Essay on the effects of cold on the human body

by

John Clarke.
In all parts of the globe as far as the Arabian race extends, from the Equator to the Poles, there, man is found suffering from changes of temperature, from the vicissitudes of the ever varying seasons, as well as from some regions from extremes of temperature.

The coup de Soleil or Sunstroke of the Equinoctes, caused by the direct effects of a burning sun; the loss of limbs, and of different parts of the body, and sometimes even death itself, from the direct effects of the intense cold of the Polar regions, are instances of the effects of extremes of temperature.

But these extreme cases are of comparatively rare occurrence, and consequently are not of so much importance, as the ordinary effects of heat and cold, which are constantly acting as the cause of disease and death, at all temperatures, and in all regions of the earth.
It is not in general the mere degree of heat and cold that acts thus injuriously, but alternations of temperature, as sudden changes in the atmosphere: i.e.,

Cold is well known to be one of the great causes of disease, and to be continually acting as such. It is the cause of very many diseases, sometimes acting as the predisposing cause, but still often as the exciting; the diseases which it produces are often slight, at other times very severe. The ordinary cold in the head as it is termed, and catarrhus of various intensity, are some of the most common of its effects.

The air passages and lungs seem particularly liable to be affected by cold; and inflammations of these parts, are the very frequent results of exposure to its influence; and when no other part of the body is predisposed to disease, they are more liable to suffer than any other.
Cold acts most injuriously in the Temperate and Cold regions, as an exciting cause of Phthisis pulmonalis; for although the predisposing cause of this disease viz. Scrofula, be present in natives of the warm climates, yet still, it is rarely that Phthisis is developed in these people, as compared with the inhabitants of the colder regions. And this of itself renders cold an important subject of study, from the immense number who die annually from this insidious disease.

It does not seem necessary that real cold should be produced in order to cause these diseases, but that from any cause (and they are chiefly atmospheric changes) acting, so as to reduce the temperature of the body, below what at the time was consistent with its previous condition.

In hot climates, where cold, using the term cold in its general meaning,
can hardly be said to exist, yet there, a sudden reduction in temperature seems to produce diseases, analogous to those produced by cold, in the temperate and cold regions.

It does not seem necessary that any certain amount of cold should be produced, to cause disease, for what in one person may cause only a slight affection, may in another produce most severe disease.

But cold, although such an active cause of disease, is in the other hand a most valuable therapeutical agent when properly employed. Its action is just the opposite of heat. Heat although a stimulant to the organic functions of the body, is debilitates and relaxes, both the mental and physical; while cold by its tonic action braces up and strengthens them.

Cold is used in various ways as a therapeutical agent, and its beneficial effects in strengthening the system of the weak and debilitated, are well
Known. It is also a most useful local application, and as such there is perhaps no way in which it is used more useful than to the head in fever.

It is often used to subdue inflammatory actions in their outset, chiefly on the external surface of the body. It is also a useful styptic in stopping hemorrhages.

It is a subject of much interest and of very great importance; both, on account of its activity as a cause of disease, and its useful properties as a curative agent. By a thorough knowledge of how it acts in both ways, much good might be done, and much evil be avoided.

In the following essay I intend to confine myself to the subject of cold. And in the first place I will begin by stating how the atmosphere produces refrigeration: 1st, in a state of rest; 2nd, in motion; and 3rd, in a humid state, or its hygroscopic state.
In the second place I will maintain the invariable effects of cold on the body, and also its effects as more or less modified by age, sex, habit, temperament, previous state of the body, &c. And in the last place, I will maintain cold as an antihistological agent.

1st. of the atmosphere in a state of rest.
The atmosphere can hardly ever be said to be in a state of absolute rest, although it is said to be so when its agitation is so slight as not to be perceived. And when the human body comes in contact with it in this state of comparative rest, the atmosphere being at the same time cold, or a good many degrees below the natural temperature of the body, an additional current is immediately established.

It is necessary that the atmosphere to produce this effect, should be so or
60 degrees below the natural temperature, and until there is this reduction, in general, no sensations of cold are produced. For, when the body is exposed to a temperature of 60° Fahrenheit, although that is 35° or 38° degrees below the natural heat of the body, still, no sensations of cold are produced, the internal heat generated being sufficient to compensate for the loss by evaporation.

