Of the general effects of Cold on the living Body — Boston Jan.y 28th 1811.

We shall speak of cold in the popular language, & according to the common feelings of men, as a positive agent, and not as a lesser or greater abstraction of caloric thus we say the sun rises, & the sun goes down when we know, philosophically speaking it does neither.

"A certain quantity of heat is obviously indispensible to the existence of life, throughout both the animal & the vegetable world. The returns of summer & winter alternately multiply & diminish, to a great extent, the number of living beings, especially of those w.c possess a comparatively less perfect organization; and, in all, a free circulation of the fluids is requisite for the support of the vital principle. Hence life is incompatible with that degree of cold, w.c produces a congelation of the fluids.

It is a law in the nature of heat, as well in living as in dead matter, that it is communicated from a body possessing a larger quantity to any other body w.c comes in contact with it, possessing a smaller quantity, untill an equilibrum is produced, or untill the degree of heat is the same in both. Were living bodies :: possessed of no other properties but those w.c belong to them in common with in organic bodies, in an atmosphere of the temperature of 32 of Fahr.t's thermometer (the freezing point of water), or a little lower, it is obvious that life must cease; but the vis vitæ, or fiery part of our systems preserves us.—

The Animal body :: is endowed with a power of generating

or evolving heat, to a considerable extent, much above the ordinary temperature of the atmosphere. This power is even encreased by the necessity occasioned by external cold, & diminishes with the encrease of the atmospherical warmth; so that during a state of health, the temperature of the animal body is pretty uniformly the same, notwithstanding the extensive variations of the external temperature (within an indefinite limit) or in other words, there is in the body a power of regulating, or varying the evolution of heat, according to the demand made from without. In the human body, the degree of heat is regularly ab.t 98; in Birds it is somewhat higher; and in some other animals it is much lower, especially in the Amphibia, w.c have been called cold blooded animals, & w.c suffer great variations of their heat.

The celebrated John Hunter made a number of interesting experiments on the power w.c different animals possess in resisting cold, in order to satisfy his mind respecting the possibility of recovering the vitality of serpents & fish after being frozen. On freezing a carp it did not recover. (I have tried the like experiment with that fish, & with the same result.) It was with difficulty that Mr Hunter succeeded in freezing a Dormouse, such were its powers of evolving heat, and the non conducting quality of its integuments, and it was not till the hair was wetted that life was destroyed, and the animal when dead became stiff, & could not be recovered. When a Toad was submitted to a similar cold

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mixture, the water froze round the animal, but it did not die. Hence it appears says Mr Hunter that an animal must be deprived of life before it can be frozen. It is :: a common opinion that snakes, in this country can be frozen stiff as a stick of wood, & be again brought to life. The opinion was worthy enquiry.

We know that the human body will maintain its heat of 98° in an atmosphere 10°, 15°, and 20° below and it maintains the same degree of heat, in an atmosphere of 200°. — Fordyce &c. Zero, or 0. This the constitution of man wisely adapted to every medium temperature of the habitable globe. (See Rees cyclop. Art. "Cold", Tooke's acc.t of Russia) In a degree of heat from 60° to 64° every exertion of the body w.c is necessary to man's subsistance or gratification, is performed with ease & safety; & this degree is called temperate. The higher degrees up to 70° are called warm, and all above that hot. In the inferior range of the scale, a few degrees ~~a few degrees~~ below 60, as down to 50° & 47° are denominated cool; and all below cold.

There is :: a considerable difference among men, even in a state of health in assigning names to particular degrees of the thermometrical scale; as their sensations vary, according to the power, w.c their respective constitutions possess of evolving heat. This may depend upon the original vigour of the system, especially of the heart & arterial system; it is also much influenced by habit; or what is called "seasoning."

The first effect of cold when applied to the human body, is to weaken & diminish the action of the superficial branches

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of the arteries, w.c become unable to transmit the blood in the usual quantity through the integuments, more especially in the extreme parts, as the hands & feet, w.c are at the greatest distance from the heart; and in projecting parts, as in the ears & nose. Hence it is that the skin becomes pale, & contracting round the miliary glands and roots of the hairs, exhibits a roughness, w.c is compared to the skin of a picked goose, & hence termed cutis anserina.

From the languor & weakness of the arterial system, produced by the application of cold, other effects in the constitution necessarily accrue. We have seen in the physiological part of our course, that a free circulation of blood (w.c has undergone the salutary change produced by respiration) to the brain & nervous system, is absolutely requisite for the support of sensibility. If the circulation is suspended for a few moments, as in syncope, the sensibility of the frame is also suspended; and on the other hand, where there is a more extraordinary supply of blood to any part, as in inflam.n, the sensibility is highly augmented. Hence another immediate effect of the agency of cold on the human body, is a diminution of the sensibility of the parts on w.c it is exerted. This is universally felt in the numbness of the hands & fingers, w.c under the impression of cold, are altogether incapable of accurate discrimination of touch. The sense of smell is in a considerable degree enfeebled by cold. The Tongue cannot distinguish the peculiar flavour of sapid bodies, if such bodies be very cold.

