Thesis

on

The Temperature of the Body.

by

Thomas Chesholme
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On the Temperature of the Body

Judging from our own sensations, we would undoubtedly suppose, that the temperature of our bodies is subject to great variations. Such, however, is not the case, for, although we find the human race scattered over all parts of the world, some inhabiting regions of perpetual snow, others dwelling under the burning rays of a tropical sun, operation has shown, that in each case, however different the external conditions, a nearly equal temperature is maintained in each case. Let us therefore inquire how it is that this strange phenomenon is brought about, but before doing this we shall speak of the degree of heat sustained by the body, and of those circumstances that tend to modify it.

What is the exact temperature of the human body? Opinions on this subject are many and various. John Hunter placed the standard of the heat of the blood at 98.47. More recently Dr. Davy, after an extensive series of investigations, placed the
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What is the exact temperature of the Human body?

Opinions on this subject are many and various, John Hunter placed the standard of the heat of the blood at 98.6°F. More recently Dr. Davy, after an extensive series of investigations, placed the
extremes of temperature in man at 98.7° and 99.7° respectively. Later inquiries tend to prove that the standard, adopted by these observers, is too low. Brown Seguar states, as the result of his observations, that the heat of a healthy man averages from 100° to 102° in the rectum. The few observations, which I have myself made, lead me to believe in the accuracy of this statement. Hunter was of opinion that the temperature of the rectum was as high as that of the left ventricle of the heart, but the difficulty of making such investigations is so apparent, that no one need feel surprised at the results of inquiry on this subject proving very dissimilar. According to we find Brown Seguar fixing the temperature of the left ventricle at from 1 to 3 degrees higher than that of the rectum. He was convinced in these views by repeated observations on the urine, from which he concluded that its temperature varies from 101°-103°. Assuming that the heat of the body declines the farther we pass from this, this distinguished observer considers its average temperature to be 103°. This standard of heat is apparently correct.
If we grant the supposition of the assumption
that the temperature of the trunk differs materially
in different parts. But I am much inclined
to question the accuracy of this supposition.
The lower part of the abdomen is apparently
as well calculated to retain heat, as the upper
part, so that, if there be a similar production
of heat there, there should also be a similar
amount of it.

Liebig, the son of the
renowned Munich Professor, has shown that
the arterial blood in places being warmer than
venous as has generally been supposed is
from .34 to .37 lower. This shows, as is
now usually granted, that the heat is principally
generated in the blood and not in the lungs, so
that we are justified in concluding, that the
lower parts of the abdomen are as high in
temperature as any other part of the body. The
truth of this statement has been rendered pro-
bable by the experiments of Professor Vick.
He experimented extensively upon dogs living
dogs, and he assured himself, that the most
elevated degree of heat is met with, in the
vagina & Rectum, where the temperature varie
from 101 ½ to 105 ½. Accordingly, we may conclude that the average temperature of the body varies from 100 7/10 to 102 7/10. This agrees with certain observations that have been recently been made on the continent upon decapitated criminals, but as all experiments upon this subject require confirmation, we will pass on to the consideration of other subjects.

The temperature of the different parts of the body varies considerably, partly from differences of vascularity, but chiefly from the facilities they possess for parting with their heat.

Besides these, the temperature undergoes modifications from many causes.

From the excellent researches of Dr. Davy, it seems proved, that the temperature of the body is subject to great variations, even when not disturbed by disease. It rises and falls under various influences, but especially from heat, cold, exercise and rest. His observations were made chiefly upon himself; they extended over a range of 9 months, and they seem to have been conducted with great care. He found, that the temperature under the tongue...
was highest in the morning and lowest about midday, being then from 12° to 1° lower than in the morning. During the day it fluctuated more or less, until the middle of the night, when it had attained its lowest point.

In accordance with this fact he observed that the pulse and respiration were also lowest at that time. This periodic diminution is the more remarkable, as it coincided with the highest degree of heat in the room. It occurred under such various circumstances, that it seemed due to the depressing influences of the night.

