

Observations on the powers and effects of cold as a cause of disease ; with some remarks on the best means of preventing its morbid effects, etc / [John Clendinning].

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OBSERVATIONS
ON THE
POWERS AND EFFECTS OF COLD
AS A CAUSE OF DISEASE;

WITH SOME REMARKS ON THE BEST MEANS OF PREVENTING
ITS MORBID EFFECTS, &c.

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[FROM THE LONDON MEDICAL AND PHYSICAL JOURNAL.]

THERE is no one of the causes of disease which, in popular estimation, is so extensively mischievous as cold. Febrile, inflammatory, almost universally, and in numberless instances nervous, cachectic, and other forms of disease, are laid to the charge of that agent; and the popular opinion has unquestionably a foundation in truth, and is to a great extent confirmed by daily professional experience. A very large portion of the mortality of all climates is attributable to changes of atmospherical heat and humidity, and this in a double sense; much disease is occasioned by hourly and daily fluctuations of the thermometer and hygrometer at all seasons; while a still greater destruction of human life is found to depend on the change from the soft airs of summer to the chilling blasts of winter and spring. "Half of mankind," says RITTER, "perish before the close of the third year."—"If, on the one hand," says the same writer, in the article *Ausdünstung* of Ersch and Gruber's Encyclopædia, "we recollect the susceptibility of the teguments and the frailty of the incompletely formed organs, and, on the other hand, the numberless occasions of taking cold, from baptism forward to the time when the child can wallow in the puddle, and sit down to cool itself in the blast, we shall soon cease to wonder at the amount of infant mortality from cold."—"The

contagious class excepted," he says in another place, "there is no disease, "not even of the nails, hair, or bones, that cold may not occasion."—"With the exception of a small number of diseases occasioned by unwholesome occupations and by the contagious, the great mass of human malady in this metropolis," says the observant BATEMAN, "is referrible to the climate or state of the seasons, and to intemperance; but that, of these two causes, the vicissitudes of the weather, especially its cold, are by far the most prolific sources of mischief." (*Diseases of London.*)

But it is the change from the mild to the severe season that, in modern times, proves the most deleterious to life and health. We have learnt how to check the production and limit the range of those destructive emanations, animal and terrestrial, that caused such devastations amongst our predecessors of earlier ages: but climate, and the causes of atmospheric changes continue beyond our control; winter is the great enemy of the very young and the very old. "The increased mortality occasioned by severe winters has generally fallen heaviest," says Bateman, "on the aged and young children, whose vital powers are possessed of less energy than during the intermediate periods of life." Nor are the healthy without their share of danger and suffering. "Those who erroneously think the cold of winter bracing and wholesome, (and the error is unfortunately very general,) forget what the weak and infirm, the aged and invalid, suffer under such circumstances, and do not reflect," says Bateman, "on the multiplying brood of pulmonary, rheumatic, dysenteric, and other inflammatory disorders, with consumption at their head, from which even the most robust are not exempt."—"During the winter of 1814," he says again, "in which the frost continued three months, the number of patients at the public dispensaries exceeded by seven hundred the ordinary average; in other years, for the same period, not much exceeding five hundred. The bills of mortality exhibited a corresponding increase at that time; and an attentive observer could not fail to remark, during the whole spring of that year, how much the gaiety of that season was chequered by the numerous funerals which daily passed along the streets." The January of 1795 was, it is well known, the coldest, while that of the following year (viz. 1796) was the warmest January of which any regular account has been kept in this country. From the bills of mortality of those years, Dr. HEBERDEN ascertained that the whole mortality of January 1795 was double that of the January following; and that the mortality amongst the aged in particular was



five times larger in the former month than in the latter. Dr. Heberden discovered likewise a great relative increase of mortality amongst infants and young children. Like results have been lately obtained by Dr. MILNE EDWARDS, in Paris, in researches of which I have not at hand the particulars; and these facts and opinions entirely coincide with what I have myself adopted from observation, on a considerable scale, amongst the poor of Westminster.

Winter and spring invariably make great additions to the sufferings of invalids, particularly in pectoral complaints, as well as great inroads on the general previously healthy community. I have had frequent opportunity of observing an increase and aggravation of rheumatic and pulmonic diseases in particular, in consequence of a change of wind from the south and south-west towards the northern and north-eastern quarters.

The remaining matter of this portion of the medicinal history of cold I shall distribute into six sections:

1. Definition of terms.
2. Morbific properties of cold.
3. Diseases of cold.
4. Principal forms of morbific cold.
5. Circumstances most favorable to the morbific action of cold.
6. The best means of preventing diseases of cold.

Definition of Cold, &c.

In medicine, cold means either a familiar disease or a well-known disagreeable sensation, or else a temperature of surrounding bodies considerably less than that of the more perfect animals, and capable of causing in them the peculiar sensation above referred to, and ultimately, if applied under favorable circumstances, of disturbing health, and even of destroying life. We can scarcely fix on any thermometrical degree as the boundary between cold in the last sense, and warmth or heat. Numerous causes modify, in various ways, our susceptibility of the sensation of cold, and likewise of the morbid effects of exposure to low temperatures. Habit modifies susceptibility. A hot bath at ninety-five degrees would be as hot as many could conveniently bear, yet I know a young gentleman, enjoying vigorous health, a native of Britain, who, from frequent use of the warm bath, can now enjoy himself in water as high as 108 or 110 degrees; a temperature a dozen degrees at least higher than he could some time since have borne: on the other hand, the hardi-

ness of some individuals, as couriers, sailors, &c., and their capability of bearing exposure to cold, is familiar to every one. Constitution must also be taken into account: a bath at seventy-five degrees of Fahrenheit, which to most people would be rather disagreeably cool, was oppressively hot to a lady of Rostan's acquaintance. Health also affects the question: in one class of diseases, we have examples at once of opposite extremes of sensibility to change of temperature and to cold. I mean the neuroses. Of defect of sensibility to a frigid atmosphere, CURRIE gives a striking example in the case of "a young woman, once of the greatest delicacy of frame, who, being struck with madness, lay all night (on one occasion) on a cold floor, with hardly the covering that decency required, when the water was frozen on the table by her, and the milk she was to feed on was a mass of ice." The sensibility of many neuralgic patients to cold and change of temperature, is matter of frequent experience. The nature of the cool substance is likewise important, as well as the mode of its application. Every one has observed the difference between the coldness of air and water of like temperatures, and has also remarked the difference between exposure to cold in a still and in an agitated or progressive medium. The countryman is hardier than the citizen, the highlander than the lowlander, the male than the female, the young than the old, the adult of middle age than infants or grey-headed persons. Hunger, venery, drunkenness, in short, a great number of circumstances, modify the sensibility to temperature and susceptibility of morbid impressions; so that a precise determination of boundary line between cold and warmth is impracticable, and the limits that separate moderate from immoderate cold are equally fluctuating, and from the same variability in the susceptibility of individuals, and a similar liability of any determination of the point that we might attempt, to exceptions and restrictions, at once numerous, minute, and equivocal. Suffice it then to say generally, taking as our standard a vigorous adult of these islands, that a still air not more than sixty or seventy degrees below bloodheat, (viz. ninety-eight to ninety-nine degrees, is moderately cold;) while a tranquil atmosphere falling short of ninety-eight to ninety-nine degrees, by seventy or eighty degrees, or more, is immoderately or extremely cold; and that water, from its superior refrigerating power, would, under similar circumstances, be moderately or immoderately cold at temperatures ten to twenty degrees higher than air.

Morbific Properties of Cold.

There can be no doubt that the operation of cold as a morbid cause, is always in the first instance chemical. Refrigeration, or abstraction of caloric, is the only effect necessarily and invariably attendant on the application of a cooling substance. The temperature of the external body may be relatively moderate or excessive, the cooling medium may be applied in a tranquil or in a progressive state; and upon such difference in the refrigerant process, no doubt, may depend very important differences in the morbid effects of cold: still, however, the result of the application of cold depends, to an equal or even greater extent, on the susceptibility of the subject; and that susceptibility is dependent on and constituted by multifarious conditions, with which atmospherical heat or other changes have nothing to do. Refrigeration is then always the first step in the process that ends in a disease of cold; the rest depends on the properties and susceptibilities of each of the principal organs and functions exposed to refrigeration, and to the recuperative energy and stability of the whole frame.

The parts and functions whose physiological states are sensibly modified and vitiated by cold are, 1st, the teguments or skin, and mucous membranes; 2d, the muscles; 3d, the blood; 4th, the respiration: 5th, the caloric function; 6th, the circulation; 7th, the absorption; 8th, the nervous system. I proceed to the enumeration and illustration of the morbid effects of cold on each of those parts and functions: the morbid properties, or modes of noxious action, of that great enemy of life once pointed out, the reader will, I hope, require little aid in the application of the elementary principles assumed. So far as they will go in explanation of the *modus operandi* of cold in the production of particular diseases; so far as I shall be successful in my attempt, I shall, in fact, have furnished the inquirer with the data required for the solution of his etiological problem; so that little will be required from me under the next head, viz. *Diseases of cold*. Indeed, a detailed development of my views respecting the causation of those diseases would be doubly objectionable, namely, for the reason just given, and for the additional one, that the detail would necessarily involve much repetition of matter previously inserted under the present head of the *Morbific properties of cold*.

An *increased sensibility in the skin to friction, percussion, &c.* is an uniform effect of the cold bath: I have often observed it. This exaltation of sensibility is accompanied by

augmented redness and vascularity, and is still more striking in the case of parts exposed to a biting atmosphere; and, though I have not myself witnessed it, I have no doubt but MACQUART is within bounds when he says that "the slightest blow upon a hand or face frozen, as the popular expression is, with cold, excites a most violent sensation, and is often sufficient to cause rupture of the vessels, contusion, &c."

