The Correlation of Climate & Food

By

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The Correlation of Climate and Food.

The differences of Climate may be regarded as depending on the distance from the equator, but this general law is modified by various circumstances, two of which deserve notice.

1st. Height above the level of the sea.

As we proceed upwards from the earth, the air not only becomes more rarified, but it gradually becomes colder. The rays of heat proceeding from the sun, do not impart any heat to the atmosphere in passing through it, and as
the temperature therefore depends, on radiation from the earth alone, it must decrease in proportion to the distance from.

2. Amount of evaporation. This depends on the state of the atmosphere, whether it is dry or humid, whether at rest or in motion. The reason why evaporation produces cold, of course is easily explicable on physical laws, for when fluids pass into the gaseous state they absorb a large quantity of heat, which becomes latent. This heat is obtained from surrounding bodies, and hence the temperature is reduced. The air, when in motion has a greater tendency to absorb moisture, as new portions of it are brought more rapidly in succession over
the water to be absorbed, in illustration of this I will quote from Capt. Parry, who tells us: "That with the thermometer at 35° below zero, if no wind is stirring, the hands may remain uncovered, for a quarter of an hour without inconvenience, whereas with a fresh breeze, even when the thermometer is at zero, few persons can keep the hands exposed without pain."

As many parts of the tropical zone the temperature is very high, in Arabia the thermometer frequently rises to 110°F or 120°F in the coolest parts, when dead calms are prevailing, and in British India it is said to have been occasionally as high as 130°F in the Arctic regions on the
other hand, the temperature falls far below the freezing point. Cap. Franklin mentions it to have been –58°F and Cap. Black at –70°F. Now here is a range of nearly 200°F, in which man, with proper precautions lives and seems to enjoy perfect health. This power of adaptation to climate, is shared by few of the lower animals, and by none to such an extent. It appears however that although there may be so much difference in external temperature, the internal temperature seems to vary little, being generally about 98°F. And it has been shown by the French naturalists, who had opportunities for making observa-
tions, on this subject during the voyage of the "Boult" that ever to the same persons, it did not vary above a few degrees, i.e. passing from one extreme to the other. And although comparatively few persons are exposed to such great differences of climate, as those we have mentioned, a great many trades oblige those employed in them to be for longer or shorter periods in very high temperatures, such as Iron works, Gas works, &c. Again we have the Celebrated Fire Eling who used to exhibit in public, and who amazed his audience by entering ovens at the temperature of 400° F. or 600° F. The temperature of his body must
Before entering the atmosphere, the spacecraft will pass through the outer corona of the sun.

3. The temperature of the corona is extremely high, reaching millions of degrees Celsius, due to the continuous acceleration of particles from the sun. The mean by which the corona temperature is maintained is due to the high energy of the particles. However, due to this, we have no idea about the real temperature of the corona.
Temperature which, alone seems consistent with the proper performance of those functions which constitute life.

We have read somewhere that there is a greater quantity of oxygen in cold climates than in warm and that by a more rapid combustion the temperature is maintained. This we consider to be a very unsatisfactory explanation, and one might suppose from it that there is more oxygen in proportion to the other constituents which is not the case, for according to the laws which regulate the diffusion of gases the composition of the atmosphere must essentially speaking be the same in all parts of the world. True it is there is a greater quantity of oxygen
in a given space in cold climate, so is there of Nitrogen, the proportion being always the same. The volume of a given quantity of air depends on three circumstances.

1° Pressure. Like all other gases the volume of a given quantity is inversely as the pressure. This must make a great difference in the amount respired in high elevations. Where the air is much rarefied, as in the high regions of the Alps and Andes.

2° Temperature. As gases expand (or their volume) for every degree of Fahr., in a range of 200° it would make a considerable difference in the amount respired. Were it obviated in a way we will immediately descibe and for which we have
been so minute in the foregoing points, that we may be the more easily understood, but first for
the third circumstance viz.

3° Aqueous vapour. The amount of this varies according to the temperature and pressure, and
ing accordance to its amount altering the amount of oxygen in a given space, but in its great degree,
for under a pressure of about

10 lbs. on the eq. in, and a temp. of 32° F.
the aqueous vapour will occupy at most 1/50 of the volume of air
and at 93° F the pressure being
the same, about 1/5 of the volume, but as this comes under the
same compensating influence as the temperature, we will
not consider it further.

It seems probable that the
temperature (or the increased amount of oxygen in a given volume in
in cold climates) can have little or no effect on the amount of air respired, as before the air reaches the air cells of the lung, it is changed to the temperature of the body, this we think must be the case when we consider the structure of the lung and the passages by which the air is conducted to those parts.

