Dr Clay Fund Read 1862

The Correlation of Climate & Food

by

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Thesis 1862

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 de-
-pends, on radiation from the
earth alone. It must decrease
in proportion to the distance from it
2° Amount of evaporation.
This depends on the state of the
atmosphere, whither it is dry
or humid, whither 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
their temperature is reduced.
The Air when in motion has
a greater tendency to absorb
moisture, as new portions
of it are brought more rapid-
-ly 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."

In many parts of the tropical Zone the temperature is very high, in Arabia the thermometer frequently rises to 110F or 120F in the coolest parts, when dead calms are prevailing, and in British India it is said to have been occasionally, as high as 130F. In the Artic regions on the

other hand, the temperature falls far below the freezing point. Capt Franklin mentions it to have been -58°F and Capt 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 "Bonite" that even in the same persons, it did not vary above a few degrees, in 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 King 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

have been little altered otherwise he must have perished. no doubt it was mainly due to an enormous quantity of evaporation taking place, however we have no data showing this.

The means by which the internal temperature is maintained Constant will now be taken into consideration, they are as follows

1st Food
2° Evaporation
3° Respiration
4th Clothing
5th Mode of Life

Before entering more minutely into these, we will say a few words on the quantity of Oxygen in the atmosphere, and its supposed influence in maintaining that uniformity of

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 climates, so is there of Nitrogen, the proportion being always the same. The volume of a given quantity of air depends on three circumstances

1st 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.

2d Temperature. As gases expand 491 of 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 describe. 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 according to its amount altering the amount of Oxygen in a given space, but in no great degree, for under a pressure of about 15 lbs on the sq. 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 1/20 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 in 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 gen-
-erally 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, tem-
perature, and amount of
aqueous vapour, of the air in
the air cells being the
same in different climates,
the amount of otygen must
also be the same. and there-
-fore 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 those different parts, on

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 otidation in the body, and serves to produce the heat.

The principal of these are as follow

The Plastic or Nitrogenised

Vegetable Fibrine
Vegetable Albumen
Animal Flesh
Animal Blood

The Combustible or Non-nitrogenised

Fat	Pectine
Starch	Bassorine
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 its carbon into carbonic acid, and of its Hydrogen into water the unassimilated Nitrogen of the food along with the unburned or unoxidised 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 otygen. so that. "It is obvious (Lubig again remark) the amount liberated must increase or diminish with the quantity of otygen introduced in equal times by respiration, those animals therefore which breathe frequently and consequently consume much otygen, posses a higher temperature than othes which with a body of equal size to be heated take into the system less otygen. This theory of Liebig has been objected to on various grounds. Boulong and Despretz considered that the food was not suffecient to account for all the heat evolved by animals. but Liebig has since shown that it is quite suffecient. again it has been objected to because what Liebig

called the "Plastic" materials does give out a certain amount of heat. and the combustible go 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 Corrections 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 frogs legs in a glass and

and surrounded a thermometer with them, on 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, Nervous System &c. 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 Bread butter. beal 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. Sir 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 natives of the frozen climates their consumption of food 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. Sir W E Parry states that as a matter of curiosity he one day tried how much -

Narrative of a pedestrian journey through
Russia & Siberian Tartary.

food an Esquimaux lad scarcely full grown would eat- I 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

		lbs	oz
Sea horse flesh	hind frozen	4	4
do	boiled	4	4
Bread & Bread dust		1	12
	Total	10	4

The fluids were in fair proportion Viz

Rich gravy soup	1¼ pint
Raw Spirits	3 wine glasses
Strong grog	1 tumbler
Water	1 gall 1 pint