During sleep the respiration and circulation are diminished in frequency. We would therefore a priori infer that there would at the same time be a diminution of temperature. Such is the case; we are frequently awakened during the night by a feeling of cold, although no actual change has taken place in the temperature of the room. It is owing to the same cause, that we require to be so much more warmly clothed during the night, than during the day. Along with this weakening of the
power of generating heat, we must ascribe the increased liability to colds and catarrhs, which exists during the night. The diminution of temperature during sleep is very well marked in the process of hibernation, which is in every way the parallel of ordinary sleep, except in force and duration. During the hibernation of animals, the respiration and circulation are reduced to an extreme degree of slowness, and it is worthy of remark that when these animals are roused up, the respiratory and circulatory functions resume their original vigour. Their temperature soon returns to its former standard. This diurnal variation in the amount of heat is not confined to man. Choripol described a similar change in birds; in them also, the temperature bore an evident relation to the activity of the respiration.

Dr. Damps experiments seemed to prove that a full meal had invariably the effect of reducing the amount of heat while a slight meal did not materially affect. This depression after eating is the more unexpected, seeing that the respiration
Pulse are quickened at the same time — some few experiments, that I have made upon myself and some of my patients who might there be considered to be quite free from disease, have led me to a different conclusion. I was induced to pay attention to this subject, because satisfactory proof was wanted, & either to show the truth or falsity of Dr Dancy's experiments. I took especial care that the observations which I should make, should be performed with the attention, all modifying circumstances being excluded as much as possible. Particular care was directed to the state of the room, the clothing of amount of exercise &c.

Subjoin a few Specimens of the experiments.

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<th>Date</th>
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The above experiments were performed upon myself. They show an increase of nearly 1 ½ inches after a good meal.

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These experiments were made upon patients, who had been admitted into the Infirmary for slight ailments, from which they had completely recovered. The temperature was tested in the same part as that selected by Dr. Darcy, viz: under the tongue. These observations, of which the above are a specimen, convinced me that Dr. Darcy's experiments on this point were not to be looked upon as conclusive. But how are we to account for the different results obtained by such an excellent observer? A little consideration will, I think, show why a full meal in his case, always caused a diminution of temperature. He informs us that during dinner, which was the only full meal he took, he was in the habit of drinking 3 or 4 glasses of
of wine &c. &c. were said, that if on any particular occasion this quantity were increased, the reduction of temperature was more strongly marked. Here lies the solution of the difficulty, for it has been plainly shown, that the effect of alcohol in a state of health, is to diminish the amount of heat. In accordance with this view we find that the excretion of &c. is in like manner heightened by the use of alcohol. In the case of Dr. Denny, the power by wine in this respect was sufficient not only to counteract the natural tendency of the meal, but even to sink the temperature below normal. By way of experiment I gave three of the above mentioned patients, a little wine & brandy. In the case of those who had a little brandy & water there was a speedy reduction of $\frac{6}{7}$. In the case who had a little brandy & water mixed, there a decrease of $\frac{8}{7}$ under the tonic, while in Barry who had but a small quantity of brandy with a very little wine there was no apparent diminution. In a state of health, where the temperature falls, not from a deficiency of aeration, but from a deficiency of the combustive materials, alcohol
which supplies their place, tends to sustain the animal heat. The good effects of wine in fever, are partly to be accounted for in this way. How to explain the heat depurifying qualities of wine is a difficult matter.