Diminution of sensibility, with functional torpor, from cold, are common effects of cold. When steadily applied, as in winter or in a protracted immersion in a cold bath, cold never fails to check the activity of the capillaries and exhalents of the skin, and transitory cold has the same effect in the predisposed. In the aphorisms of SANCTORIUS, (sect. 2, aph. 9,) we are informed that "if, in a warm season, a cold day happen, in the space of that day, supposing the way of living to be the same, about one-third part of the perspirable matter will be obstructed." The secreting and excretory processes are suspended; the oily and saline, and perhaps gaseous, ingredients of the perspiration, which are products of organic action, are, to a greater or less extent, wanting; the skin becomes dry and scaly; and the effete matters that should find their egress at the external surface are repelled towards the interior, where they must find some other outlet, or are detained in the circulating mass, to vitiate that source of all nutriment, and sow the seed of disease and death.

One of the first effects of cold on the skin, though last in this enumeration, is *contraction or shrinking*, which causes that appearance popularly called gooseskin: it is attended by an acuminations of the bulbs of the hairs, and by an erection of the hairs themselves, which gives a disagreeable roughness and coarseness to the surface affected. In an intensely cold atmosphere, this constriction has been known to proceed to such an extreme as to produce cracking and laceration of the skin, as from excessive tension.

Mucous surfaces. The mucous surfaces, with the exception of that of the lungs and air-passages, are not exposed to the action of cold, and are seldom the seats of disease from that cause, except mediately and in consequence of some morbid impression transmitted to them from the skin. The following passage sufficiently proves that, in healthy subjects, the pulmonary mucous membrane is but little susceptible of derangement from cold.

"Exposure to a cold atmosphere, when the body is well clothed, produces no bad effect whatever, beyond a frost-bitten cheek, nose, or finger. As for any injury to healthy

lungs from the breathing of cold air, or from sudden changes from cold into a warm air, or *vice versa*, it may, with much confidence, be asserted that, with due attention to external clothing, there is nothing in this respect to be apprehended." Captain PARRY, whom I quote, (3d Voyage,) speaks from observation of the effects of extreme cold, and of violent and sudden transitions, on the health of 120 persons during four winters in polar regions, in which transition of from ninety to one hundred degrees in a space of less than half a minute were events of daily and hourly occurrence. He further says, that, under such circumstances, or previously to such transitions, "a covering for the mouth" is not at all necessary, though very comfortable," (chap. 3.) Every one has experienced the safety, and even benefit, of iced drink, ices, &c. The mucous membranes, therefore, partly from being inaccessible (*ex. gr.* those of the abdomen and pelvis,) to the air, partly, perhaps, from superior natural hardiness, (if such an expression is admissible,) are little liable to the diseases of cold from direct refrigeration, and suffer generally from atmospherical influence but mediately, and in consequence of disturbance of the cutaneous functions, suppression of the perspiration, and vicarious irritation.

The importance of that antagonism or disposition to vicarious action between the internal and external surfaces, which I have just alluded to as a source of disease in the mucous membranes from cold impressions on the skin, is very great. It has been before stated that the pulmonary tegument, with its ramifications in the face and pharynx, is the only mucous covering that can be immediately exposed to atmospherical influence; the only organ in fact, the skin excepted, that can suffer from cold directly, and without an exertion of the circuitous morbid power of some sympathetic connexion with the skin. It has also, in effect, been stated that, in the majority of cases, catarrhal affections of the air-passages are generally not owing to the inspiration of cold air, but to disturbed cutaneous action and suppressed perspiration. Now the mortality from cold is enormous, and arises not from cutaneous or mucous diseases solely, or even principally, but from inflammation, and other morbid affections of the serous coverings and substance of the viscera of the great cavities. The importance, then, of duly-sustained functional action in the skin, not only to the health of the mucous membranes, but to that of the frame in general, is very great. I am almost convinced with RITTER that he who takes adequate precautions against diseases of cold, avoids nine out of every ten disorders that he would have been liable to; and I consider his suggestion

by no means absurd, when he half seriously, half jocosely, recommends that the following adage should be written over every door in Germany, in letters of gold, one foot long, "Behüte deine ausdünstung, auf das du lange lebest und gesund seyest."*

A curious morbid effect of the cold bath, and of a cold atmosphere, is frequent micturition, dependent apparently on irritation of the mucous membrane of the bladder. In some instances, the influence of cold applied to the external surface in producing irritation in the urinary organ strikingly illustrates what I have said relative to the influence of cutaneous refrigeration over the internal parts, and particularly the mucous tegument of the urinary passages. MARCARD mentions the case of a gentleman, who had borne with impunity the severity of a Russian winter, yet could not apply the palm of his hand to a cold stone without a desire to make water and an expulsive effort of the bladder.

Bulimia is another curious example of the morbid effect of cutaneous refrigeration: examples of it are numberless. PLUTARCH, in his life of Marcus Brutus, mentions that that remarkable person, having made a forced march, in order to reach Dyrrhachium (a town on the coast of Illyricum opposite Brundisium,) before Caius, Anthony's brother, had left his sutlers behind, owing to the ruggedness of the way and depth of the snows, and was seized with the disorder called Bulimia, or violent hunger, occasioned by cold and fatigue. Brutus growing very faint, and no provisions being at hand, his servants were forced to go to the gates of the enemy, to beg bread of the sentinels. He also says, that this disease affects both men and cattle after fatigue in the snow. BEAUPRÉ says that, in the retreat of the French army from Moscow, many fell victims to a frightful bulimia. In that unhappy retreat, the suppression of the cutaneous evacuations was followed by the most destructive derangements of the interior teguments. "The skin," says Beaupré, became dry, discoloured, filthy, earthy, and as if contracted. The suspension of the excretions of the skin was attended, as usual, by excessive and morbid activity of the mucous surfaces. From the month of November, the excessive cold had benumbed the vital energy of the skin, whilst that of the mucous membranes received a considerable increase, and such as characterizes inflammatory affection of that system; consequently, during the winter of 1812, Wilna, where great numbers of the French sick were deposited, and in the vicinity of which the

* "Guard well thy perspiration, that thou mayst live long and be healthy."

inhabitants having lost their houses, had been equally exposed to cold and privation with the French army,—Wilna was infested with an epidemic catarrhal fever.

Muscular system. The morbid effects of cold on the muscles are *trembling, stiffness, cramps or spasms, instantaneous rigidity.*

The sensible part of the condition of *trembling* has its seat, no doubt, in the muscles: the quivering motion of the muscular fibre is, however, I suspect, but a part of the morbid effect of cold: I am disposed to consider it as itself an effect of an anterior morbid impression on the cutaneous nerves in which the motor nerves participate. To give my reasons for this opinion at length would occupy too much space. HUMBOLDT always found that cold applied to the substance of a muscle was followed, not by tremor, but by quiescence. Versuche über die gereizte Nerven-und Muskelfaser, &c. Like trials have, in some experiments of my own on the heart, been attended by like phenomena.

Stiffness and inaptitude to motion is a constant effect of protracted exposure in the cold bath: I have often experienced it. Of this state, the rigidity above mentioned amongst the effects of cold on the muscles, is but an exaggeration. QUINTUS CURTIUS, in his "Life of Alexander," mentions, (speaking of the sufferings of the army in a wild northern expedition,) "In this uncultured wild, the destitute army has every variety of ill to endure: the blast of the desert extinguished life in many, and caused the feet in others to mortify; its white glare perniciously affected the eyes of the majority; some, having stretched on a bed of ice their exhausted frames, were, through want of motion, so stiffened by the frost that, when they tried to rise, they were unable; the torpid were lifted up by their comrades. There was no better remedy than compelling to walk," he continues; "the vital heat thus excited, the use of the limbs in part returned."

"In the Russian campaign," says Beaupré, "soldiers have been seen expiring instantaneously, as if thunderstruck from excessive cold. At Smolensko the temperature was so rigorous, that more than thirty grenadiers of the Italian guard fell frozen as they attempted to set themselves in line on a height beyond the Borysthenes. A battalion of the regiment I belonged to, when encamped on the same height, lost in this way many men in a single day." In such cases, as also in examples of persons suddenly immersed in very cold water after violent exercise, as skaiters, instantaneous death is principally attributable to asphyxia produced by fixation of the chest, owing to spasmodic rigidity and rapid congela-

tion of the muscles of the thorax. In some cases, also, apoplexy or syncope might be supposed.

The Cramp that attacks swimmers is an effect of cold on the muscular system, with which every one is familiar. Dr. CURRIE informs us, that "the principal source of inconvenience and pain experienced by Mr. Amyot, (in his perilous situation after the shipwreck in the mouth of the Mersey, in December 1790, of which Dr. Currie has published an account,) was spasms of the voluntary muscles: what most distressed him were cramps in the muscles of his sides and hips, which were drawn into knots." We are informed by MM. PARAT and MARTIN, (*Memoires de la Société Méd. de Lyons*), that the French soldiers that inhaled incautiously the piercing blasts of Mont St. Bernard, during Napoleon's march across the mountains into Piedmont, were in numerous instances affected with spasmodic contraction of lips, constrictions of the fauces, and other similar affections of the air-passages. Captain SCORESBY mentions, in his "*Arctic Regions*," that on one morning, after a night during which the thermometer had fallen from thirty to fifteen degrees (Fahr.), the following effects were observed: the circulation of the blood was accelerated; a sense of parched dryness was excited in the nose; the mouth, or rather lips, were contracted as if by a sphincter, and the articulation of many words rendered difficult and imperfect.

Blood. The blood is, perhaps, after all, that constituent of the animal that suffers, in many cases, the most important modifications from cold. The blood is a current into which pass all the effete particles, on their way to the several emunctories; it is likewise the source of all materials deposited by nutrient arteries in the substance of the organs. Every accession and every loss to its tide is preceded or followed by chemical change, and to every chemical change the presence of caloric, in some certain quantity, must be essential. To the continuance, therefore, of the higher functions of the blood, the application of cold, i. e. the abstraction of heat, must, to a greater or lesser extent, prove an obstacle. The effects, therefore, of refrigeration on the blood, considered merely in its chemical relations to the vital organs, must be of great importance. The share, therefore, of the blood in the constitution of the majority of diseases of cold, (*ex.gr.* in inflammatory and cachectic diseases,) must, however indefinite and unascertained, be very considerable. And the extent of the morbid power would be greatly enlarged if, in addition to the chemical affections just alluded to, we should, with G. R. TREVIRANUS, Dr. EDWARDS, and others,

attribute to the red globules a sort of independent vitality. Though not a convert to that physiological theory, on whichever side truth may lie, I consider the facts and reasonings of Dr. Treviranus ("Biologie") extremely interesting, and readily acknowledge the importance of the observations of Dr. Edwards, to the accuracy of part of which, through the favor of that gentleman, I can myself bear witness.