Capt. Cochrane says "that the Russian Admiral Lutke afterwards told that one of the Yakuti 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 Esqui-
-maux what Sir John Ross states
it as viz Twenty pounds of flesh
and oil daily. Thus the inha-
-bitants of the artic regions live
principally on animal fat and
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 comparat-
-tively indolent in their habits,
they thus require 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 Carbonaceous
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 120F 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
take Stearine $C_{114} H_{114} O_{12}$ to represent
the composition of the fats, and
Sugar. $C_{12} H_{10} O_{10}$ the Combustible
food of the warm climates
The great difference in the propor-
-tion of the Oxygen to the other con-
stituents 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 ~~and~~
acting through the Lungs. and
hence its Combination with its
due amount of Hydrogen. ~~and~~
cannot be expected to be as pro-
ductive of heat. Moreover we
find the latent heat of gases
is in proportion to the volume

and considering the very con-
- densed 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 then the food of
the inhabitants of the tropical
climates would be most suita-
ble for their wants, being pro-
- ductive 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 three means by which the temperature of the body is maintained uniform viz Evaporation. This goes on both in the lungs and on the surface of the body. The whole skin is studded with numerous little glands, situate 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 2800 in the square inch and their combined length 28 miles. The function of these glands is to secrete fluid which is generally regarded as excrementitious. 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 re-gulate the temperature of the body. Sequin gives the total amount of fluid given off as 18 ps per minute. 11 ps by the skin and the remaining 7 ps by the lungs. The maximum loss (unless under peculiar circumstances) amounts to 5 lbs in the 24 hours. minimum 1⅔ 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 Fire Fiend, whose performances in all probability depended on this action

Smiths Philosophy of Health

W. 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

"On going undressed into the room (which he previously says to have been 260° F) the impression of 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 thur-
-mometer. Egg and Bey-steak
were not only cooked but
dried up after remaining about
33 minutes in the room". He
also gives us some intresting
experiments which he made
at the Phanix Gas Works.
" Experiment I 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 at 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 Bar 29.25

Minimum ~~Maximum~~ Loss. 2 lbs. 8 oz
Maximum. 4- 3

From these experiments then it appears that heat acts as a stimulus to the sudoriparous glands 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 respir-
-ation is even more inconstant. during sleep it is slow and is increased by exercise, may more it is increased by cold, which acting on the incident nerves distributed to the part is a stim-
-ulus which by reflex action on the muscles of respiration in-
-creases 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 Lefattier

Annals 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

	Temp 32°	Temp 59-68	Temp 86-108
A Canary	0.325 Grains	0.250	0.129
Turtle dove	0.974	0.684	0.336
Two Mice	0.531	0.498	0.268
Guinea Pig	3.006	2.080	1.453

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 may 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 in the habits of different nations. once no 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 lungs.

and hence the amount of heat produced. This would scarcely do in the colder climates. - Tho - we find the natives of - them a more active set of people - taking much exercise, and by that means fanning the flame of Life which would otherwise have a tendency to become extinguished.

In the foregoing pages we have tried to show 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 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 in, is not definite but must vary according to the climate. No doubt man was intended to inhabit many different climes and it is a doubtful question whether a man could be capable of living in the

Artic regions on vegetables alone we will not say it is impossible but if it is possible the transition would require to be slow his alimentary system would require 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 known how frice a man setting out from England for India who in a short time finds his appetite failing to his former he estimates it in various ways thinking he should eat as much in his new abode as he did in former times soon however startles

his return necessary probably on account of hepatic disease he 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 consider the wonderful foresight of the Creator who has placed that food in the power of man which is most suitable for the circumstances in which he is. Can the Esquimaux procure the luscious fruits of the tropics? No. But Nature has placed the Walrus, the Seahorse, and the Whale in his power and moreover imbued him with an instinct to live on them and prefer them to any other.

God then has intended Man

to inhabit various climes and to maintain in them a defen-
-sible form,. To allow of which
He has made man omnivorous,
He has duly regulated the
proportions of animal and ve-
-getable food over the whole
world: and endowed man
with an instinct by which
he takes sufficient of each
to supply his wants.
This then is another instance
of the Providence of Him.
"Who plants his footsteps on the sea
And rides upon the storm".