According to Liebig, the calorific properties of the different kinds of food, stand in the inverse proportion to the amount of oxygen they contain. In ordinary fat the proportion of oxygen is only about 10 per cent, whilst that of hydrocarbon is at least 26 per cent. In alcohol the proportion of oxygen is nearly 35 per cent, to 65 per cent of hydrocarbon. Accordingly against it is apparent that a certain weight of fat with propanol, with the same amount of O, will produce a considerably higher degree of heat than an equal proportion of alcohol, of even the purest quality. Alcohol seems to have a stronger attraction for oxygen, than the ordinary combustible materials of the blood, so that it is consumed in preference to these. This accounts for the dark colour, which the blood presents after the ingestion of alcoholic liquors.
The only cause of the diminution of temperature, we would not expect to find any deficiency in the secretion of breath after the use of alcohol, as the oxygen contained therein, having the strongest attraction for H., leaves the E. to combine with the oxygen of the inspired air. I am therefore inclined to suspect, that, besides the inferior heat-producing powers of alcohol, there is another cause in operation. It seems probable that, owing to the escape of alcoholic vapours from the lungs, a mechanical obstacle is presented to the free aeration of the blood. This explains satisfactorily, the diminished separation of CO₂, after the use of spirituous liquors, and, along with the lower caloric properties of alcohol, accounts for the decrease of heat after its use.

To return to the point, although these experiments, of which I have just spoken, may be deemed sufficient to settle all doubt concerning the actual increase of temperature in the mouth, certain objections have been raised against them. During the process of digestion, an increased supply of blood passes...
To the stomach: it has been supposed, that the whole alimentary canal might participate in this increase, & thus that the mouth might indicate an increased amount of heat, while the surface of the body was actually cooler. To settle this point I tested the heat of the same patients in the axillae, using the same precautions as before.

Experiments on Temperature in Axillae before & after Dinner:

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I considered these results so very conclusive, that I did not pursue these investigations further. In only one case was there no in-
crease of heat after dinner, and it seemed to be due to having perspired during dinner, and to the being covered with perspiration during the experiment. No man, therefore, concludes that the invariable tendency of a full meal is to elevate the temperature of the body.

Various other circumstances modify the temperature. Exercise in particular, when not carried to fatigue, raises it. Heat and cold exert a slight influence over it, heat raising it slightly, while cold depresses it.

Davy observed the heat of his body on different occasions as much as 3°4 below average after returning from a seat in a cold church.

The influence of season is best observed in man than in the lower animals. It seems to modify the heat producing powers, for Edwards found that warm-blooded animals perished much more speedily from a low temperature in summer than in winter. In this way we must account for the chilly effect produced upon the generality of people in summer by a day which in winter would have been reckoned unusually warm. Doubtless the
effect is partly referable to the influence of
contrast upon our feelings. The temperature
of warm climates, is represented by the summer
of our country, with this difference that it
is higher, and that it continues with little
variation throughout the year. It follows that
it will have similar effects and that its
inhabitants will have a degree of cataleptic
power, inferior to those of temperate
countries, as Such we judge to be the fact.

Let us briefly enquire into the means
natural adopts for sustaining this temperature.

We have seen that the temperature of the body
undergoes very little variation, even under the
most opposite circumstances, and well it is
that nature possesses the power of maintaining
a degree of heat, at all times nearly equal, for
numerous experiments have shown, that a
variation, to any great extent, is incompatible
with the existence of life. The power of
generating heat is not strictly confined to
the animal kingdom. At the flowering
season certain plants present the peculiarity
of liberating a considerable amount of heat.
We find this power, connected with the absorption of oxygen, the formation of \( \text{CO}_2 \), and in proportion to the amount of \( \text{O} \) absorbed, so is the height of temperature attained. In like manner, we find that the temperature of the lower animals, corresponds with the activity of the respirating process. Reptiles which possess little power of sustaining a temperature above that of the surrounding media, have a feeble respiration, and make use of very little oxygen. Fishes consequently rank below reptiles, in their heat producing powers. The higher classes of mammalia are distinguished by great activity of the respirating functions and according to we find, they are enabled to sustain a high temperature, under very adverse circumstances. Of all animals, birds present the most complete system of respiration. Not only are they supplied with very efficient lungs, but in addition to these they possess an extensive series of air cells, by means of which the blood in the ramifications of the aorta, is supplied with
oxygen. In accordance with this, we find that birds possess a higher temperature than any other division of the animal kingdom. Thus we see that throughout the whole divisions of the vertebrata, the various degrees of temperature bear a close relation to the means they possess of consuming oxygen.

