salt ocean is perfectly fresh & fit to drink; (& so are the islands of ice, altho' they are formed from the water of the salt ocean) Both the operations of freezing & of raising the water from the ocean freshens it. — Plausible is this theory is; & imposing as all mathematical theories generally are; especially when they come from a Newton or a Halley, yet some doubt whether there be not something besides this division of water by heat, for it is

for it is found that the evaporation, or the rise of fresh water from the Ocean into the Atmosphere goes on very briskly in the cold regions of the Northern seas; ~~which~~ for then the vapor is visible to the eye, by reason of the coldness.

Some think that the air takes up the water from the salt ocean on the principle of a solvent, or menstruum as the chemists call it. It is a pretty general law in chemistry, that a thinner fluid will dissolve a thicker, in wch case the thin fluid is called its menstruum or solvent. Now air wch is the thinnest & most subtile of all fluids except fire, will dissolve every thing, & water among the rest. Now water as well as air will dissolve just so much of a thing & no more (e.g. ℥vi of water will dissolve ℥i of salt, & no more. When the water has taken up as much salts as it can contain, & remain clear, it is said to be saturated; but if you add more salt, it will not be able to hold it in solution, but it falls to the bottom of the vessel, & then it is said that the water is supersaturated (has more than enough) & the salt falls to the bottom. Now some say, that the Ocean being in close contact wth the air, & both of them constantly shook together by the winds, the air dissolves the water & takes it up into itself; But air, like all other menstruums, can take up just so much

much water & no more, without being turbid, or what is called cloudy. If more & more water be added, that is more vapours crowded into it, the air becomes, like the solution of salts, supersaturated & cloudy, i.e. more gn enough] & it lets go the superabundant water, in the same manner the salts did; & the water falls from the clouds to the earth in the form of rain. — If this theory does not account entirely for the ascent of water from the Ocean, & its leaving the salt behind, & its floating in the form of clouds, & its seperation in the form of rain, perhaps we may gain something by joining both theories together. We know. e.g. that heat encreases the solvent power of every menstruum. The three Elements fire, air & water are offsprings of each other. We have said already that there are not two distinct drops of water in the Ocean w^c do not owe their fluidity to fire; because if fire be withdrawn it turns to a hard chrystal. If water then cannot exist without fire, fire cannot without air; and they are continually operating on each other, & in no part of the creation is this more apparent yt in this never ceasing circulation of water from the Ocean, through the Atmosphere, down the mountains, & by rivers to the Ocean again; yet there is no waste, or alteration in the sum total of the water.

This circulation, or rise of water from the ocean is an unceasing process; because it is absolutely necessary for Vegetation; but it passes without notice because it is not an object of sight.

Let us sum up all & say that

"From that immense body of water wc encompasses the globe, there incessantly arises an ocean of vapours; wc being rarified by the combined action of the Sun & of the air, spread themselves in the upper regions of the atmosphere, where they remain suspended in equilibrio, being mixed wth the fluid in wc they float, and gravitate with it. Collected afterwards into clouds, more or less dense, & borne on the wings of the wind, they fly across the celestial plains wc they adorn with their colours, & continually variegated forms. Fixed at length on the tops of Mountains, they pour upon them abundant rains, wc being collected in the vast reservoirs embosomed within them, furnish, by a happy circulation, a supply of fountains, rivers, lakes & seas, & this chiefly for the use of vegetation, wc has an ultimate reference to the food of man. — Like veins & arteries, the rivers flow, & branch out on the surface of the earth.

They

they run through immense countries, water, fertilize & unite them by a reciprocal Commerce; and majestically rolling their waves towards the sea, plunge themselves into it, in order to be again exhaled from it in vapours, and re enter afresh the channels of this magni-
-ficent circulation" — (see Bonnet)

And thus you see how Providence has connected & bound together the opposite parts of our world, fire & water, air & earth, making it a system, or a consistent whole, and all for the use & benefit of man & the rest of the animal world. Now with what dif-
-ferent eyes with what feelings do differently informed youths view this Great Book of Creation, where

Nature with open Volume stands
To spread her Maker's name abroad
And every Product of her hands
Shews something worthy of a GOD!