All bodies of unequal temperatures have a tendency to establish an equilibrium, and so, when the body is exposed in a cold atmosphere, a current is established towards the body. The portions of air first in contact with the body by receiving caloric, grow lighter, and ascend, and fresh portions of the colder air come in from all sides, and supply their place, and thus a continual current is kept up.

If this process was going on in a confined portion of air, the current
would be kept up until the air has brought as nearly as possible to the same temperature, as the surface of the body.

The air is a bad conductor of caloric, and in cold still air refrigeration does not take place so rapidly, as in air in motion. It will depend on the intensity of the cold, and length of exposure to its influence, how far the body will become refrigerated in still air.

It is well known how much greater cold can be borne without suffering in still air than in air in motion. Captain Parry says: "With the " thermometer at 95 °F that is 87 degrees " below the freezing point, and no wind " stirring, the hands may remain " uncovered for two minutes or a " quarter of an hour without inconvenience; while with a fresh breeze, "and the thermometer nearly as high " as zero, few people can keep them " exposed so long without considerable
paw. Showing how much more cold can be induced in still air, without sensations of cold being produced, than in air of the same temperature in rapid motion.

2nd. Air in motion.

Cold air in rapid motion abstracts caloric rapidly from the body, and the more rapid the motion, so will be the abstraction of caloric; from a continual current of cold air being brought against the surface.

Sir John Leslie states that air with a motion of eight miles an hour, abstracts twice as much caloric from the surface in the same space of time, and at the same temperature, as it would do in still air, and with a motion of sixteen miles, three times as much; and so on in a regular increasing proportion. Therefore, when the temperature is low, and the air in rapid motion, the
Injuries of cold produced are very intense.

It is important to remember this in regard to clothing, in providing against the injurious effects arising from sudden exposure to air in motion; for it is in this way that persons often suffer.

For example, a person sitting in a room where the temperature may be the same as the external air, suddenly passes into it, without any additional clothing, may be injuriously affected by the change, unless sufficient exercise were taken, to compensate for the loss of heat that would rapidly take place if the person were not exercised.

And it is often by cold winds, and drafts of wind that the injurious effects of cold are produced, and sometimes the slight draft from the chink of a window, or any such source, produces bad effects, that if the body were fully exposed would
Certainly, as I have been produced.

Dr. Edwards in his work on Physical agents says in speaking of
air the motion. The atmosphere which
surrounds the body is not only
warm, but humid; that which re-
places it is not only cold, but
drier. It is well known that a current
of air independently of any other
difference, may in proportion to
its rapidity, produce an almost im-
definite amount of evaporation.

3rd. Humid or moist air.
The atmosphere at ordinary temper-
atures, is seldom without a certain
quantity of moisture, but at low
temperatures the quantity of aqueous
vapour that can be contained in it
is small. For at low temperatures it
becomes deposited, but as the warmth
of the atmosphere increases, so does
its capacity of holding more moist-
ure in suspension increase.

When the atmosphere external to
the body is of a high temperature
and contains much moisture. Evaporation does not go on actively, but when the atmospheric temperature is low, and becomes heated with the contact of the body, evaporation goes on according to the degree of evaporation previously existed, and according to the degree to which it had been heated by the contact of the body. For the more the cold air has been heated, the more capable does it become of taking up the moisture.

Dr. Edwards says, "Wholly to suppress perspiration by evaporation, the air must not only be of extreme humidity, but also at a temperature not inferior to that of the animal. If the air were colder it would become warmed by the contact of the body, it would then cease to be at its extreme of humidity, and would permit an evaporation proportionate to the degree to which it had been warmed. The evolutions produced by cold moist air are more disagreeable, and induce
than those produced by dry air, and it is the most injurious way in which cold can be applied.

"Mr. Dawson, in the "Edinburgh Medical and Surgical Journal," says of Rain.

"Rain possesses a considerable power of abstracting heat from the body. For in addition to its immediate refrigerating effect, as soon as the dress becomes damp, it virtually forms an evaporating surface in intimate connection with the body, and from which it removes a variable quantity of heat, according to the rapidity of the evaporation."

I will next proceed to state the invariable effects of cold.