In like manner, the amount of heat in the human body shows an evident connection with the consumption of oxygen. We have seen that exercise, meals, and mental exertion also mention activity, raise the power of raising the animal heat. In accordance with this we find the excretion of CO₂ increased as well as the activity of the circulation and respiration augment under all these circumstances. We can mention other examples of the connection of heat with the consumption of oxygen.

Certain animals possess the power of sleeping during the cold season of the year. In these animals the respiration of the pulse sink to a considerable extent. They make use of very little oxygen and consequently
eliminate a small proportion of CO₂. We are thus enabled to comprehend the great diminution, which takes place in the temperature of their bodies. When these hibernating animals are roused up, their circulatory and respiratory functions, assume their original vigour, and their temperature returns to its previous standard. As a proof of the little necessity these animals show for oxygen, during the process of respiration, at this season, we may refer to the increased power they have of prolonging their existence, in gapes that almost support life, or even when submerged in water. Upon the same principle must be explained, these marvelous stories of Indian Fakirs, who bury themselves alive for weeks without food, and almost without air. In these cases the animal heat sinks almost to the lowest point consistent with life, while the respiration and circulation are almost in abeyance. The interesting experiments of Bhopal proved that in Starvation death resulted from the lowering of the temperature.
the animal continues to live, while its store of combustible matter lasts. We can thus understand that these Indians reserving a power similar to that possessed by hibernating animals, may be enabled to prolong their existence while they can prevent their temperature sinking below a certain point.

Various views have been taken as to the particular substance in the blood with which the oxygen combines in order to be carried to the tissues. It has been supposed by some that the union took place with the protein compounds. That it is not with the fibrin, whose presence is proved by the fact, that a perfectly defibrinated red blood is injected into the main artery of a limb, that has been thoroughly washed out by diluted serum, the blood returns by the veins not only venous in appearance, but containing minute quantities of fibrin, which may be increased by exciting muscular contractions during the injection. From this fact we have good proof of the truth of that doctrine, so ably taught us in this school, that fibrin is one of the effete productions
of the body. Again entire blood will absorb much more oxygen than either serum or aqueous humour, so that we are led up to the conclusion, that it is chiefly with the corpuscles that the absorbed oxygen combines. Leigns doctrine has received very general support. He thinks, that it is with the iron, contained in the red blood corpuscles, that the oxygen combines. According to this view we would, ceteris paribus, expect to find the temperature diminished in those diseases, in which the red globules are deficient in quantity. The low temperature in Anaemia and Periphere, has been explained in this way. There is one disease however in which there is a most extraordinary deficiency of these, without any diminution of temperature. In Leucocytesemia, our knowledge of which we owe to our distinguished Professor of Physiology, in spite of the great decrease in the number of red blood corpuscles, the temperature is maintained at its normal point. I have seen a good few cases of this disease and never observed any deficiency in the amount of heat. There are three cases of
present in the Infirmary. In two of these the disease is particularly well marked. In one
the temperature under the tongue is 99. In the other it reached 102.0. Dr. Gaffney who
has several times been under observation in
the clinical wards, presents a temperature
of 99.5%. Some modification of Liebig's
theory is necessary in order to explain these
facts. It is possible that the white corpuscle,
may, like the red, possesses the power of combi-
ning with oxygen. This would be sufficient
explanation for such adverse circumstances.
It seems the less unlikely, since Dr. Bennet's
publications have shown the intimate connec-
tion, which exists between the two kinds of globules.
Seeing then, that the absorption of air is
the means adopted for the generation of heat, let
us enquire, with what substances it is that the
necessary combination with oxygen takes place.
If we consider the different conditions under
which men exist, we will see that those in-
habiting the polar regions must require a
much greater production of heat than the in-
habitants of the Tropid Zone. Consequently
we would expect that some very material differences should be in operation, in order that they may attain this object. The condensation of the atmosphere by the cold of the Polar regions, by allowing an increased introduction of oxygen into the system, is one of the means adopted for supplying the increased demand for heat. This increase of oxygen is not alone, sufficient to counteract the intense cold of the Arctic regions. Fuel must likewise be supplied in increased quantity. Looking at the food of the Equi-mammal, in a chemical point of view, it has been shown to be the best calculated for sustaining a high temperature. Their diet consists almost entirely of fatty materials, the chief use of which is for combustion. The enormous quantities they consume, the relish with which they devour all sorts of fats and oils, show that there is an actual necessity for such matters in their system. The differences of diet in the Polar and in the Tropic regions is very remarkable. Each is best suited for the conditions of the climate in which it is used. Were the Flinders to change his diet,
consisting almost exclusively of Rice, for the
flour and fat of the Equinox, he would
probably decline, under disease of the liver
induced by disease of the breast, the increased
labour thrown upon that organ. On the other
hand, the simple food that suffices in the tropics
would come far short of the necessities of nature
in the cold regions of the North. Such being
the case we cannot but admire that instinct,
which prompts the in either case, to select those
articles of diet, which are best fitted for their wants.
It would be well for those of our countrymen
dwelling in the East Indies, were they to obey
the warnings of nature and not pamper and
encourage appetites, which have lost their keen-
ness merely because the external warmth necessi-
tates a less production of heat. Were they to ap-
proximate their mode of living, more to that
of the Native Hindoos, then can be no doubt
but that a happier & healthier existence would
be the result. As the obnoxious materials,
then, which are the principal means for sup-
porting the Temperature, but other important
means affect. Whatever is capable of combining
with oxygen in the body, seems to take part in this important process. Economy is one of nature's great laws. A muscle cannot act without the consumption of oxygen so that the slightest muscular exertion is accompanied with the production of heat. In all probability the nervous system is placed under similar laws. This explains the increase of heat which occurs in a muscle when exercised. It is, however, in part owing to the friction of the fibres against each other. In some tribes, who undergo much exercise in the warmer regions, the muscular waste seems enough to sustain their temperature, but in our own country other means are requisite.