The lungs are admirably adapted for such a purpose being partly composed of minute tubes through which a small quantity of air passes on its way to the air cells. This structure may be compared to the most improved engine boilers of the present day where the tubular arrangement has been introduced as in locomotives and many
of the marine engine boilers. The action of course is generally reversed, the principle however remains the same, and this action probably holds good with regard to the amount of aqueous vapour. And now, the pressure, temperature, and amount of aqueous vapour of the air in the air cells being the same in different climates, the amount of oxygen must also be the same, and therefore can have little or no effect in maintaining the internal temperature constant in different climates. In a future page of this paper we will show that it is the chemical composition of the food taken by the inhabitants of these different parts, or
which this beautiful equation principally depends.

Food is divided into two great classes, depending on its composition, viz. nitrogenised, and non-nitrogenised, as they contain nitrogen or not, and according to Liebig, as they have different parts to play in the animal economy. He has named the former 'Plastic' as it serves to build up the body, the latter 'Combustible' as it undergoes oxidation in the body, and serves to produce the heat.

The principal of these are as follow:
The Plastic or Nitrogenised

Vegetable Fibres

Vegetable Albumen

Animal Flesh

Animal Blood
The Combustible or Non-nitrogenised
Fat
Pectine
Starch: Bassonius
Gum
Wine
Cane Sugar
Beer
Grape Sugar
Spirits

Liebig further says: "It signifies nothing what intermediate
forms food may assume, what
changes it may undergo in
the body, the last change
is uniformly the conversion of
to Carbon into Carbonic acid,
and of its Hydrogen into water
the unassimilated Nitrogen
of the food along with the un-
burnt or undistilled Carbon
is expelled in the Urine and
solid excrements." And it has
been fully proved that those
changes which the food undergoes
that oxidation, is productive of
as much heat in the body.
Lewis on the Physiology of Common Life.
as if it were burned in the air or in pure oxygen. So that, “It is obvious (L宜居 again remarks) the amount liberated must increase or diminish with the quantity of oxygen introduced in equal times by respiration, those animals therefore which frequently and consequently consume much oxygen, possess a higher temperature than others which with a body of equal size to be heated take into the system less oxygen. This theory of L宜居 has been objected to on various grounds. Bouleng and Steuertz considered that the food was not sufficient to account for all the heat evolved by animals, but L宜居 has since shown that it is quite sufficient. Again it has been objected to because what L宜居
Called the "Plastic" materials does give out a certain amount of heat, and the combustible goes in some measure to build up the body. This is almost unworthy of notice, as Liebig was no doubt aware that no chemical change took place without the development of more or less heat. The proportion, however, is so small in the Plastic compared with the combustible as to warrant the two great classes to be so named, and in no way to interfere with correctness of the theory. That heat is liberated every time a muscle contracts is well known, and the experiments of Matteucci and Helmholtz show that it is independent of the circulation. The former placed several frog's legs in a glass and...
and surrounded a thermometer with them, or irritating their nerves, so as to produce muscular contractions, the temperature rose, and besides in tetanus the temperature is sometimes very high 110°F with no increased rapidity of breathing. These facts however we think tend to show no fallacy in the theory of Liebig and moreover we must consider the heat produced by muscular contractions, nervoussystem etc. as only manifesting in different ways that originally derived from the food. Man by instinct seems to combine these two classes in the proportions most suitable to his wants. Butter is eaten with butter, beef with fat pork. Rice with fowl or mutton. But when we consider the
Second Voyage for the discovery of the North-West Passage.
Chemical composition of the food of the inhabitants of different nations they appear perhaps more remarkable. Dr. John Ross observes "He who is fed well resists cold better than the man who is starved, while starvation follows but too soon a starvation in food. This doubtless explains in a great measure the resisting powers of the native of the frozen climates their consumption of food it is familiar being enormous and often incredible." No doubt this is so and moreover the quality as well as the quantity has a most important influence in producing the large amount of heat requisite in those regions. Capt. Pii W. T. Parry, states that as a matter of Curiosity he one day tried how much
Narrative of a pedestrian journey through Russia & Siberia & Turkey.
good an Equinone had. Specially full grown would eat of freely supplied. "The undermentioned articles were weighed before being given to him. He was twenty hours in getting through them and certainly did not consider the quantity extraordinary.