All persons are liable to be affected by cold, although some do not suffer so readily as others; and this depends on various circumstances, as Habit, Temperament, state of the body, 

But although all are not equally liable, yet all can be affected by it, and for this reason, the inhabitants of the Polar regions are found clad in warm
clothing made from the skins and furs of wild animals, which are best capable of protecting the body from the cold; but at the same time these people can endure much more intense cold than the inhabitants of the Temperate or warm regions, from being habituated to endure cold from their infancy, and from their highly carbohydrate food, as fatty matters, and oils, on which they principally subsist, and which serve to generate much internal heat.

I will divide the subject of the Invariable effects of cold, into the Immediate and Secondary. By the immediate effects I mean, the first sensations caused by the application of cold, and the healthy action which induces. And by the secondary effects I mean, those effects caused by severe or long continued cold, by which the vitality of a part or the system may be lowered, so as either to cause loss of the part, or to excite disease, and may even directly cause death.
1st. The immediate effects of cold.

When a person is suddenly exposed to cold, as in a current of cold air, or any cold substances applied to the body, in whatever form. Certain sensations and appearances are produced. I will take for example immersion in cold water.

When a person goes into a cold bath at a low temperature, the nervous system receives a shock, the nerves of sensibility of the surface immediately are acted upon, and convey impressions to the brain where the sensations are perceived, and which are more or less intense according to the degree of cold.

The surface of the body becomes pale, from the contraction of the capillary blood-vessels, which become almost stopped. The skin becomes tough and contracted; principally owing to the contraction of the fibrous tissue surrounding the hair-bulbs, this gives the skin the appearance of a plucked goose, from which it has received the name of
"Cutis Annervia" it is one of the first appearances produced by cold. By this contraction of the tissues, and retardation of the circulation, the limbs and other parts of the body become diminished in size. The respiration becomes hurried and irregular from the shock to the nervous system; this must be a reflex action; indeed the whole of the effects produced may be more or less ascribed to a reflex action; but cold acts to a certain extent independently of the nervous system in producing contraction.

When the respiration becomes hurried, so does the circulation. The heart's action becomes increased, this doesn't take place when the cold is very intense or long continued, so as to act sedately, in this way it acts much as an ordinary stimulant. Whenever the cold is discontinued a reaction immediately ensues.

After the first shock of the cold has passed bye, the body so far recovers itself, and hastens to produce more internal heat, to compensate for the loss at first sustained.
This is essentially a vital process, and whenever the cold acts so as to overcome this vital power, it brings the body into greater or less danger.

2. The secondary effects of cold.

When the body is exposed to intense or long continued cold, its effects are very different from the first or healthy action of cold, although at the same time it is just a continuation of these effects, but going on to a greater length, so as to cause depression of the vital powers.

Intense cold has been known to cause death in a very short time, its sedative action being very quickly produced. It is told of Russian soldiers on duty as sentinels although relieved every second hour or in even less time, that they have been found frozen at their post, with their muskets in their hands, and these are instances of men well clothed, well fed, in good health, and habituated to a cold climate, falling so suddenly under the action of intense cold. Since it acts so severely on these native soldiers, it is not to be
wondered at, that such innumerable numbers of the French Army should have
perished on the retreat from Moscow.
Every circumstance that could render them
liable to be affected by cold they endured,
until hundreds and thousands perished.
They were natives of a warm and mild climate,
as compared with the cold country
they had to pass through in the
depth of winter; but besides this,
want of food and clothing, exposed to
the greatest fatigue and hardships, despairing
of ever seeing their native country
again; all these circumstances rendered
them doubly liable to be affected by
the cold. Beaupré in his account
of the retreat mentions particularly how
the despairing suffered so much more
than those, who, with some hope still
left, endeavoured to make the best of
their miserable condition.
The secondary effects of cold (as I have
mentioned) are produced by long exposure
or suddenly by intense cold. The appear-
ances and sensations I have mentioned under
the immediate effects are produced, but instead of a reaction, there is nothing but depression of all the vital functions. The heart's action becomes reduced and weak, the nervous system is depressed, sensibility is impaired, the whole body becomes shrivelled up, there is great rigidity of the muscles. The internal organs become congested, and the brain seems particularly liable to suffer, which causes a great inclination to sleep, this great and almost uncontrollable desire to sleep, proves so destructive to many, for if it is once yielded to death is almost inevitable. The person dies in a state of complete comatose.