In these tropical regions, where the thermometer frequently ranges far above the heat of the blood, the question may well be asked, how the heat of the body is kept sufficiently low. The process is very simple, being merely that of evaporation. The greater the heat, the greater is the transpiration of fluid, and consequently the greater is the production of cold. As long as the respiration is allowed to flow without interruption, people have the power of withstanding an extraordinary degree
of heat. Numerous instances are on record when
men have sustained a temperature upwards of 300°.
Chabert 'the fire king' was in the habit of en-
tering ovens, heated to the extent of 400° or even
600° without any disagreeable results. In such
cases the dryness of the air favors the evaporation;
should however means be adopted to check it, even
a slight elevation of temperature is sufficient to
give rise to great inconvenience, or even to cause
death. A. F. Delacroix & Berger tried several
experiments upon the lower animals, & they found
that death ensued whenever the temperature of
their bodies had attained an elevation of from
11° to 13° above their natural standard.

It has long been known that the skin
exerts a great influence over the due aeration
of the blood. The amount of heat excited by
the skin is very considerable; it is the result of
the direct absorption of oxygen through the skin.
From this we might infer that a considerable
amount of heat is generated through means of
the skin. If the cutaneous surface of animals
be coated over with varnish, their temperature
gradually falls and they soon die, poisoned.
Apparently by the non-elimination of some substance, that should have been carried off by the skin. But if such animals be kept in a warm place, the heat of their bodies does not sink, as it does in a lower atmosphere, so that by this means a fatal result may be avoided. The poison seems in this case to kill by lowering the animal temperature. arrows posed that if the temperature of animals were lowered by any means to the extent of 30°F the animal immediately perished. Repeated experiments have repeatedly shown the exactitude of his a priori observations, that they are now placed beyond doubt. From this we may infer that if in any disease the temperature shall sink below that point, there shall be danger of death ensuing from that cause. Brown deemed it of opinion that this takes place in cholera, certain paralyzed + various diseases where the respiratory phenomena are greatly altered likewise in many cases of poisoning. His experiments on the latter subject, are full of interest & seem to be worthy of all confidence. It has long been known that the temperature falls in most cases of poisoning. Chosak observed the temperature of a
dog into whose veins he had injected opium such
from 70 to 247, 24 hours after the operation.
Demequina Demerit observed an abatement of
several degrees, in the temperature of dogs destroyed
by several poisonous agents; but it is to Brown-
Sequard that we are indebted for our chief infor-
mation in this subject. This distinguished observer
performed a series of experiments upon various sorts
of animals with different poisons & he found that
all had the effect of causing a marked lowering
of temperature. Opium, Belladonna, Digitalis
Acid of Alcohol were among the poisons
which acted thus. He found that this deficiency
of heat, was often sufficient to cause death, when
the animal would have recovered from the other
effects of the poison. In such cases he found that
a dose of poison which was sufficient to destroy
life, if the temperature were allowed to sink with-
out obstacle, did not kill if the heat of the
animal were maintained at its normal point.
He drew these important deductions, from exper-
iments of the following sort. An equal dose
of poison, was given to two animals of the same
dize, and of the same species. one was placed