The morbid changes in the vital fluid above alluded to are Plethora, the Inflammatory State, and the Degenerations of cachexies, fevers, &c.

Plethora from cold seasons and weather arises partly from diminished waste, and partly from increased supply. There is in healthy persons, in winter, a great diminution in the evacuation by the skin, which is by no means compensated for by increased activity of the other emunctories. SANCTORIUS found that temperate persons weigh about three pounds more in winter than in summer. The indolent and luxurious experience, in many cases, great augmentation, both in size and weight, towards the end of the cold season. In winter, the expenditure, in the form principally of perspiration, not only is greatly less, but the appetite, powers of digestion, and consequently supply of nutrient matter, are often considerably greater, than in summer.

The *inflammatory state of the blood*, marked by the formation of the "buffy coat" on blood drawn by the lancet, is the effect, probably, of some reaction of the nervous system on the vascular, and on its contents. That state may, I believe, exist without local inflammation. It is not a normal state in any population, however far from the line; nor does cold weather produce it simply as cold weather. It has been supposed that the state of the blood under consideration is produced by the matter of the suppressed perspiration, which, being retained in the circulation, vitiates the fluids, and communicates to them that morbid disposition. It has been further proposed as a solution of the question why some persons more readily catch cold than others, that the former class excrete a more irritating, and as it were poisonous, perspiration; while the comparative immunity enjoyed by the latter is owing to the blander and more innocuous composition of their perspiration. But I have little faith in either of those speculations. Another opinion that I have met with is still less probable, viz. that the cold coagulates, as it were, the albuminous matter, and condenses it (as I understand the writer) so as to render it concrescible on the abstraction of heat and motion. The ætiology, in truth, of "buffy blood" is quite uncertain. An infant physiology leaves us almost

entirely in the dark respecting the normal susceptibilities of the blood. We have nothing like adequate information regarding the relation between that fluid and the nervous system more particularly, which is the very quarter probably in which further light would be most useful. There is, on the one hand, good reason to suppose that the blood is capable of assuming the inflammatory state, independently of any morbid operation on the part of the nervous organs: plants, insects, brainless monsters, paralytic limbs, &c. are susceptible of inflammation. Nor are facts of an opposite tendency wanting. Irritation of nerve by mechanical stimulus is capable of producing turgescence and inflammation, with all its consequences, in a part previously healthy. The nervous system is in the highest degree sensible to change of temperature: there is no direct or unequivocal proof that the blood is like the nerves, susceptible of morbid changes from atmospheric influence, as an exciting cause of disease. The source of that animal heat, also, which figures so prominently in diseases of cold, may be the blood alone or the nerves alone; or it may be the product of conjoint action, the blood furnishing the material, and the nerves the stimulant. With such an imperfect knowledge of the relations between the blood and physical agents, and between the blood and the nervous system, it is impossible that the ætiology of diseases of cold should not to a great extent be a mystery.

Another morbid state, or class of morbid states, above referred to, are those *cachectic* conditions of the blood that characterize many of the chronic diseases of cold, *ex.gr.* scurvy, jaundice, chlorosis, and other obscure affections in many cases attributable to cold. Exposure to cold has frequently occasioned icterus and *suppressio mensium*. Amenorrhœa and scorbutus are diseases most frequent in cold latitudes. In those and other cachectic states, febrile or otherwise, there can be no doubt of the presence of an unhealthy crisis of the blood. The following picture, though a sketch of an extreme case, will illustrate the operation of cold seasons in vitiating the blood, by preventing depuration at the emunctories, and favoring stagnation, degeneration, and perhaps decomposition. "The want of a constant supply of warmth is here (in polar regions) immediately followed by a condensation of all the moisture, whether from the breath, victuals, or other sources, into abundant drops of water, very rapidly forming on all colder parts of the deck. A still lower temperature modifies, and perhaps improves the annoyance, by converting it into ice; which again an occasional increase of warmth dissolves, by converting it into

water. Not only is a moist atmosphere thus continually kept up, but it is rendered foul by the want of that ventilation which warmth alone can furnish. With an apartment in this state, the men's clothes and bedding are continually in a moist and unwholesome condition, generating a deleterious air, which there is no circulation to carry off; and whenever these circumstances combine for any length of time together, so surely may the scurvy, to say nothing of other diseases, be confidently expected." (*Parry, 3d Voyage.*)

Respiratory Function. The effect of even severe cold on the respiratory functions and organs is usually not very remarkable. *Hurry of respiration* is a familiar effect of the cold bath. Inhalation of intensely cold air has been followed by *sense of suffocation*, and even by a feeling of *laceration* in the chest. FLETCHER, in his account of a Russian winter, (*Purchas's Pilgrimes*, vol. iii. b. 3,) states, that "when you pass out of a warm room into a cold, you shall feel sensibly your breathe waxe starke, and even stifeling with the cold as you draw it in or out." MAUPERTUIS (*Figure de la Terre, &c.*) found the cold at Tornea, in December 1736, I think, so intense, that, "on opening a heated apartment, the external air rushing in, turned the vapour of the room into flakes of snow; and, on going out of doors, the air seemed to tear the chest." Even immediate death, from asphyxia apparently, has followed the sudden passage from a heated room into an extremely cold atmosphere; of which MACQUART has seen an example. If the chemical changes that take place in the lungs be, like several other animal processes, susceptible of increase and diminution from atmospherical agency, may not the suffering of asthmatics in cold weather be caused by suspension, at least in part, of the process of decarbonization? The influence of residence in a warm atmosphere, of the free use of alcohol, of mercurialization, &c. on the consumption of oxygen, proves that the chemical part of the arterializing process varies more or less with circumstances, and to a certain extent favors the supposition. No doubt, the additional load of fluids thrown on the pulmonary mucous membrane by the suspension of excretion in the skin must also be remembered, and is of the first importance in the theory of humid catarrhs, &c. If cold be capable, as above supposed, of suspending the chemical functions of the lungs, it is probable that sudden death from inspiration of cold air, of which BEAUPRÉ, MACQUART, BRAMBILLA, FLETCHER, and others have recorded examples, may, in some instances, be attributable to such an event.

Animal Heat and Calorific Function. The morbid effects of cold on animal heat and the calorific function are, 1st, Ab-

straction of Heat; 2d, Depression of the Power of evolving Heat; 3d, Reaction. Under refrigeration, the cutaneous warmth rapidly disappears, and an almost death-like coldness of the surface is readily produced. The viscera, however, and the blood circulating in the deeper-seated vessels, retain their normal heat long after the chilling of the surface. After having reduced my pulse twenty beats, and my heat in the axilla six or seven degrees, I found that the bladder had lost nothing of its natural warmth: its contents still gave ninety-eight or ninety-nine degrees of Fahrenheit. Reaction readily follows refrigeration, more particularly if the return of heat be favored by external warmth. That law of organic nature which resists disturbing causes, counteracts depressing agencies, expels noxious elements, supplies deficient conditions of life and health, is remarkably exemplified in the operation of cold in the living body. The glow experienced by persons in vigorous health after the first impression of coolness on the face, &c. in frosty weather, is a familiar illustration of this subject. The effect of exposing parts chilled by frost to the heat of warm water, or of a fire, is another instance. Such facts abound; but I have met with no proof of this recuperative, compensative energy so unequivocal as that furnished by the effect of immersion in cold water. In the situation of a healthy adult male, free from every excitement, moral and physical, fasting, just risen from bed, and immersed, with the least possible previous exertion, in a cold bath of still water, there can be but few sources of fallacy. In such circumstances, I have repeatedly found my heat (under the tongue,) to decline, not in the ratio of temperature or time of exposure, but irregularly, and so to speak, reluctantly, with frequent momentary rises and fluctuations, and those unaccompanied, so far as I could see, by any corresponding changes in the nervous or vascular systems. In the experiments of Dr. CURRIE, if they can be depended upon, results still more strikingly confirmatory of the existence of that organic power were obtained. Dr. Currie's observations on the effects of cold bathing furnish several instances in which not only was the heat of the subject found to decline irregularly, as above stated, but even after the lapse of some time, the thermometer was observed to rise again, so as, in the course of fifteen or twenty minutes, to reach within three or four degrees of the standard of health. Such a result I have myself never obtained as that last mentioned.

Protracted refrigeration depresses the calorific energy. The chemical processes are checked in the superficial and subcutaneous circulation, and the average temperature of the blood

is lowered; the activity of the capillary vessels, and ultimately of the heart and great vessels, is diminished; the energy of the nervous functions is lessened; it is plain, therefore, that, from internal sources, the re-establishment of the normal heat after protracted refrigeration must be slow and gradual. Dr. Currie mentions that a man, whose heat before bathing was one hundred degrees, and after fourteen minutes immersion ninety-five degrees, and who was cooled down to eighty-eight degrees by three minutes' exposure after the bath to a north-east wind, had, at the end of an hour spent in a warm bed, and notwithstanding that he had had a draught of ale, attained to no higher degree than ninety-five degrees. In another experiment, the same person had not recovered his natural temperature (ninety-eight degrees) three hours after bathing and exposure to the wind, notwithstanding frictions, brandy and water, and the application of a bladder of hot water to his præcordia. I am aware that, in enumerating amongst the elementary causes of diseases of cold, reactive effort and depressed energy of the calorific function, I lay myself open to the charge of ascribing real sensible effects to mere abstractions and hypothetical entities. But I am no disciple of the mystic physiology of Montpellier; and I am well aware that, in pathological as in physiological ætiology, *vital properties*, *vital functions*, &c. are not substantive causes, but logical entities, or figures of speech. Since, however, it is uncertain what the agent or agents are that produce animal warmth, I have preferred using language involving no theory on the subject, and refer those who attribute animal heat to nervous or vascular action to what I shall hereafter say on the morbid effects of cold on the circulation, and on the nervous system.