Travellers in the Polar regions mention its effects on the nervous system, as producing a state resembling intoxication, causing irregular movements, more or less confusion of the intellect, incoherent talking.

I need proceed to state how Age, Sex, Habit, Temperament, General state of the
Constitution. And the state of the health modify the effects produced by cold.

1. Age.

Very young persons are more liable to be affected by cold, than persons of adult age. The amount of internal heat produced being much less in the young than in the old.

Dr. Edwards says, "The reduction of bodily temperature is less injurious in its permanent effects, in proportion to the youth of the animal" and according as the power of producing heat increases, that of supporting a reduction of temperature diminishes.

And again he says, "Young animals suffer less from reduction of temperature, and recover more perfectly than adult. But they require different degrees of internal cold: the nearer the animal is to adult age, the greater cold is required to reduce its temperature, from the power they have of producing internal heat."
In general man supports cold better than woman, as might be expected. It depends much on their mode of life, and the difference of physical constitution. Women from their productive habits, mode of life, and from their delicate constitution, are more liable to suffer from vicissitudes and exposures to the action of external agents, than man, who, indurated with strong physical and mental powers, was intended to endure hardship and mental and bodily labour.

3. Habit

Habit perhaps more than any other cause enables man to endure changes of temperature. It enables persons born in cold climates to bear with impunity degrees of cold that would be at first quite intolerable to a native of a warm climate. But by living in a cold climate even natives of the warm regions have through time become habituated to the cold, and if they survive the disease which oftencarry off people.
who undergo changes of this kind, they may ultimately become almost as insensible to the action of cold as the native inhabitants of the cold regions.

Inhabitants of temperate climates suffer much from the effects of cold, in the Polar regions, when they arrive there for the first time. Although perhaps not so much as might be expected, and this may be principally owing to the precautions used in the way, good food and suitable clothing. But in time they become habituated to the climate and suffer less than on their first arrival.

11th Temperament.

Temperament also must to a certain extent modify the liability of persons to be affected by cold.

It is said that persons of Nervous and Phlegmatic temperaments are not so readily affected by cold than those of Sanguine or bilious, and I believe from this that the inhabitants of different regions of the globe exhibit...
Certain peculiarities of temperament according to the regions they inhabit.

5th General State of the Constitution.

From the state of the constitution some persons are more readily affected by cold than others.

Persons of naturally robust and healthy constitutions resist its action better than those of feeble and weak constitutions. In the strong and active more internal heat is generated than in the weak.

Fat is known to act as a preservative against the action of cold, to a certain extent, but although this is the case, fat persons do not always resist its action best, and they are known sometimes to suffer very easily, while sometimes those of lean and spare habit of body resist it much better, and do not suffer so readily, but this may be in a great measure owing to their in general more active habits.
State of the Health.

The previous state of the health has a very great influence on the effects produced by cold. Persons who have been weakened or debilitated by previous disease, or persons who have lead lives of intemperance in either eating or drinking, or in whatever way the vital powers have been weakened on such persons cold acts injuriously, often causing inflammations of some organ of the body. In such persons some one particular organ is generally weakened and therefore predisposed.

In hot climates, for example, many persons who lead lives inconsistent with the climate, have the liver weakened and predisposed to the action of cold, and inflammation of that organ is a frequent result of exposure to its influence.

The state of the mind sometimes acts in a wonderful manner, both
in causing persons to be readily affected by cold, and also in render-
ing others quite insensitive to its action.

Some persons of a very nervous disposition, chiefly females, who
are in continual dread of the
least breath of cold air, and who
have their thoughts constantly
directed to the state of their health,
are very liable to be affected by
cold. There are other cases
again in which certain states
of the mind, have rendered persons
almost entirely insensitive to the
action of cold. They are cases
of mental abstraction from almost
everything, but some favorite study
or amusement.

The man of science who has
all his mind engaged in some
favorite study, absorbed in profound
meditation, heard cold without
seeming to feel it; the keen sports-
man or naturalist in his favorite
pleasant endured cold, which to most persons might prove anything but salutary or agreeable. Whatever strongly affects the mind, and distracts the attention, causing the powers of the nervous system to be directed in some one particular direction, lessens the sensibility to all external impressions.

But some of the most wonderful cases are those recorded of Maniacs, who for a time have seemed perfectly insensible to the action of intense cold, showing no symptoms of suffering; there are many cases told of such persons.