Sea horse flesh. Kind. Frozen 2 lb 4 oz
Cold boiled 4 lbs
Bread & Bread and 3/4 lb

Total 10 1/4

The fluids were in fair proportion 1/3

Rich gravy soup 1 1/4 pint
Raw Spirits 3 1/2 hogsheads
Strong grog 1 tumbler
Water 1 gallon 1 pint

Capt. Cochrane says that the Russian Admiral Danichoff was told that one of the Kamkuts consumed in twenty-four
hours, the hind quarter of a large ox, twenty pounds of fat, and a proportionate quantity of melted butter for his drink. The Admiral, to test the truth of the statement gave him a thick porridge of rice boiled down with three pounds of butter, weighing twenty-eight pounds, and although the glutton had already breakfasted yet did he sit down to it with great eagerness and consumed the whole, without stirring from the spot, and except that his stomach betrayed more than the ordinary fulness he showed no sign of inconvenience. These quantities had probably little to do with the climate as many similar cases have occurred in this and warmer countries, we will therefore
Consider the food of the Esquimaux which Dr. John Ross states it as viz. Twenty pounds of flesh and oil daily. Thus the inhabitants of the Arctic regions live principally on animal flesh. On the other hand we find the East Indian races live wholly on rice fruit and such like substances, existing in a tropical climate comparatively indolent in their habits, thus requiring little heat or tissue producing materials. Some discrepancy may seem to exist between the last sentence and what we have previously said. Considering their food is principally Carbohydraceous this appears compatible according to the view we have taken and which we will now attempt to explain.
The question might be asked: Why do the inhabitants of those regions of 110°F or 120°F take any heat-producing food, seeing that their body would have no tendency to fall below 98°F but rather to become higher in temperature. Why do not rather live on a little flesh, which would be able to supply the plastic materials they would require with as little heat as possible, or drink large quantities of water which by evaporation might tend to keep the temperature of the body at the normal standard. We know they do not the former, the latter only to a moderate extent, but as we have previously said, consume large quantities of food rich in carbon. Let us examine this then.
For the present purpose we may write \( \text{C114 H114 O12} \) to represent the composition of the fats, and sugar. \( \text{C12 H10 O10} \), the combustible food of the warm climates.

The great difference in the proportion of the Oxygen to the other constituents may be at once seen, and as the amount of heat is calculated from the amount of Carbon and Hydrogen. The fats must be more productive of heat, but it appears to have been overlooked that the Oxygen in the compound is in a different state than it is in the air acting through the lump, and hence its combination with its own amount of hydrogen cannot be expected to be as productive of heat. Moreover we know the latent heat of gases is in proportion to the volume.
And considering the very condensed form the oxygen and hydrogen are in in any of these compounds, we consider it probable that the oxygen not only neutralizes the heat-producing power of its equivalent amount of hydrogen but before it can assume the form of water or its vapour must absorb heat. Should this be the case it would at once solve the difficulty in theory thus the produce of the inhabitants of the tropical climates would be most suitable for their wants, being productive of little or no heat and supplying a large quantity of water which, by evaporation would aid in maintaining their temperature normal.

Let us now pass on to consider
the second of these means by which the temperature of the body is maintained uniform by evaporation. This goes on both in the lungs and on the surface of the body. The whole skin is studded with numerous little glands, situated either in the cutis vera, or immediately beneath it. Each is connected to the surface by means of a little tube, the number of these glands according to Mr. Erasmus Wilson is on an average 2,000 in the square inch and their combined length 20 miles. The function of these glands is to secrete fluid which is generally regarded as excrements. Nature however has often more than one object in view in the
performance of a single function and this is by no means a bad example, as it serves in a very material manner to regulate the temperature of the body. Depurin gives the total amount of fluid given off as 18 lbs. per minute, 11 lbs. by the skin and the remaining 7 lbs. by the lungs. The maximum loss (unless under peculiar circumstances) amounts to 5 lbs. in the 24 hours. Minimum 1½ lbs. This regulating power comes into operation when the body is exposed to a high temperature or one much above the standard heat of the body. As an example of this we have previously cited that of the fireman whose performances in all probability depended on this action.
Smith's Philosophy of Health
Dr. Southwood Smith mentions many similar instances and gives experiments performed by himself and others, to the same effect, one of which we will quote which was performed by Dr. Blagden.

"... I went undressed into the room (which he previously says to have been 260' F.) the impression on the air was much more disagreeable than before, but in five or six minutes a powerful sweat broke out which instantly relieved me. During all the experiments of this day when I tried the heat of my body the thermometer always came very nearly to the same point (the ordinary standard), not even a degree of difference as in our former experiments. To prove there was no fallacy..."
in the indication of the thermometer. Eggs and Beef-steak were not only cooked but also dried up after remaining about 33 minutes in the room. He also gives us some interesting experiments which he made at the Phoenix Gas Works.

Experiment 1 Nov. 18, 1836

Eight of the workmen regularly employed at the establishment in drawing and charging the retorts, and in making up the fires, which labour they perform twice a day. Commonly for the space of one hour, were accurately weighed in their clothes before they began and after they finished their work. On this occasion they continued all their work exactly three quarters of an hour. In the interval between the first
and second weighing the men were allowed to partake of no solid or liquid nor to part with either. The day was bright and clear with much wind. The men worked in the open air. The temp of which was 60°F. Br. 29.8

Minimum: 2 lbs. 8 oz.