Vascular System. The effects of cold on the vascular system have been much disputed. From the best consideration I have been able to give to the facts that have fallen under my own observation, or that I have met with in books, I have come to the conclusion that *Cold, in its immediate or direct operation on the heart and arteries, is purely sedative*, and that the phenomena owing to which various esteemed authors have, as I conceive, erroneously attributed to cold a stimulant power over these organs, have been referrible to the action of unobserved disturbing causes and sources of fallacy. I have made a considerable number of experiments with a view to the determination of this question: of these experiments I have generally myself been the subject. The form of application I have used in most instances has been the fresh water bath, at a temperature commonly twenty-four or twenty-

five degrees above the freezing point; and the result of these trials many times repeated were uniformly confirmatory of the sedative action of cold. I usually entered the bath immediately after rising out of bed, and continued immersed until the supervention of rigors and brisk shivering, and found, for the invariable result of the experiment, a diminution of the frequency of the pulse of fifteen or twenty strokes, with some decrease of force also. I have some confidence in the result of these trials, because I know myself to have been perfectly free from any peculiarity of habit or susceptibility with respect to heat or cold, and because I took the greatest care to avoid every fallacy arising from inattention to diet or regimen, or to moral or physical agitation or exertion, or to bodily position before, during, and immediately after experiments. Some particulars of the results of those trials I published some years since, in an appendix to an English edition of a French work on the Medical History of Cold; and I have since that time (1825-6) met with nothing to alter my opinion on the subject.

The circumstances that have, as I think, misled various writers relative to the effects of cold on the circulating system are numerous. I shall point out some of the principal: 1st, Aversion to the bath is one cause; the influence of moral feeling over the heart's action is matter of hourly popular experience. If the subject of observation enter the cold medium reluctantly, we must not be surprised if, even after the lapse of some minutes, we can detect no diminution in the frequency or force of the heart's action. 2dly. Another cause is the extreme sensibility to changes of temperature observable over the whole cutaneous surface of some individuals. There is no viscus over which that most important organ, the skin, does not exert, under some circumstances, the most marked influence; the rousing, vivifying, otherwise stimulant, action of the cold affusion or cold douche in coma, insensibility, &c. from alcohol, opium, prussic acid, and other narcotic poisons, is well established; the restorative effect of sprinkling cold water on the face, neck, &c. in syncope is practically known to every fine lady. A third source of fallacy is disturbance of the respiratory function: on this subject I have the following observations in the volume formerly referred to. "In every instance in my experiments on the cold bath, I found the abdominal parietes yield to the water, so that much less than usual of the room necessary for the air inspired was obtained by pushing down the viscera, and consequently much unusual labour devolved on the elevators of the ribs. In some instances, the renewal of the preternatural state of respiration by leaving the bath was immediately, on sitting tranquilly for

a little, followed by a fall of many strokes in the minute. In ten minutes after the bath, it fell, on one occasion, from fifty-seven degrees (to which the bath had reduced it from sixty-four degrees) to forty-five degrees."

A fourth source of error is the occurrence of shivering. In the course of the experiments above alluded to, I never failed to observe a striking change in the state of the circulation after the refrigerant process had been carried far enough to produce rigors, &c. To quote my own observations again, "On the supervention of shivering, I always found the pulse to rise in frequency, and become at the same time irregular, and rather difficult to count." A fifth source of fallacy is voluntary muscular exertion, whether immediately before the exposure or during the experiment: so powerful is the influence of muscular efforts in counteracting the sedative power of cold over the blood-vessels, that, under exposure to the most intense and freezing atmosphere pedestrian exercise is sufficient, in most instances, to preserve even the toes from asphyxia and congelation. A sixth fallacy arises from inattention to posture: it has been for a good many years known, and has lately been verified by some able inquirers of the Irish metropolis, that between the recumbent and erect postures there is a difference of more than a dozen beats per minute. A seventh source of error has been the not taking into account the stimulant operation on the heart of an unusual accumulation of blood in the great vessels, in consequence of refrigeration of the surface. Such are the circumstances, from inattention to which, as I believe, able writers have fallen into the error of attributing to cold a stimulant power over the heart and arteries.

Of the *sedative* power of cold over the circulation, we have interesting illustrations in the narratives of late travellers in polar regions. Captain FRANKLIN mentions that anasarca was common and troublesome amongst his party during their excursions in the snowy regions of the Esquimaux. Captain PARRY informs us, that the greatest difficulty was experienced in effecting the cicatrization of wounds and ulcers during his stay in winter quarters. During the late severe winter of 1929-30, I myself experienced the necessity of at least moderate warmth as a condition of healing superficial ulcers in the case of a young lady, who had scalded herself. Granulation was in this case very difficultly obtained, and cicatrization was not brought about without the aid of artificial warmth and unusual coverings.

Another effect of cold on the circulation is *turgescence*: a sharp blast, or the application of a very cold body to the skin, often produces vascularity, redness, and fulness. Ex-

treme atmospherical cold operating on the whole surface of the body often produces priapism, or venous turgescence; and there is reason to believe that the spleen and other diverticula, and the great veins of the cavities, are similarly affected. But the turgescence of the arterial capillaries first mentioned, or reactive turgescence, otherwise vascular reaction, is probably not a direct or immediate effect of refrigeration, but rather the result of an erethism of the cutaneous nervules, occasioned by the sudden or very rapid abstraction of their caloric. The causation of the reactive efforts observed in the vascular system and calorific function, when subjected to refrigeration, will be hereafter considered.

But the morbid effect of cold on the circulation, which is perhaps the most important, is that change in the distribution of the blood which might be called *centralization*, and which consists in the retirement or abstraction of the fluids from the skin and superficial parts, and generally from the capillary arteries of the extremities, and their accumulation in the great trunks of the viscera and cavities, and principally, I imagine, in the great veins of the head, chest, and abdomen. This is an effect of protracted cold that is universally admitted, and highly probable, if not quite certain; but the necrotomic proofs are, it must be granted, rather scanty. Opportunities of examining the bodies of persons dead of protracted refrigeration are happily rare in this country. When death does happen from exposure, it is usually in cases in which exhaustion from labour and famine, and other circumstances, have conspired with cold, and the induction is consequently embarrassed. But there are several considerations that make for the conclusion generally adopted, and none that I have met with that have any weight in the other direction. Priapism is an effect of extreme atmospherical cold; now it is quite certain that the erectile tissues owe their occasional distention to venous congestion. Protracted immersion of the leg in very cold water generally produces a bluish redness of the skin, which is apparently a local venous congestion. The state of persons emerging from cold water, after the super-vention of violent shivering, &c. resembles that of a sick man in the cold stage of fever, not only in the feeling of coldness and real deficiency of caloric, and in the muscular agitation and arterial disturbance, and contracted and functionally inert skin, &c., but also, in many cases, in the aching head, and oppressed chest and abdomen. I recollect very distinctly the appearance of a Genevese *commissionaire* who attended me some years since at Göttingen, and having often boasted of his skill in swimming, diving, &c., proceeded at length to give me a

"taste of his quality." Having plunged from a height into a pond used by the students for bathing, he remained below, or at least out of sight of my friend Dr. Haycraft and myself, who watched him narrowly for about twelve minutes, and then ascended, or at least reappeared and came to land, having in many respects the appearance of a patient in malignant cholera. The pulse, indeed, was easily felt, but was weak, hurried, and very irregular; the face was hippocratic, with shrunken features and singularly wild and ghastly expression; the lips, extremities, &c. were purple or bluish; the skin of death-like coldness, &c.; he shivered violently, and complained of great inconvenience from oppression at the chest, &c., and assured me that he would never repeat the experiment: which I should mention he had voluntarily undertaken and gratuitously performed. As the story is singular, I may add that he represented himself as having acquired the power of enduring protracted immersion by diving in early youth for small pieces of money thrown by English and other foreign residents into Lake Lemane; and that, on the particular occasion in question, he dived to the bottom, where, at a depth of about eighteen feet, he laid hold of a stone, and was thus enabled to maintain his position below.

The veins and the erectile tissues they supply readily admit of even great distention. The functions of the veins are principally passive; amongst several extrinsic forces, by aid of which they forward the blood towards the centre, is probably a pumping action of the right side of the heart. The arteries are elastic and react with energy upon distending fluids, and readily shrink after the evacuation of their contents by hæmorrhage, or other mode of depletion. In the capillaries, the reactive force is probably very great. Those vessels, however, possess another property: they seem sensible to stimuli in the same manner nearly as muscular fibre. Amongst other stimuli, we are assured by Drs. THOMSON and HASTINGS that a capillary has been seen to contract under the influence of ice, even so as to disappear; its contents having been expelled into the veins. These facts confirm the power of centralizing the blood above attributed to extreme cold. A refrigerated blood will stimulate the heart feebly, and that organ will consequently absorb less blood from the veins, and expel less into the arteries than under other circumstances. The capillary arteries also, particularly the superficial ones, being torpidified, and perhaps shrunk and rendered somewhat rigid by cold, will receive and forward less than their usual quantum. The spleen, the portal circle, the sinuses of the brain, and great pectoral vessels are then the natural asyla

or diverticula of the blood. The effects of heat upon refrigerated parts, or individuals, further confirm this position; which is of the utmost importance if well founded, and in favor of which, being well convinced that it is so, I am anxious to adduce every important fact and analogy I can find capable of, in any degree, compensating for the defect of necrotomic evidence. The changes in the sensation and in the external appearance of an individual refrigerated and shivering from a very cold atmosphere, all either favor the theory of centralization or are indifferent to it. The rapid return of lively sensibility, warmth, smoothness, fulness, redness, &c. to the skin upon the application of heat, all point to fluxion towards the surface and depletion of the asyla and diverticula above mentioned as their essential cause or necessary concomitant. The opinion under consideration is further corroborated by the great frequency of anal, pulmonary, and other internal hæmorrhages in cold climates and seasons: and there are other pathological facts that confirm it.