One very remarkable case is recorded of a woman who was found in the depth of winter, on one of the Pyrenees range of mountains. She was quite naked, and her only food was from roots of plants which she found among the rocks; it is said "she fled in the approach of any one, she was ultimately caught, and
died soon after. Her altered physiognomy, her pale, sorrowful posture, expressed grief and profound melancholy, which occasionally gave place to maniacal delirium.

This issue came out of many showing what suffering from want of proper food or clothing, and exposure to extreme cold, can be endured by persons labouring under certain mental derangements.

I will next proceed to the consideration of cold as a predisposing and exciting cause of disease.

Cold is continually acting as the predisposing as well as the exciting cause of disease. And as a consequence the colder the season the more disease is produced. This has been shown by Dr. Heberden from London statistics of deaths, that by far the greatest number of deaths occur in the colder months of the year. And he says of cold climates "In very cold climates
"the coldest part of the year is most
like apprehended, for increase the
cold but a little, and it becomes
quite inconsistent with human life."

He shows from the statistics
that he before mentioned, the striking
difference of mortality in London
between the January of 1795 and
the same month of 1796. In 1795
the temperature was very low, and
the number of deaths great, while
in the following year it was the
very reverse. The January of 1796
was on an average about 15 degrees
warmer than in the same month
of 1795. The number of deaths in
the former year (1796) of aged people
amounted to 153, while the number in
the latter year (1795) in the same month
amounted to 717, or about five times
as many deaths occurred in the coldest
month as in the other. Showing how
very remarkably the god suffered
from the cold.

But although it is among the
aged that the effect is most observable yet still among all both young and old the effect is apparent. Dr. Heberden says of young children under two years of age the effect was noticeable, but not nearly so marked as in the case of the aged. The mortality among the children being the colder season about 1/3 more than in the other.

But as at ordinary temperatures cold is constantly causing disease, and as the more intense the cold, the more difficult does it become to resist its influence; so it would be expected that the colder the season the more disease would there be produced in consequence, and the longer continues the cold the more formidable the diseases, as well as the more numerous.

In long continued and severe winters fevers are said most to abound, and in winters they are more prevalent than in the warmer months.

Dr. Allain says "During an epidemic fever, so many attacks occur after
"Exposure to cold, that many Pathologists have thought this a sufficient exciting cause of that disease; and in the Malarious Countries so many agues are contracted apparently by exposure to cold, or intemperance, that some have represented the Malaria as the predisposing, and cold or disorderly Humeal as the common exciting cause."

Dr. Hederin mentions apoplexy as being more common in the cold seasons than the warm, and it is said by some that cold is the cause of apoplexy in the aged, while heat acts as the cause in the middle-aged and robust.

Dr. Travers in his Practice of Physic, in speaking of cold, says, "Many or most of the internal inflammations acknowledge and as their ordinary exciting cause. Acute Rheumatism has perhaps no other origin."

And Dr. Bateman in his observations on the diseases of London, remarks, "With the exception of a small number of diseases occasioned by unwholesome occupations, and by the contagions."
"the great mass of Human malady in this metropolis is attributable to the climate or state of the seasons, and to intermixture, but, of these two causes, the vicissitudes of the weather, especially its cold, are by far the most prolific sources of mischief."

It is chiefly on the external parts of the body, immediately exposed to its influence, that cold acts as the predisposing cause of disease, and it is in general the too rapid restoration to health that acts as the exciting. The diseases caused in this way vary much in intensity, from mere congestion of a part, to the most destructive gangrene. In order to produce these effects the cold must have lowered the vitality of the part and of the system, and then the too rapid return of heat causes such a sudden reaction that the weakened part generally suffers or suffers to a certain extent. One of the commonest effects of cold in this way is the chilliarm, which occurs on those parts of the body of a naturally weak circulation, and low vitality, on which the cold acts most readily.
than the two rapid restoration of warmth, causes excess of reaction, and congestion, which by repeated exposure may turn into an ulcer, which is not always very manageable.

Chilblains are much more apt to occur in some persons than in others, and they are said generally to occur in persons of weak circulation, and also in persons labouring under hypopidemia, and other causes.

It depends on how far the vitality of a part has been destroyed, and on the reaction that ensues, what the consequences will be.