a temperature about 50° & the other was kept in an atmosphere, the temperature of which was maintained about 80°. In these circumstances, the first died at the end of a certain time which varied from 4 to 48 hours, while the other whose temperature either remained unaltered or at least suffered very little diminution, recovered completely. From this we perceive that it was the lowering of the temperature that was the cause of death in these cases.

Very important practical lessons may be gathered from these experiments. If they were more generally known, I feel convinced that certain modifications would take place in the treatment of cases of poisoning. I was recently, by fortune, to see one serious case of poisoning by laudanum. In that case, I well remember, the feeble respiration, the pale, cold skin, & the shrunk features: how much the lowering of the temperature had to do with the fatal result I cannot tell. But certainly the cold affusion to which he was treated, and the total disregard for all means of supporting the animal heat, were not means calculated to induce his recovery.

We have seen before that the gradual cooling
of the body, causes death. This is apparently by its interference with all the vital functions. It seems, however, to result from a different cause, when there is the sudden application of a severe cold. The direct effect of this seems to be to cause congestion of the nervous centres and the cessation of the circulation from asphyxia.

Let us now extend our enquiries as to the influence exerted by the nervous system over the production of heat. Very little attention is required to shew that the temperature is in part under the influence of the nervous system. The warm blush of shame, the pale, cold check of fear equally attest the importance of the emotions in the production of heat. The nervous system seems to influence the generation of heat in two ways, directly and indirectly.

We have seen, that the temperature of the body has a very evident relation to the activity of the circulatory and respiratory functions. This is the mode in which the nervous system influences the respiratory calorific powers. For both these systems being very easily affected by the nervous force, the production of heat is consequently af-
ected, in proportion as the change that takes place in them. Section of the pneumogastric causes a great diminution in the numbers of the respiration, and consequently a considerable increase in the temperature of the body. Thus, in this case also, variation in the amount of heat depends, either upon variation in the circulation or respiration. In the same way the temperature may be indirectly influenced by the nervous system through means of the muscles.

The sympathetic nerve seems that alone, which exercises any direct influence over the amount of heat. This system of nerves seems to supply the capillaries by their contraction or dilatation, to regulate the supply of blood to the various tissues. The increased amount of blood, admitted by the dilatation of the vessels is the cause of the increased heat seen in blushing. Too much influence seems generally to have been attributed to the nervous system as regards the temperature of the body. In the various forms of paralysis there is generally some diminution in the heat of the paralyzed part. This change has generally been at-
tributed to the want of nervous influence, but a few considerations will suffice to show, that it is due to a different cause.

The admirable experiments of John Reed upon frogs, and similar investigations performed more recently upon warm-blooded animals have settled that the changes that ensue in paralyzed limbs, are entirely due to the absence of the muscles.

The consequence of this want of action is that there is less demand for oxygen, than when the muscles are in constant use, I consequently there is less heat generated in such limbs. Although the supply of blood in paralyzed parts, is always, as a minimum, nevertheless we find that the arterial blood does not become transformed into venous, with its usual completeness. But this may be almost completely prevented by exciting muscular contractions, the demand for oxygen being thus increased. The blood then issues from the paralyzed limb in a darker stream.