Maximum: 4 lbs. 3 oz.

From these experiments then it appears that heat acts as a stimulus to the sudoriparous gland which, by increasing the amount of secretion thereby induces an increase in the amount of fluid absorbed or evaporated and by that means keeps the temperature of the body at its normal standard. Closely allied to this function is that of Respiration. This function is performed by the alternate
Contraction and dilatation of the chest, by which the air is forced out and taken in respectively, now the extent of these movements is subject to variations, and the amount of air breathed will be in due proportion. The rate of respiration is even more constant; during sleep it is slow and is increased by exercise, may more if it is increased by cold, which acting on the incident nerves distributed to the part is a stimulus which by reflex action on the muscles of respiration increases the rapidity of their contractions, thereby increasing the amount of combustion. The amount of carbonic acid given off must therefore be greater; this has been proved by the experiments of Letellier.
Annuaire de Chemie et de Physique 1849.
who confined several of the lower animals at different temperatures for a definite time, and measured the amount of carbonic acid they produced. The result of some of his experiments is as follows:

<table>
<thead>
<tr>
<th>Temp</th>
<th>Temp</th>
<th>Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>59.68</td>
<td>86.108</td>
</tr>
<tr>
<td>A Canary</td>
<td>0.325</td>
<td>0.250</td>
</tr>
<tr>
<td>Turtle Dove</td>
<td>0.974</td>
<td>0.684</td>
</tr>
<tr>
<td>Two Mice</td>
<td>0.531</td>
<td>0.498</td>
</tr>
<tr>
<td>Guinea Pig</td>
<td>3.006</td>
<td>2.080</td>
</tr>
</tbody>
</table>

Clothing. Man being endowed with mind has thus an enormous advantage over the lower animals, by being able to supply himself with clothing suitable to the circumstances in which he may be placed. The polar bear transported to the tropical climates of Africa is forced to wear the noble mantle which nature has given him. Whereas man would throw aside his...
For materials more suitable for this altered state, clothing acts by preventing radiation from the surface of the body, being generally composed of bad conductors of heat. It thus lessens the amount required. Some people make use of little clothing compared with others in the same climate. Part of this may depend on habit. But it must be observed that those who use little clothing make up for it by an increased amount of food.

Mode of Life. A few words on this will suffice. There is a great difference here in the habits of different nations. accent and doubt. The climate has much influence in producing it. It is natural to lounge and sleep where the temperature is high, lowering the activity of the limbs.
and thence the amount of heat produced. This would certainly do as in the colder climates. We find the natives of them a more active set of people, taking much exercise, and by that means changing the flame of life which would otherwise have a tendency to become extinguished.

So the foregoing page we leave with the impression that the density of the atmosphere can have little or no effect in maintaining the internal temperature uniform and that it depends chiefly on the chemical composition of the food. The question, what nature intended the food of man to be has been much discussed. Some authors have attempted to prove that animal food was not eaten till after
The deluge, but was introduced in consequence of the deterioration of the herbage underwent on that occasion. Some consider Man to be herbivorous, some carnivorous, and some have even laid down the proportion the one kind should bear to the other. They must surely all be in error, when we consider the structure of the teeth, the length of the intestinal canal. We have no hesitation in coming to the conclusion that Man was intended to be omnivorous. Moreover, the proportion the two classes should be, is not definite but must vary according to the climate. No doubt Man was intended to inhabit many different climates, and it is a doubtful question whether a man could be capable of living in the
Artic regions on vegetables alone we will not pay it is impossible but if it is possible the transition would require to be slow, his alimentary system would require to undergo great changes, great enlargement, to be able to digest the enormous quantities of such food which would be requisite in those regions he would be altered he would be unlike man.

The fact thus apparent that different climates require different food is not sufficiently perceived. God finds a man putting out from England for India who in a short time finds his appetite failing to his sorrow. He stings it in various ways thinking he should eat as much as he did in former times. Poor (however it (readers
this return necessary probably on account of hepacious
we should therefore live in those regions according to the
simple habits of the natives and be guided by them in the
quality and quantity of our food. It is curious to this consider the wonderful
forethought of the Creator who has placed that food in the power
by man which is most suitable for the circumstances in which
he is. Can the Logos man procure the succulent fruits of the
Tropics? No. But Nature has placed the Walrus, the Lea-horse, and the
Whale in his power and moreover imbued him with an instinct to live on them
and prefer them to any other. God thus has intended Man
To inhabit various climates and to maintain in them a definite form. To allow of which He has made man omnivorous. He has duly regulated the proportions of animal and vegetable food over the whole world, and endowed man with an instinct by which he takes sufficient of each to supply his wants. This there is another instance of the Providence of Him, "Who planted His footstools on the sea and rides upon the storm."