If the cold be intense & long continued, the powers of the whole nervous system become weakened; a torpor of the animal functions ensues; the action of the muscles is feeble, & scarcely obedient to the will; an unconquerable languor & indisposition of motion succeeds; a gradual exhaustion of the nervous power shews itself in drowsiness, w.h terminates in sleep, from which the person, unless speedily roused, awakes no more. [See a striking instance of this related by Capt.n Cook, in an occurrence that took place during a botanical excursion, of Sir Joseph Banks & Dr Solander among the hills of Terra del Fuego, very far towards the South pole. Rees cyclop. art "Cold".

When cold is combined with moisture, its effects are extremely deleterious, & even fatal; for water not only conducts the heat away more rapidly, but by evaporation it abstracts an additional quantity from the body, which induces an extreme chill. It appears that those who are long emersed in fresh water, in cold weather suffer more, & perish sooner yn those emersed to the same height in salt water. When people are shipwrecked on our coast in the winter, those who have remained 20 hours emersed in the sea water, have survived, when those who were only knee deep in the water died; and these, not by being frozen stiff, but by being convulsed, & delirious. Sailors suffer more by being wet with heavy showers of rain & hail, yn if wet constantly by sea water.

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all the fatal effects of cold, internally, or externally applied, have occurred in those situations, where the system, after having been much heated & enfeebled by severe exertions, was loosing its preternatural heat from profuse perspiration, and, in general, also from the cessation of the exertions by which heat was originally produced. Dr. Currie mentions a young man, who had been engaged a long time in a most severe match at "fives". after the game was over, he sat down on the ground, panting for breath, & covered with profuse perspiration. In this state, he drank largely from a pitcher of water, just drawn from the pump. As soon as he recovered his breath from drinking, he laid his hand on his stomach, and bent forwards, his countenance became pale, his breath laborious, & in a few minutes expired!

[To obviate this fatal effect Liquid Laudinum sh.d be given by tea spoonfuls; and if time allows of it, bladders of warm water ~~&c~~ heated to 110°, or 115°. of Fah.t should be applied to the pit of the stomach; or rather both should be used at the same time.]

As to the Effects of Cold as a remedy in certain Diseases, we refer you to Dr. Currie's Reports, as I have not yet made up my mind on this subject. From that work it appears that whenever the heat of the body is increased above its natural degree, and is retained steadily, the action of cold is safe, pleasant, and salutary. Now in Continued fevers the heat is retained with greater tenacity than from exercise. There is in the febrile state a constriction, a kind of inflammatory con-

constriction of the cutaneous vessels, w.ch tends, at once, to keep up the febrile action, & to prevent the flow of perspiration, the great refrigerating process of the constitution. The safety and an affusion of cold water in the hot stages of continued fevers is decided & complete. It is said to remove completely that sensation of heat w.ch augments the febrile action, & prevents the refreshment of sleep.

From Dr Currie's exp.ts we are induced to conclude that a considerable elevation of the heat of the body above the standard of health, is incompatible with the process of perspiration. Thus, at the temperature of 104, or 105 of Fah.t the vessels of the skin remain obstinately constricted, the skin continues dry, and pungently hot to the touch of the bystander; and it is only when it is reduced to 99°, or 100°. that the orifices of the vessels relax, and a free perspiration diminishes the heat, and moderates the febrile condition. Hence the absurdity of forcing sweats, by a load of bed cloths.

We learn from Dr Currie's expt.s that the only means of exciting perspiration under such high temperatures is to cool the body to that lower degree at which the vessels can relax, & pour out their fluids. In fevers i.e. as in health, when there is no sense of chilliness present, when the heat of the surface is steadily above what is natural, & when there is no general or profuse (sweating) perspiration, the free use of cold drink, & the affusion of cold water over the skin

skin, are the most salutary remedies wc. can be adopted. The consequences of washing the body with cold water, in the steady heat of a continued fever is said to be, that as soon as the patient is returned from the shower bath to his bed, a gentle, sometimes a profuse perspiration breakes out, & a calm & quiet sleep ensues, the actual heat of the surface, & the deffieffing sensation of heat, are greatly diminished, the pulse becomes much less frequent, the tongue cleaner & moist; the pains of the head & limbs are alleviated, & the whole febrile condition is relieved, & its course rendered milder, & considerably abridged. And it is said that the relief is the more effectual and permanent, in proportion as the remedy is more early resorted to as on the 3d or 4th day of the fever. See Rees Cyclop. art "Cold" from whence the foregoing is chiefly taken —