Brown Separd came to the conclusion, as the result of his recent researches, that the nervous system exerted very little, if any, influence over the organic functions. In Young Regens, on which
he had removed all the spinal cord below
the 5th cervical vertebra, he found all these
functions fulfilled perfectly; among other
things he mentions that the animal head was
similar to healthy that of healthy regions of the
same age. When referring to the diminution of
temperature in cases of paralysis, we attributed
it to the want of muscular action induced by the
nervous action. It is but right to state that in
such cases the sympathetic retains its functions.
Were there paralysis of this nerve also, there would
probably be a slight increase of heat, as the
paralysed region would then admit a larger
supply of blood to the limb. A very extensive
series of investigations, has been made by Bernard
upon the effects produced upon the temperature, by
section of the different kinds of nerves.
Let us first refer to his researches into the
function of the sympathetic. The experiments
were made chiefly upon Rabbits., the section being
performed in the neck. After the operation a very
manifest increase of temperature took place upon
that side of the head upon which the nerve had
been divided. This elevation of temperature took
place under certain circumstances with great rapidity. The thermometer manifesting an increase sometimes as great as 7 to 8°, a few minutes after the section. The difference of the two sides was apparent to touch, but was more conveniently determined, by the introduction of a thermometer into the nares or auditory canal of the animal. The operator found that after section of this nerve in dogs, the persistence of the elevated temperature did not last much above 6 weeks or two months, while in rabbits it remained for even a shorter time. This in all probability arose from the rejoining of the divided extremities of the nerve, after allowing the transmission of the nervous force, since after excision of the superior cervical gland, it seemed to continue for an indefinite period.

This increase of temperature was invariably accompanied with an increased vascularity of those parts, in which the heat was abnormally developed. If the cut extremity of the nerve was immediately galvanised, all those phenomena, which had resulted from dissecting, disappeared. The temperature rapidly dimin-
crushed and of the galvanic stimulus were continued, it even sunk below that of the sound side. The reflexes contracted under the influence of the galvanism, and the vascularity, speedily passed away, the mucous membranes assuming their original patency. If the Galvanic current were checked, all those phenomena originally produced by division of the nerve, gradually reappeared, to disappear again, if the galvanism were renewed. Under these circumstances, we are justified in concluding, that the increase of heat was solely due to the increased vascularity, especially when we consider that similar results are obtained by hanging an animal with its head down, for the space of a few minutes. The similarity of the results obtained extends to all the phenomena produced by section of the sympathetic, viz. contraction of the pupil, increased sensibility, suffusion of the eyes, with increased vascularity and heat. It is worthy of notice, that similar results attend injury upon the sympathetic. In a patient recently admitted into the Infirmary, with aneurism of the left Carotid, it was
noticed that there was contraction of the nictitans on that side. On testing the temperature I found the following differences:

Right Nasal 90.6    Left Nasal 86.4
Right Side of Mouth 92.4    Left Side of Mouth 94.7

Externally, the increase of heat was so well marked that it was quite evident to touch. It was so very apparent that upon requesting three patients at different times to tell me whether or not they could distinguish any difference in the temperature of the sides of the man's face, each declared without hesitation, that the left side was distinctly the warmer. It was especially interesting to observe that this side of the face frequently perspired, while the other remained perfectly dry. After perspiration, the elevated temperature sank considerably. The conjunctiva of the diseased side was rather more congested than on the sound side.