Absorbents. Absorption is retarded by cold seasons and atmospheres. Dropsies are difficult of cure, and frequent of occurrence in cold countries and seasons, not only because cold checks perspiration, and, by closing one great outlet, leaves much additional labour for other emunctories, but also because it diminishes the activity of the circulation, and checks those processes, chemical and mechanical, on the perfection of which depends a complete removal of effitte particles and effused fluids. If absorption be a vital process, it must obviously suffer from protracted refrigeration; and if it be physical or *endosmotic*, it is clear that it must stand in need of sufficient caloric as a necessary condition of fluidity, solubility, affinity, and perhaps permeability.

Nervous System. The morbid affections of the nervous system producible by cold are more numerous than those of any other system from the same agent; they comprise diseases, both positive and negative, of the sensitive nerves, of the motor nerves, and of the moral functions.

Cold produces both *pain* and *numbness*: of the former there are many varieties. There is the familiar disagreeable sensation, the feeling of chill or coldness, which is experienced in all degrees from mere coldness to a piercing, freezing cold. If our sensations were well watched, and as Macquart, I believe, truly says, "they are in such matters trustworthy and excellent monitors," we should, I am convinced, be able not only to escape the consequences of exposure on many occasions by timely retreat, or other precaution, but, when unavoidably or accidentally sufferers from the morbid power of cold, we

should seldom be at any loss to identify the time and place of the injurious impression, and consequently should rarely be in any doubt as to the cause of our disorder. So sensitive is the nervous system in health to every movement of caloric, every fluctuation of temperature, that I am convinced that no dangerous refrigeration of the surface could pass unnoticed by those who attend to their sensations. Those impressions of cold that occasion diseases of internal organs by, as it would seem, some irritation transmitted from the surface, and which appear to be the usual occasions of rheumatism and of inflammation of the viscera, are commonly, if not invariably of this kind. The other forms of pain of cold usually attend or occasion inflammation of the tegument exposed. PELHAM, in his account of the eight seamen left by accident at Spitzbergen, where they passed the winter of 1630, speaks of a *burning* pain: he informs us that, "after the new year, the frost became so intense as to blister their flesh like fire, and sometimes to seize them so that their flesh felt sore, as if they had been cruelly beaten." Another form of pain is that of *pricking, lancinating* pain which attends local asphyxia. MAUPERTUIS, in a passage above cited, informs us that he experienced a *lacerating* pain from inhalation of the cold air of a Tornea winter. MM. PARAT and MARTIN speak of similar forms of pain of cold. *Numbness* or *torpefaction* is a familiar effect of protracted or intense cold: it is rarely productive of important mischief. Incautious admission of heat to a part so far refrigerated as to have lost its sensibility is the usual occasion of morbid affections arising from the benumbing power of cold. In this way it is that chilblain, frostbite, and what has been very improperly called local asphyxia, are usually produced. Without reaction, turgescence, and inflammation, these consequences of exposure to cold are impossible; they are essentially phlogistic, and are the results of reaction occasioned generally by external heat, and always attributable to vehement reactive erethism of the cutaneous nerves, followed rapidly, sometimes almost instantaneously, by fluxion, tumefaction, vesication, gangrene, and sphacelus. The application of external warmth is, I have said, generally the occasion of this violent reaction. In rare cases, however, and commonly under the influence of intensely cold blasts operating on a vigorous frame, inflammation, vesication, &c. are observed to follow the exposure, independently of any subsequent external excitement. Numerous instances of this occur in the narrative of travellers and voyagers in arctic regions. Mr. PELHAM, already cited, mentions that the atmosphere of

Spitzbergen sometimes blisters like fire. Captain MIDDLETON says, that "the fog and mists brought here" (Hudson's Bay,) from polar parts appear visible," &c.; "and if our hands or faces be uncovered, presently raise great blisters as white as a linen cloth and hard as horn." Of such effects erethism and turgescence, in a word reaction, is still the cause. The explanation is, I think, plainly this: instantaneous congelation of the cuticle follow the access of cold air; a warm, soft, pliant covering attached to a membrane most copiously supplied with sensitive nerves and capillary arteries, and consequently most delicate and susceptible, is all at once as it were petrified, and converted into a cold and rigid substance; and its attachments to the cutis are rudely strained and lacerated. To this mechanical injury if we add irritation of the nervules of the skin, from sudden transmission and escape of caloric, we shall have altogether sufficient materials for an explanation of the almost instantaneous turgescence and inflammation which must precede the effusion, vesication, &c. observed in such cases.

Cold is a common cause of paralytic, apoplectic, and convulsive seizures. Dr. FOTHERGILL has remarked (and as a result of extensive and accurate observation, the remark would, even if unsupported by numerous other authorities, be entitled to great attention,) "that sudden transitions from heat to cold, and from cold to heat, often produce those complaints," (viz. apoplexy and palsy.) We are assured by MARCARD and other writers, that the cold bath has often occasioned apoplectic and epileptic attacks.

The researches of Sir C. BELL have brought into additional notice a species of palsy before ill understood; namely palsy of the muscles of the mouth, cheek, &c. originating, in many cases, in exposure to cold, and depending on loss of functional power in what older anatomists called the portio dura of the seventh pair of nerves.

The disturbance of the higher cerebral functions produced by extreme atmospherical cold are various and striking. Insensibility, somnolency, delirium, maniacal fury, convulsive agitation, are the principal effects of intense cold on these functions. Several of these effects are strikingly exemplified in the following passage from Captain PARRY's Third Voyage. In the eighth chapter of that interesting history, we are informed by Captain LYON, that "several of his party" (they were on their return to the ships from an inland excursion in very severe weather, at a temperature below zero,) "began to exhibit symptoms of that horrid kind of insensibility which is the prelude to sleep; they all professed extreme willingness

to do what they were told in order to keep in exercise, but none obeyed; on the contrary, they reeled about like drunken men; the faces of several were severely frost-bitten, and some had for a considerable time lost sensation in their fingers and toes: yet they made not the slightest exertion to rub the parts affected, and discontinued their general custom of warning each other on observing a discoloration of the skin." He afterwards adds, "my attention was particularly directed to Serjeant Spackman, who having been repeatedly warned that his nose was frozen, paid no attention to it, owing to the state of stupefaction he had fallen into. The frostbite had now extended over one side of his face, which was frozen as hard as a mask; the eyelids were stiff, and one corner of the mouth was drawn so as to expose the gums and teeth. He complained sadly of giddiness and dimness of sight, and was so weak as to be unable to walk of himself." The following passage is still more striking. "Sometimes," says BEAUPRÉ, in his account of the Retreat from Moscow, (*Treatise on Cold*, chapter 4,) the eye was open, fixed, dull, wild, and the brain was seized by a quiet delirium; sometimes the eye was red, and announced transient excitement of the brain, and in those cases the delirium was better marked. Some stammered out incoherent words; others had a reserved and convulsive laugh; in some blood flowed from the nose and ears; they agitated their limbs, as if groping for something." "I have observed men overpowered by cold;" (he subjoins, still speaking of the sufferings of the French experienced under his own eyes in the vicinity of Smolensko): "I have seen them uncovering their breasts, agitating their arms as a man labouring under a deep delirium in an ataxic fever, in a state in which they certainly no longer felt desirous of food, &c." The irresistible propensity to sleep is very strikingly exemplified in the following anecdote related by the same writer of himself. "During the frightful night that we left Smolensko, I felt much harassed, and towards five in the morning a feeling of lassitude invited me to stop to rest. I sat down on the trunk of a birch tree, beside eight frozen corpses, and soon felt an inclination to sleep, to which I yielded, for it seemed delicious. I was fortunately dragged out of that incipient somnolency, which would infallibly have brought on torpor, by the cries and oaths of two soldiers opposite me, who were striking violently a poor exhausted horse that had just fallen down. I emerged from the state with a kind of shock; the sight of what was passing before me recalled strongly to my mind the danger to which I was exposing myself, &c." The illustrious BOERHAAVE, we are informed, I

think, by Haller, narrowly escaped destruction from sleep and asphyxia during the winter of 1709.

Diseases of Cold.

Cold has a threefold morbid power; as a *physical or chemical* agent, as a *predisposing cause* of disease, and as an *occasional*.

As a physical cause, its operation is definite and simple: it abstracts that caloric whose presence is a necessary condition of functional activity, and has for its effect suspension of the vital action of the organ or organs subjected to its influence. Asphyxia, local or general, and congelation, are the results of extreme refrigeration, and the only disease cold is capable of producing, independently of reaction. In a former place, I have shewn that chilblain, and what has improperly been called local asphyxia, namely, gangrene consequent upon refrigeration, are the results, not simply or directly of abstraction of heat, but of reactive erethism, turgescence, and inflammation.

The mortality from cold as a predisposing cause, is attributable principally to fevers often of a contagious nature; to inflammations of the brain, lungs, heart, liver, and bowels; to hemorrhagic diseases of the brain and lungs; to dropsies of the chest and abdomen; to catarrhal and asthmatic complaints: to scrofulous, icteric, scorbutic, and chlorotic cachexies; to diarrhœas and diabetes; to rheumatic, gouty, and calculous disorders. Of the ætiology of several of the diseases above named, so far as connected with the history of morbid cold, I have already, in fact, sufficiently treated in the section on the morbid properties of cold. The diseases I refer to more particularly are asphyxia, and catarrhal and other congeneric affections of the lungs; diarrhœa, dysentery, and other abdominal derangements; scurvy and other humoral cachexies; dropsical and hemorrhagic diseases of the head and other great cavities. Having, therefore, for the better illustration of the morbid agency of cold, already stated, in the preceding section, much that would otherwise call for notice here, I shall, under the head of *diseases of cold*, content myself with a rapid enumeration of the effects of that agent in its twofold character, as an occasional and predisposing cause.