It is generally on the internal organs of the body that cold acts as the exciting cause of disease. And diseases of these organs are generally caused by exposure to sudden alternations of temperature, although sudden alternations are dangerous, yet it requires certain limitation, as sometimes very sudden exposure to great differences of temperature for a short time may be borne with impunity.

As is the case with the Russians, who, are in the habit of passing from baths of very high temperature into the snow without
suffering from the sudden change, but this can be accounted for. Habit may to a certain extent have an influence in preventing any evil result from this practice, but it has also been true by strangers, who have equally escaped unharmful.

Blanchet mentions in his work on cold that while in Russia he had tried the experiment. In his first trial he says he went into a bath of lower temperature than is usual, and on going into the room he felt slightly chilled. But in subsequent trials he tried baths of a higher temperature, and then he did not suffer the slightest inconvenience.

The great heat the person has been exposed to in the warm bath, causes great activity of the circulation, and consequently there is much internal heat produced, and for some time after this power remains. But besides this the sensibility of the surface is to a great extent destroyed (it is known that both high and low internal temperature have the power of destroying sensibility) and both these combined render the person insensible for
a time to the action of cold, and when no disturbances are perceived, there is certainly not much risk of any evil result. There have been numerous experiments performed by several different persons to show what a very high degree of heat can be borne for a short time, and on returning to the temperature of the atmosphere at the time, no evil has resulted. But these experiments only show that sudden alterations may not produce any bad effects, if the exposure be not long continued, and the person be in a good state of health.

I have before mentioned that the diseases produced by cold are very numerous, ranging from very slight affections to the most formidable diseases; and that the most common affections were those of the lungs and air passages. Common Cataract is perhaps an affection that almost no one has escaped with suffering, it often prevails as an epidemic from sudden changes in the atmosphere, but is constantly caused by exposure to cold, as in passing from a heated apartment into the cold air etc.
Dr. Allison says" bronchitis, in its simplest and  
"mildest form, is perhaps the most frequent  
"inflammatory disease produced by exposure to  
"cold and wet."

Allison says in speaking of cold: "The  
"immediate effect on the body of the abstraction  
"of heat from the surface is to diminish the organic  
"functions going on there, thus, checking the flow  
"of blood and, and leading to internal congestion. When  
"the cold is applied to an extremity, and is continued  
"the circulation in the whole limb becomes diminished  
"and equally leads to internal congestion in the former  
"case. This congestion generally affects the lungs, or air  
"passages, the intestines or liver, frequently in human climates  
"the muscular substance, and it is directed to these by  
"various circumstances, which may be, and very often are,  
"altogether independent of the refrigerating cause.  

And he further mentions: "The particular  
"kind of affection of the lungs or air passages which  
"results from the abstraction of heat from the surface of  
"the body, is much influenced by its condition at the  
"time. And in the manner in which the heat is  
"abstracted; for instance, when the body is perspiring,  
"if a considerable extent of the surface be exposed to dry  
"air so as to admit of evaporation, or if cold be actually
"applied as in bathing, a calcar will be produced:

"or if the individual be in poor health, or fatigued,

"there may develop a severe bronchitis. On the other

"hand congestion of the parenchymatous substance

"of the lungs, seems to be caused by a longer exposure

"to the refrigerating causes. And we will see ultimately

"connected with checked inspiration as cataracts or

"bronchitis." In a normal condition, laryngitis, pleurisy

and other inflammatory diseases of these parts are

also the frequent results of cold.

Although cold produces disease of the organs

there is a greater variation than of any other; yet still

it produces very many diseases of other parts

of the body, as of the abdominal viscera, produc-ing the most serious inflammations, as

nervitis, enteritis, hepatitis, and many other

diseases, all which are produced by cold

often combined with wet, and it is rather

difficult to say why sometimes one organ and
	not another should be affected. And all

produced by the same exciting cause, but

there must be some predisposing cause to

account for it; although it may be slight

and not easily discovered. For instance

it is said that interitis is liable to recur
after a meal, when the digestive system is at the time more loaded with blood, than when digestion is not going on.

I might have extended this subject to a much greater length, and might have enumerated the many and important diseases produced by excéd, as well as how it acts in their production. But from want of time I have been unable to do this, and if I had, it might have only rendered the essay tedious from its length.