This case is interesting, as showing that interference with the functions of the sympathetic in man, is productive of similar results to those that occur in the lower animals. Among the results of section of the
Sympathetic may be mentioned the resistance which it causes to the influence of a low temperature. The sound side cools much more rapidly than that on which the nerve has been divided, so that the longer the experiment is continued, the greater is the difference between the two sides. On the other hand that side of the head which was already elevated in temperature, was not sensibly raised more, on exposure to a higher temperature while the other side became to much heightened, that it soon equalled it in temperature. Bernard is of opinion, that the various results obtained, cannot be explained by mere paralyses of the vessels. If this were the case, he argues that we would have an instantaneous dilatation after the division of the nerve, but he seems to overlook the fact, that the irritation of the sympathetic resulting from the operation, must cause a certain amount of contraction before the paralysis ensues. Valentin has shown, that stimulation of this nerve causes contractions of the different muscular tissues it supplies. The same has been seen in the capillaries, too, seen in as large a vessel, as the
Torto. It is probable then the carotid artery and increased heat following section of the sympathetic result from the paralysis of the ultimate vessels.

Bernard extended his researches to the effects produced by section of the nerves of motion and common sensation. He found that section of the 7th nerve, before leaving the cranium, was followed by loss of temperature to the extent of several degrees, but if divided after its exit from the cranial cavity, the temperature was slightly elevated. This he explains, by the incoagulation the nerve forms with the sympathetic. Section of a nerve of common sensation is followed by diminution of temperature also, but to a less extent than in the case of the motor nerves. If a nerve containing the three kinds of nerve fibres, to cut, a slight elevation of temperature succeeds its division.

The diminution of heat after division of motor and sensory nerves seems entirely due to the inferior demand for oxygen, resulting from the paralysis of the muscles. All muscular movements must cease, upon section of the motor nerves...
root of a nerve, while the effect of section of the sensory root, must have been to destroy all combined movements, for such cannot latter place, where there is complete anaesthesia of a limb, unless the "Muscular sense" be replaced by some other, which could hardly occur in one of the lower animals.

We may conclude from these remarks that the sympathetic nerve alone has any influence over the temperature of the body. Bernard's experiment have been performed with great care, but sometimes in accounting for the results of his experiments he overlooks very obvious explanatory facts, is very upon things of little consequence. For example, after dividing the anterior roots of the inferior spinal nerves in a day, he found on one occasion that there was an increase of temperature on the sound side. He explains this by the rewarming (réchauffement) of the wound without at all taking into consideration the fact that the animal had repeatedly raised itself, and run out of the room dragging its paralysed limb after it. The Muscular excitement required for these movements was
quite sufficient to elevate the temperature of this limb, without any other consideration. Want of tone presents me evidence, as I had intended, into the consideration of the temperature in disease. I shall therefore only refer to two abnormal conditions of the body by : anemia & scrofula. Both these diseases, if I may so speak, are characterised by a temperature below average, & in both owing to the diminished number of the red globules, the corpuscles are in deficient amount. The low degree of heat seems therefore to be due to the diminished supply of oxygen not proving sufficient to oxygenate the fatty matters. It appears to be owing to this that the combustive materials, in place of being consumed to & elevate the deficient temperature, are so frequently deposited as adipose tissue. The treatment indicated in such cases is to increase the number of corpuscles & though then, the supply of oxygen. Iron possesses an undeniable power for it of the generation of these globules, & should therefore be given in both these diseases. When given in anaemia a speedy increase in the quantity of the blood globules, etc.,
Placed at the same time the temperature becomes increased. Andral & Lajard have shown that the store of combustible matter becomes diminished, even although the digestive powers have been improved. In cases of anæmia, I have known the deposit of fat so great, as to annoy the patient & deceive the practitioner into the belief that it was a sign of strength & therefore to induce him to prescribe alkalis, and purgatives for the purpose of bringing the patient into a better condition. The scientific mode of practice would have been, to increase the number of the exsiccators & thus to eliminate the fat by the natural process. By this means the patient, in place of being weakened would have gained strength, while the object of the treatment would have been more effectually attained. This is only one of the many proofs that a thorough knowledge of Physiology is the only foundation for proper practice. To Physiology I feel convinced that, too much attention cannot be directed by medical men, & it is with pleasure that I now behold some of the best physicians in the land, thoroughly alive to the truth of this statement. Under their guidance we may rest assured that Medicine will still advance with rapid strides until none can deny its right to rank among even the most perfect sciences.

Fins.

L. Chisholm.