In most countries the great mass of mortality is attributable to fevers, and of that class of diseases cold is amongst the most active, predisposing, and indeed also exciting causes. "Quivis ferè morbus epidemicus, vel contagiosus, apud inferiorem populi classem, et exoritur, et quam maximè dominatur,

et eradicatur tardius, ita ut levior etiam angustiore loco reclusa, adfectio, *hyberno imprimis tempore, quo cum frigore auræ etiam vitalis allisionem avertere student*, in funestam, mox carcerali nosocomialique; febri, similem ægritudinem terminetur, et in amicos miserâ exhaustos, predispositos, propagetur. *Quæ substanta corporis nuditate, et refocillantis defectu foci, à summo gelu, quæ ex habitationibus fuliginosis et impuris, quam fœdi cutis morbi, à neglectâ corporis munitie, et à transpiratione per angustias contineras languente, miserioribus sint proprii, hoc non nisi verbo hic attingo,* &c. (J. P. FRANK, *de Populorum miserâ morborum generici.*)

"It is needless to mention how much an ample supply of fuel is conducive to health," says a learned experienced writer of this city, "not merely for warmth and for culinary purposes, but as promoting ventilation, which it does, not by the change of air necessarily induced by the current of air up the chimney, but by enabling the poor to admit fresh air in cold weather;" as well, he might have added, as by rendering ablu-tion and cleanliness of every kind practicable and convenient. "It is in the winter season," Sir G. BLANE further remarks, "from want of fuel that typhous infection is most apt to arise, and also to spread." It is obvious that the confinement and inactivity that the indolent and poor voluntarily impose on themselves, for the sake of avoiding the disagreeable sensations of cold weather, must, in various ways, favor the attacks of disease, independently of accumulated effluvia, must predispose to scrofula, chlorosis, amenorrhœa, dropsy, catarrh, pulmonic and other internal inflammations, pectoral, abdominal, and other hemorrhages, &c.

But it is as an exciting or occasional cause that cold is most extensively operative as a morbid agent: there is almost no disease of an acute character, nor any chronic paroxysmal complaint whose attacks we do not observe produced by it. So extended is its morbid influence as an occasional cause, that even to enumerate the diseases whose explosion it is capable of determining in predisposed subjects would be almost to repeat the nosological catalogue. Complaints the most different in symptoms, and seat, and result, are amongst its occasional effects: fever of every kind, every variety of inflammation, spasmodic diseases of every kind and degree, from the cramp that annoys the swimmer to the merciless cholera and tetanus. It has been known to occasion every sort of neuralgic disease, every species of vitiated action to which the excretories are liable; it occasions apoplectic, paralytic, epileptic, and hysteric seizures; and gives rise to every description of indigestion and of asthmatic disease. But of all its

powers of noxious action the most extensively mischievous is probably that by which it occasions internal fluxions, congestions, and inflammations. To this power is owing not only the bulk of the mortality of purely inflammatory diseases, but also a large share of that of continued or essential fevers also. It is now well known that local inflammation is amongst the most frequent and formidable complications of typhoid, eruptive, and other pyrexia: this power I have not been able to include in the list of morbid properties of cold, because it is not by any one property that such local diseases are occasioned; for several distinct and independent organs and elements conspire in the production of the effect; viz. the skin with its nerves, vessels, and blood, and the internal organ with its nerves, blood, and vessels, &c.; and secondly, because the seat and order of the simpler effects or morbid changes, which, beginning with cutaneous refrigeration, terminate in internal visceral disease, are, I conceive, quite uncertain. The explanation usually given of the causation of these diseases is founded on the obscure doctrine of sympathy; the external teguments in the coverings and parenchymata of the viscera are said so to sympathize with each other, that functional disturbance in the former is followed, in susceptible subjects, by similar derangement in one or more of the latter; and, in a practical point of view at least, I readily admit that this doctrine of *sympathy* or *antagonism* is well worthy of consideration; indeed, it has served my distinguished friend Dr. JAMES JOHNSON for a basis of excellent therapeutical instruction in his very valuable work on the Diseases of India, and other subsequent writings, and furnishes unquestionably many indications of the highest practical utility; but it is still, in a scientific point of view, if I mistake not, very imperfect and unsatisfactory. It furnishes but two links, as it were, of a long chain of causation, and these remote from and unconnected with each other by any bond or force that we can discover. Between the first frigorific impression on the skin of the feet, let us suppose, and the ultimate establishment, at the distance of many hours, perhaps of a day or two, of a fluxion, &c. in the lungs, liver, &c. there is, according to this doctrine, an enormous blank, an interval full of important organic and humoral changes of which sympathy takes no account whatever: under these circumstances, I have considered myself justified in omitting the power of cold now under consideration, in my enumeration of the morbid properties of that agent, leaving open for future inquiry its *modus operandi* as an exciting cause in the origination of visceral disease. Before, however,

quitting the subject, I would observe that this question is so entangled with that of predisposition, that, so long as the latter doctrine continues in its present state, a *rudis indigestaque moles* of hypothesis, conjecture, fact, and inference, offering no definite principles or rules of reasoning or action, there is little prospect of its satisfactory solution; and this remark will hold good, I imagine, even after we shall have become very much better acquainted with the intimate nature of several diseases occasioned by cold, of the proximate causes of which we are at present, to a great extent, or for the most part, ignorant.

The morbid influence of cold as an exciting cause is, therefore, almost coextensive with morbid action; nor shall I probably be considered to over-rate the morbid power of cold by any who will take into account, on the one hand, our constant immersion in an atmosphere of very variable temperature and humidity, over whose fluctuations we have little control, and with which it is necessary to our existence that we should retain in strict contact one surface at least of our bodies; a surface whose extent has been estimated at nearly a score of square feet. This estimate of the morbid power of cold is rendered further probable by the reflection that of the three great classes of exciting causes of disease, namely, the moral, the internal or organic, and the external or physical, which last includes atmospherical fluctuations, the third class or external causes are not only the farthest beyond our reach, when quiescent, but the least under our control when in action. In the list of diseases above enumerated as producible by cold, it will have been observed that many, if not all, are common to the two classes; namely, to the class of disorders which it excites as well as that to which it merely predisposes. The coincidence and almost identity between those classes is founded on the nature of things, and depends on a law that pervades the whole domain of pathological etiology. Cold, like almost all other causes of disease, varies in its action according to its own energy and according to the amount of susceptibility in the subject to which it is applied; when intense or aided by a high predisposition, it determines at once the attack of disease; if moderate or not favored by adequate susceptibility, it of itself produces no change, and is null, or merely contributes to complete, in cooperation with other causes, a growing predisposition to some disease which may be called into active operation by perhaps a fresh exposure to cold, and will in every case require the aid of some determining application, change, event, or, in other words, occasional cause. And there is another view of the subject of predis-

position, perhaps still more difficult and embarrassing: how it is, in differently predisposed individuals at one time, or in the same individual at different times, refrigeration is followed by such various results; why does cold produce in one person or at one time catarrh, at another pneumonia, or pleurisy, or enteritis, or diarrhœa, or herpes, or erysipelas, or some other one of the thousand febrile inflammatory, nervous, &c. diseases of cold? To this question, which has been already glanced at, and which goes deeper into medical philosophy than the writer is capable or called on to enter, there can be given no general solution; medical science is too far in arrear of the physical sciences to admit, like them, of the enunciation of its practically useful truths in terms at once concise and logically true. It resembles moral and political science in the complexity of its inquiries; the number and variety, and in many instances contingent importance, of its necessary data, bear the like proportion to its facts and ascertainable desiderata. In medical philosophy, in short, the neat and commodious aphorism is, if disencumbered of the voluminous postscript or commentary, too often worse than useless. In several of the above supposed, an acute and diligent physician might, after minute inquiry, be enabled approximatively to account for the occurrence actually observed in each, rather than any other; but an approximation is much less than science requires.

Circumstances most favorable to Cold as a Morbific Agent.

The circumstances which most favor the mischievous power of cold, and which I think it proper to specify here, are the following three:

1. *Exhaustion* by labour, or by stimuli (such as external heat), or by venery, or inebrity, or fasting.
2. *Internal fluxion*, unaccompanied by general excitement, as those of catarrh, digestion, catharsis, &c.
3. *General delicacy*, including convalescence, infancy, and age.

Exhaustion by labour or exercise is a state that gives to cold terrific power. Alexander the Great, it is notorious, narrowly escaped death from having taken the cold bath under such circumstances. An accident of a similar nature, but more unhappy result, lately occurred in the person of the son of the late premier of England. "Captain Canning," we are informed by the Rev. Dr. WALSH, in his *Notices of Brazil*, "had heated himself by violent exercise at rackets, and when he proceeded to Mr. Gordon's house, (in the vicinity of Funchal, in Madeira,) he entered the room he used to occupy,

and having put on his morning-gown, he went down to a large tank in the grounds, where he undressed himself, and, plunging in, sank never more to rise with life." Such accidents are not very rare, but the most frequent occasion of death from cold in circumstances of exhaustion from exercise is a cold drink. This is a frequent cause of illness and death in hot seasons; examples of it are common even in our mild climate. The causation of sudden death from cold drink is obscure. Laudanum is the great remedy. Accidents of this nature might generally be avoided by taking drink in very small quantities and at intervals, instead of considerable draughts at once.

But sudden vicissitudes of temperature are, in the popular estimation, the great causes of disease; and, in their anxiety to shun the peril of one extreme, the vulgar, from ignorance of the true principle, often run into the other: thus it is universally held dangerous to go into the cold bath warm, although that state of organic energy of which cutaneous heat is an index is an indispensable condition of safety and advantage from cold bathing. The truth is, that danger arises not from warmth or even moisture of the surface, to the bather, but depends on the proportion borne by his reactive and calorific energies previously to bathing, to the frigorific power of the cold medium. There is abundant proof that even proper sweating by no means indicates unusual susceptibility of morbid effects from external cold. The impunity with which the Russ rolls in the snow, or plunges into the river, while reeking from his vapour-bath, is well known. The like practice prevails amongst some of the North Americans. I have myself had cold water thrown over me after having spent half an hour in a vapour bath at 115° , (and I am convinced that, had the vapour been much higher, the affusion would have been still less dangerous, much farther within the bounds of safety,) without any result except a lively sensation of cold, owing to the moderate temperature of the bath, and consequent slight excitement of the skin. Had the bath been much hotter, I should have been, I imagine, less sensible of the difference. The experiments of Dr. FORDYCE, Sir C. BLAGDEN, &c. (*Phil. Trans.* vol. 65,) plainly shew that, abstractedly from exhaustion and defective reactive calorific energy, there is no danger in exposure to cool air, even in a state of profuse perspiration. "During the whole day," says Blagden, "we passed out of the heated room (temperature 240° , 60° ,) after every experiment, immediately into the cold air, without any precaution; after exposing our naked bodies to the heat, and sweating most violently, we instantly went into a cold

room, and staid there even some minutes before we began to dress; yet no one received the least injury." The same impunity attended the passage into the cold air of Dr. Dobson and other experimenters at Liverpool. Internal reactive calorific power is in such cases unquestionably the great desideratum of protection.