We have now finished that part of our course w.ch relates to the great outlines of Nature. From treating of systems of the world, & their first formation, we descended to speak of one of the smaller bodies circulating in our Solar System, viz the Earth on w.ch we live. — So far from our earth being round like a block of marble, we find it marked with many inequalities; in some places we see it rising into mountains; in others intersected by large rivers; and in a great part of it excavated for the reception of the vast Ocean; and on a closer observation we find the whole is surrounded by an atmos, or vapour sphere, extending about 45 miles high. There is nothing absolutely still in Nature. All is motion. The ocean is never at rest; but its immense mass of waters is carried rapidly round the world, like the blood circulating through the human veins. But this is not all. It is circulated, by a sort of natural distillation through the atmosphere, where it floats in form of clouds, w.ch being attracted & condensed by the cold & lofty mountains, its ~~[illegible]~~ already freshened waters pass down their sides, & return in the form of rivers to the Ocean again, without the loss, or the addition of a single drop!

But what is the use of this circulation? How comes it that Nature is so solicitous to provide & to keep in rapid motion this vast body of water in, upon and round this Globe?

We answer

We answer that it is, in the first instance for the sake of Vegetation, wc has an ultimate reference to the sustentation of man & other animals. If the Earth had not been productive of Vegetables, it cd not have been replenished with animals. Thus the lower order of things is referred to the higher! Hence you see the truth of that copious & elegant expression in holy writ "All flesh is Grass." On taking a glance, or rapid view of this globe, two very different sort of substances strike the eye of the beholder. the one is a vast body of water covering more than half of it; and the other is a green coat, or carpet of Vegetables. Upon examining the ~~salt~~ water of the vast Ocean, we find it an homogeneous mass i.e. uniformly the same;- But not so the green carpet wc adorns the Earth. We find, on close examination, that this green coat, with wc the Earth is clothed, is composed of innumerable organized bodies, wc tho' essentially the same, are infinitely varied in shape, size & quality. Although this variety appears, to the superficial observer to be absolutely endless, yet there is a surprising sameness wc runs through the whole of the vegetable Kingdom.

As vegetables occupy so great a space on our globe, and are so constantly under our eyes, & are of such vast importance to our existence & comfort, that they claim a primary attention in every course of Natc History. But we must be cautious not to allow our attention to be called off to the variety of vegetables around us.

We mean not to distract your attention by ~~remembering~~ calling to your recollection ~~you~~ of the almost endless variety of vegetables that compose that beautiful green covering w.ch adorns the Earth, our attention must be directed to the examination of that organized being a Plant. We are to shew you what a plant is, and wherein it differs from all other organized beings, & in what particulars it resembles them. — But before we go any farther it is proper that we fix the meaning of the terms we shall use. We have told you already that by an organized being we always meant both a vegetable & an animal, but never a mineral:

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It is needful to be still more particular

By Organization, we mean what some call structure, texture, or fabric, w.ch is the natural disposition of component ultimate particles into a fibre, & thence into a vessel.

By Fibre is meant a natural thread like structure, the foundation of every vegetable & animal organ.

Anatomy has never been able to demonstrate the simple, or disgregated animal or vegetable fibre. It never has unravelled its exquisite & essential organization, so as to tell the fibre of a man from a dog, a horse, an Elm, or an Oak. The simple fibre is the ne plus ultra of the anatomist.

A Vessel is a natural tube or pipe, conical in capacity i.e. growing smaller & smaller, and composed of fibres. The collection of vessels in an animal or Vegetable constitutes its vascular system

System. The fluid parts of an animal or vegetable are contained in the vessels or vascular system. The fluids contained in the animal vessels are generally called the Humours, & the greatest portion and their motion circulatory of them is named Blood. Those filling the vessels of a Plant are generally denominated Juices, & the chief part sap, wc does not circulate, but only rise & fall, like ☿ in a thermometer.

By System, we mean a complete whole, wrought up into a narrow compass, retaining a living principle.

An Animal is matter organized into fibre, vessel & humor, constituting a system, or economy, possessing sensation & other functions, particularly loco-motion, or the power of moving from one place to another; and all from an innate, inherent energy.

A Plant, or Vegetable is matter organized into fibre, vessel & humor, or juice, constituting a system, or economy, possessing a low degree of sensation, but divested of the power of moving from one place to another.

Life or Vitality is alike common to both plant & Animal and is that state, or condition of animal or vegetable organization wc is requisite to the capability of function. Whereas Death is that degree of alteration, or derangement of animal or vegetable organization, that produces an abolition of function, & putrefaction & decay naturally follow —