The following passage from Scoresby is interesting in more than one point of view: "Where no sensible perspiration prevails," (he speaks of arctic regions, where great and often exhausting labour only could produce sensible perspiration,) "I have never seen in a healthy person any ill effect resulting from the greatest transitions. For my own part, indeed, whenever I have occasion to expose myself to a severe cold, I like to get the body well warmed, finding that, the more I am heated, the longer I can resist cold without inconvenience. Internal warmth, however, is greatly preferable to superficial heat, and the warmth produced by simple fluids, such as tea, soup, preferable to that occasioned by spirits. After the liberal use of tea I have often sustained a cold of ten degrees at the mast head for several hours without uneasiness; and, though I have often gone from the breakfast-room, where the temperature was fifty or sixty degrees, to the mast head, where it was ten degrees, and without any additional clothing except a cap, I never received any injury, and seldom much inconvenience, from the uncommon transition." The truth seems to be that a vigorous adult has nothing to fear from any frigorific exposure of an ordinary kind, provided his organic power of evolving caloric be not exhausted or materially diminished by previous exertion. The increased sensibility to cold, and susceptibility of injury from that morbid agent, produced by the exhausting excitement (of the nervous, vascular, calorific, and possibly sanguineous functions,) caused by drunkenness, laborious exertion, venery, violent emotions, &c. strongly corroborate that opinion. Long exposure to moderate external heat often greatly increases susceptibility. Dr. WALSH mentions an instance in which, after long exposure to a temperature of seventy-two degrees, the occurrences of a seabreeze of sixty-one degrees so chilled every one as to force them to put on additional clothing. They had been going at the rate of 210 miles in twenty-four hours, in a temperature of seventy-three degrees in the sun, but just as they had passed Cape Frio (on the coast of Brazil,) "a strong breeze set in from the sea, which swept them along there at the rate of thirteen miles an hour," (one third faster than before.) "During the continuance of this breeze, the thermometer fell to sixty-one degrees, and the

sense of cold, from the sudden transition of temperature, was quite painful. After bearing it for some time shivering on deck, it became intolerable, and we all went below, put on our warm clothing and dreadnoughts, and again appeared with thick woollen jackets and trowsers, as if we were entering Baffin's Bay, and not a harbour under one of the tropics."

I am convinced that diseases of cold are often caused by slighter changes than that recorded by Walsh. In persons whose occupations are indoor and sedentary, who live in warm apartments, pass their day in indolence, and use little locomotive exercise, there is often such susceptibility as to make them liable to disease from exposure even to the gentle and almost tepid or warm current caused even in close rooms by the draught through the chimney. REAUMUR assures us, that a sudden change of temperature of four degrees is always sensible; and MACQUART affirms, that a change of ten degrees is always disagreeably so: they both speak of healthy subjects only. Now RITTER has found, by experiment, that, in a close apartment, the air near the window differs three or four degrees from that of the middle of the room; the transition of temperature, therefore, to which a delicate person may be exposed on a change of seat from the immediate vicinity of the fire to that of a closed window, may amount to a dozen or even a score of degrees. But the importance of avoiding sudden transitions to persons whose reactive calorific energy is habitually feeble, and whose nerves have not been hardened by fresh blasts, &c. is now, I trust, sufficiently obvious. Nothing need be added about the inconvenience of exposure to cold after getting out of bed, &c.

The existence of an *internal fluxion unaccompanied by general febrile excitement*, is favorable to the morbid action of cold on those who are destitute of great reactive vigour: thus persons affected with chronic catarrh, chronic inflammation of the abdominal viscera, and other tedious phlogistic cachexies, bear cold very ill. During the process of digestion, exposure to cold is, *cæteris paribus*, more dangerous than at other times. The incautious use of the cold bath shortly after eating has often been attended by formidable results: the same holds of catharsis.

A third combination of circumstances favorable to the morbid action of cold is that *general delicacy characteristic of convalescence, infancy, and age*. It is a matter of daily experience that old people and convalescents suffer great inconvenience, and often fatal injury, from blasts or other atmospheric changes that would be quite innocuous to the healthy individual. It seems probable that the aged and sickly are,

in many instances, to a greater and less extent in the same circumstances as inferior and young animals with regard to their calorific powers. It has not been experimentally proved, but yet seems likely, that the calorific function suffers in age and disease a diminution of power, so that the state of the old and infirm resembles more or less that of young birds, fishes, and other immature or inferior animals, whose temperature has been ascertained to vary with the medium by which they are surrounded. Even in healthy adults animal heat is by no means a fixed quantity. Although ninety-eight degrees be perhaps truly enough represented as the heat of man, it is still but the average: individuals exceed or fall short of that degree according to age and other circumstances. From DAVY's experiments, it would seem that that average is too low for certain foreign countries, and for whole extra European races of men. In practical writers there are numerous examples of animal heat depressed, for considerable periods of time, below the standard of health. The capability of resisting external cold by the compensative property of the calorific function is, for these and other reasons, I suspect, often degraded in age and infirmity. Tender infants also, I think it highly probable, have not yet attained to the full vigour of adult calorific power, and are therefore victims, on a very large scale,* to the morbid energies of cold from an organic debility, similar to that which lays age and infirmity open to its attacks.

Forms of Cold most dangerous.

The principal and most active forms of morbid cold met with in practical life are three: *moist atmospheres, damp clothing, and currents of air.*

Moisture is not of itself injurious to health. Moist warm atmospheres are indifferent to the vigorous, and they are generally favorable to the weakly. *Wet* summers are healthful in this country, provided they are not cold; the summer of 1797 furnishes a very striking proof of this truth. "From the middle of May it was," says HEBERDEN, "one of the wettest ever remembered, it was nevertheless in every respect a healthy year." Not so, however, *wet cold* seasons. BATEMAN assures us "that the succession of rains to heat" (i. e. of a cool or cold moisture to warmth,) "is amongst the most active causes of disease of the chest and abdomen," which are the most destructive complaints in this metropolis. "A foggy

* "Prenez mille enfants a leur naissance," says a learned writer, now before me, "a peine ont ils va le jour qu'il en perit vingt-trois; la dentition en emporte cinquante; les convulsions, les vers, les coliques du premier age, enlèvent plus du quart du deux cent soixant-dix-sept; la moitié de ce nombre de morts est due sur-tout a l'air froid et humide dans les campagnes," &c.

atmosphere," he again observes, "acts much more injuriously than a clear (i. e. comparatively dry) one of equal cold. Indeed, there is," he assures us, "no condition of the air so invariably pernicious, so chilling and oppressive to the organs of respiration, as that frequent combination of frost with fog in the metropolis." Of the truth of the preceding observations of that judicious physician (Bateman,) I have had frequent experience amongst the poor inhabitants of Westminster for the last three years, during which I have had considerable opportunities of watching the operation of weather and season.

The danger of inhabiting or sleeping in *damp apartments*, is proved by examples of daily occurrence in private life. The superior morbid activity of a *damp atmosphere* depends on its superior conductive power. A humid air absorbs free caloric with much greater avidity and rapidity than a dry.

Damp clothing is another active and dangerous form of cold. The mischievous energy of wet clothes is so well known, as to require no illustration. The great capacity of evaporating water for the matter of heat, is the cause. The frigorific power of damp clothing may be conceived from this consideration: that the only protection or antagonist influence that man requires to enable him to defy the summer fires of Sahara or South Carolina, is the power of cutaneous exhalation. Although inhaling and immersed for some time in an atmosphere exceeding very far the temperature of boiling water, the bakers' girls were found, by Reaumur, to have pertinaciously retained their normal heat. After twelve or fifteen minutes' immersion in an atmosphere many degrees above 212°, BLAGDEN, BANKES, DOBSON, and other experimenters, found their thermometrical heat little differing from that of ordinary health. Such is the frigorific power of perspiration, or, in other words, of evaporation from the surface.

But *currents of air*, perhaps, of all causes of diseases of cold, are the most active and extensively mischievous. *Damp clothes* may be avoided; *foggy atmospheres*, and extremely *humid cold winds*, are unknown in many seasons and climates: but *currents of air* must be encountered. The atmosphere is constantly in a state of agitation; its intestine and progressive motions, while, on the one hand, they promote our well-being by ventilation, endanger, on the other hand, our health and our existence by their refrigerant operation. The destructive power of exposure to cold winds without adequate protection, is strikingly illustrated by the narrative published by Dr. CURRIE, in the Philosophical Transactions for 1792. "Of several individuals that clung to the wreck, two sat on

the only part that was not submerged: of the others all were constantly immersed in the sea, most up to the shoulders; three only perished, two of whom were generally out of the sea, but frequently overwhelmed by the surge, and at other times exposed to heavy showers of sleet and snow, and to a high and piercing wind." Of these two, one died, after four hours' exposure; the second died three hours later, "although a strong healthy man of twenty-eight, a native of Scotland, in the flower of life, early inured to cold and hardship, and very vigorous both in mind and body." The third that perished had been a weakly man. The remaining eleven who had been more or less completely *submerged*, were taken from the wreck next day, after twenty-three hours' exposure, and recovered. The person amongst the whole who seemed to have suffered least was a negro: of the other survivors, several were by no means strong men, most of them had been inured to the warm climate of Carolina." In the case of the two first that perished the morbid power of the "high piercing wind" was aided no doubt very powerfully by evaporation. In Dr. Currie's account of his experiments on the cold bath, we have the following interesting illustration of the superior refrigerant power of wind or air in motion. After continuing in the water fifteen minutes, the subject of some of his trials exhibited "little or no diminution of his heat in rising into the air in a perfect calm, though during a frost; while the like exposure in a second trial, under similar circumstances, but with a north-east wind blowing sharply, produced a rapid diminution (of animal heat,) though the air was many degrees warmer" than in the preceding experiment.

I have above cited several examples of even death instantaneously produced by the chilling influence of a piercing north wind. Every valetudinarian is aware of the inconvenience and even danger of exposure to blasts from chinks and other apertures in rooms otherwise close.

Prevention of Diseases of Cold.

The remarks I have to make in this section will come under the head of *Clothing*, *Exercise*, *Internal Heat*, or stimulating ingesta, and *Diaphoretic Means*, as hot diluents, bed-heat, &c.

Every considerable augmentation of refrigerant influence requires, on the part of the subject exposed, proportionate precautionary means for the protection of health: these preventive measures must consist either of increased clothing or of the use of means capable of compensating for defect of personal coverings, by diminution of intrinsic organic suscep-

tibility. The class of preventive means last alluded to will be by and by considered, under the heads of exercise and stimulating ingesta: at present I shall confine myself to the question of clothing.

Transition from a tranquil into an agitated or progressive atmosphere, as from indoors into the open air, from the inside of a stage-coach to the outside, &c., is accompanied with a great increase of the refrigerant power, which the frame has to encounter, and will, in many instances, above all if moisture be present, require additional protective covering. When the exposure is but short, or the weather is fine, or the constitution vigorous, and reactive energy therefore ample, such precaution, no doubt, will generally be quite unnecessary: yet those compensative conditions must be often wanting in a greater or less degree, and exposure, therefore, not provided against by appropriate internal or external means, will often prove hazardous, and sometimes fatal. In how many cases has phthisis been traced to an indiscretion of the sort now alluded to; to a journey on the top of a stagecoach in bad weather, or by night with insufficient clothing, &c. In how many instances have youth, and accomplishment, and loveliness, fallen victims to the noxious influence of cool, perhaps damp out-of-door atmospheres, in passing from one rout to another, or in returning from scenes of splendid riot to domestic solitude and repose.

In passing from a state of activity or exertion to one of relative quietude, precautions are often required for security: such transitions occur when horse or foot exercise is exchanged for riding in an open carriage, or gestation on the water, and obviously demand the like precautions with transitions from walking, running, &c., to sitting, lying down, &c. But of all conditions that require provident measures, that of sleep stands most in need of them. In that condition the calorific function is less excited, less exposed to incidental stimulation from physical agents, or moral impulses, or muscular exertion, than in any other. Less heat is evolved; the body is much more readily chilled, the cutaneous functions more easily disturbed, and every derangement of internal parts, producible by frigorific impressions on the skin is more promptly effected. In the state of sleep, it is therefore, if ever, necessary to guard against exposure to cool moisture, currents of cool air, and every other cause of diseases of cold. All this is very plain, and is generally known, and requires no further notice. Before quitting this topic, however, I would briefly enter my protest against the absurd and mischievous extreme to which many, perhaps most people, carry the use of woollen and

other night clothing. It is common for females, in particular, who seldom, amongst the richer classes at least, know the comfort, the real luxury of woollen or chamois coverings for the shoulders, chest, feet, &c., and who wear below the knee, on the arms, upper part of the chest, neck, or head, either slight or no covering, to retire to sleep on beds of feathers, under half a dozen or more folds of one material or another, mostly woollen, and this in soft, nay even in summer weather, and with every avenue for fresh air, every door and window, closed, and bedcurtains perhaps drawn closely all around: from such violent transitions what wonder if inconvenience result! The sleep is more or less disturbed by dreams and feverish uneasiness; the strength is not properly recruited, and the sleeper awakes unnerved, languid, indolent, often hot or chilly, generally anorectic. Under such circumstances, a susceptibility of inconvenience and injury from cold, above the average, may reasonably be looked for, and will, I believe, seldom fail, if occasion offer, to shew itself. Nor is the relaxation attending long immersion in warm air the only disadvantage in such cases; for there is obviously the further one of long-continued respiration of an impure atmosphere to be taken into the account: a disadvantage of no trifling importance in the cases of such as retire early to small rooms, and emerge into daylight after protracted slumbers.

Another point in which many fail, is the adaptation of clothing to season, weather, &c. No one questions the propriety of such adaptation in the abstract; but the number of those that commit the grossest errors on this subject in practice is enormous. What can be more obvious than the temerity of wearing the same kind and quantity of clothing in the heats of summer and frosts of winter: yet there are not wanting in the very first rank of the medical profession persons chargeable with such imprudence. I recollect very well the substance of an argument I once had with a fellow-traveller, an Austrian cadet, on his way through mountains, in mid-winter, *en voiture*, from Vienna to Laybach. He obviously suffered inconvenience from want of warmer clothing, yet would not admit the propriety of adding even a flannel vest to his wardrobe. He considered it, he told me, "militärisch," soldier-like, to dispense with woollen under-coverings. A like answer would no doubt be given by many defaulters on this side of the water. Ladies would hold it to be *feminine*, gentlemen, *manly*, &c., to dispense with the extra under-clothing proper for winter and cold weather. But indolence, temerity, and fine breeding, are bad protectives against inclement seasons.

Exercise. An observant individual can seldom fail to know when, from universal weakness or incidental exposure, he is in danger from external cold; and a provident man will easily, in general, foresee future exposure. When actually exposed, the great prophylactic is muscular exertion, and, if possible, locomotive exercise. RITTER's advice is excellent, when he recommends that we should counteract the chilling influence of a draught or of a damp atmosphere, to which we are constrained to expose ourselves, by proportionably increased exercise in order that we may be enabled to compensate for the augmented expenditure of caloric by an increased evolution of it. The calorific power of general muscular exertion is such that, but for the antagonist frigorific power of cutaneous exhalation and vaporization, there can be no doubt that even moderate exercise would be incompatible with health, and that violent locomotive exertion would, in comparatively tranquil atmospheres at least, prove destructive of life. It is so great, that, duly persevered in, and aided by clothing sufficient to protect the skin and extremities from the immediate contact of an intensely cold air, it has been, on innumerable occasions, found sufficient to bear man harmless through the most formidable trials, as the narratives of Parry, Franklin, Scoresby, and many others, abundantly testify.

Respecting the use of *hot drinks* and *aliments at once nutritive and stimulant*, before and during exposure, little need be said. All experience is in their favor; every traveller on our stagecoaches knows the protecting power of warm tea and coffee, punch, &c.; there is even unequivocal experimental proof of the power of stimulant drinks to sustain the animal temperature under exposure. During my experiments on the cold bath, I found, in some trials with warm drinks and wine, (taken before immersion,) the sensation of cold little less lively indeed, and the access of shivering little retarded; but the pulse and heat under the tongue were much less reduced by the cold than in other trials made without such preparation. As a preparative, however, for protracted exposure to cold, &c., pure vinous liquors are obviously unsuitable means: the excitement they produce is transitory, and is followed by dangerous depression of calorific power: and their repeated and free use is, amongst other objections, liable to this, that it favors that somnolency which is one of the most perilous effects of cold. I have little doubt that the protective power of punch, negus, &c. is more owing to the hot water than to the pungent spirit.

The fourth division comprises the means of cutting short incipient diseases of cold. On the supervention of chilliness

and other symptoms, effects of recent exposure to cold, such as slight headach, horripilation, dejection of spirits, hoarseness, slight sorethroat, coryza, lachrymation, cold feet, anorexia, lumbar pains, &c., we should have immediate recourse to the shelter of a warm bed; all solid aliment should be withheld; our only ingesta should be warm diaphoretic drinks. Diluted vinous liquors taken warm, such as weak hot punch or negus, are often excellent diaphoretics in such cases. But, in general, the alcoholic ingredients may be safely dispensed with, and when the excitement is considerable and headach is present, it cannot, without rashness, be recommended. The preceding measures are usually sufficient, if early enough employed, to cut short incipient derangements from cold. Where irritation is considerable, which is indicated by flying pains in the back and limbs, lively sense of cold, smart shivering, &c., opiates had better be employed in addition to the means already mentioned: for this purpose Ritter highly extols a combination of opium and camphor, two or four grains of the latter with from the eighth to a fourth part of a grain of the former every second hour, until the horrors, headach, pains, &c. shall have vanished or greatly declined. I have no doubt of the utility of such a combination; but pure laudanum or opium combined with warm diluents will probably be found fully as efficient. Dover's powder is also an excellent remedy. Another remedy, at once efficient and agreeable, is the common effervescing draught, containing half a scruple of nitre, a drachm (more or less) of the compound tincture of camphor, and in some cases half a drachm or more of nitrous æther, and as much of Hippo wine, to be repeated every third, fourth, or sixth hour. Where the feeling of cold, as evidenced by horripilation, rigors, &c. is lively, warm bathing, local or general, followed up by some of the remedies just proposed, is very proper.

Prevention of disease is better than cure: it implies a more masterly degree of skill and power in the prescriber, and a smaller expense of care and vital power on the part of the sick. In practical medicine the first indication in the dignity as well as time, is prevention: in other words, the avoidance or counteraction, as far as possible, of morbid agencies; and when illness arrives, the employment, without loss of time, of the means best calculated to disperse the earlier groups of organic preternatural conditions or symptoms, and thus, by anticipation, get rid of the complications and difficulties so soon superinduced and accumulated upon primary simple and tractable derangements by the influence of sympathy and habit: with these views, I have thought it advisable to append to

my observations on the morbid effects of cold, remarks on the circumstances that most favor the action of morbid cold, on the means best calculated to neutralize its agency, and on the remedies that should be employed after injurious exposure to prevent the establishment of any nosological effect or regular disease of cold: on the plan, as on the execution, it is the reader's province to decide.

