The nature of fever in relation to certain methods of treatment

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It is difficult and even impossible to draw a sharp distinction between the specific fevers so-called and those inflammation which are attended by general constitutional disturbance. A few diseases which are generally regarded as pure inflammations such as Pneumonia are thought by some to depend on a specific poison and many specific fevers are attended by local inflammation which form an important factor in their history. In some therefore of fever in general terms acute inflammations are necessarily included.

The nature of fever has of course been much discussed in all ages.
and even at an early period some glimmering of the truth seems to have been perceived; but until very recently men this has been hidden in a cloud of erroneous ideas arising from ignorance of physiological processes. Even now it is necessary in considering the nature of fever to keep the point under discussion clearly in view and not to confound it with closely allied subject.

The chief stumbling block in the way of a correct knowledge is the confusion which arises from jumbling together the cause, the nature, and the effect of fever. These three things are different from each other and in all discussion must be kept rigidly apart. The cause of fever may be a poison introduced into the blood, or
or a local inflammation.

This poison or inflammation by its action on the blood induces changes in the tissues of the body, and these changes constitute the intimate processes of fever and give rise to its essential phenomena. These changes also produce results in various organs which must be distinguished as the effects of fever and not having any necessary connection with its nature.

Suppose a poison to have entered the blood; it seems probable that its action is twofold: (1) It reproduces itself and (2) it induces some kind of change in the blood.

It must be assumed that this blood change occurs:

(1) Because in most fevers a period of incubation occurs.

If the poison were itself able to infect fever, why should it not do so at once?
(2) The fever generally leaves the organism protected for a period at any rate against a second attack. It is reasonable that some blood change confers this immunity. Modern theories and experiments render it probable that some low kind of fungus is the cause of several fevers. It is known that such fungi readily receive a change, to wit, a fermentation in any fluid into which they may be introduced. It seems therefore that a change like fermentation results from the introduction of the fever poison into the blood and that the products of this process acting on the tissue induce the phenomena of fever. Up to this point nothing of the true nature of fever has appeared; the fever indicated is merely the operation of the cause. A profound blood change has doubtless been induced
a change potent for evil to the existence of the organism but if the process stopped here if it went no further than this blood poisoning no phenomena of fever would appear death might occur but it would not be death from fever in fact the products of this fermentation in the blood themselves constitute by their action on the tissues the immediate real cause of fever if this be true it follows that all methods of treatment which aim either at preventing the entrance of the original poison into the blood or at its destruction in the blood are preventive methods of treatment and it seems to me that specifics such as Salicine in Rheumatism and Quinine in Ague ought to be regarded as preventive remedies.

The action of the product of fermentation upon the tissues results
in the familiar phenomena of fever, of which the most striking and important is the rise of bodily temperature. There can be no doubt that in the method of production of this rise of temperature the whole mystery of the fever process is involved.

The first question which has arisen at this point is whether the rise of temperature is due to successive production of heat within or diminished loss of heat from the body. This question may now be considered as settled; there seems no room to doubt that loss of heat in fever is not only not diminished, but is even increased. It has been proved that a body suffering from fever will warm a given quantity of water more rapidly than when its temperature is normal. Radiation must be more rapid from a body at a high temperature than at a low one, and the increased
frequencies of respiration, providing for greater loss of heat by the lungs. If there be no diminution in loss of heat, there must necessarily be increase in its production, and evidence that this occurs is at hand in the increased quantity of products of oxidation, of which the types are lactic acid and carbonic acid, secreted during fever. This heat can only be supplied in the body, under the circumstances of fever in one way, that is by chemical action; and physiology has shown plainly clearly that such chemical action occurs only in the protoplasm of the tissues. The blood serves no other purpose in health than to carry oxygen and nutritive substances to the tissues and remove matter from them; it has been displaced from its former position as the grand scene of the oxidation of the body. In fever A. Conville
the poison to the tissues upon which it acts, but it takes no further part in the process of the disease, there go on wholly in the protoplasmic substance of the tissue, the fever does not rage in the blood.

This increased chemical action in the tissues, or metabolism, is then the fundamental point in the nature of fever, and is the immediate cause of the rise of temperature which is pathognomonic of this condition. There remains, however, another point of vital importance to be considered.

In health the most striking fact among the phenomena of animal heat is that strict balance which is maintained between production and loss of heat so that a nearly constant temperature is maintained. The consideration of this equilibrium affords abundant evidence of the control
excited by the nervous system over the phenomena of animal heat, and it appears that its maintenance is a primary object of that control. By means of an active thermo-regulator mechanism the quantity of blood in any given area of the body is readily controlled and altered; if heat be produced too rapidly the blood rushes to the surface in increased and a more rapid cooling counteracts the effects of increased production by increased loss and vice versa.

In fever this normal equilibrium is disturbed. The loss does not balance the production and the temperature rises. But it does not continue to rise indefinitely, some or later a new equilibrium is obtained and the temperature remains at or about a new "pathological normal" if such an expression may be allowed. This shows that the control of
The nervous system over animal heat is disturbed and converted in form, but it must not be supposed that it is lost. In some cases, indeed (hyperpyrexia), this seems to occur; the temperature continues to rise to a great height. Then is evidence of profound effect of the nervous system and death occurs. Here production of heat seems to have run riot in the body without any controlling influence of the nervous system, and we may suppose that in such cases its influence has been destroyed.

It appears then that there are two great factors in the essential processes of fever, namely increased tissue metabolism resulting in increased production of heat, and a modifying of the normal controlling influence of the nervous system over the phenomena of animal heat.
The question next arises, are these two factors independent of each other, or is one secondary to the other and is one which? I think that at present no attempt can be made to answer this question. If the matter be clearly laid down for consideration, probabilities seem to be pretty much as follows. 1st. It seems reasonable to suppose that the action of the poison on different kinds of tissue may be attended by different results. Or the general tissue of the body, especially the muscles and sweat glands, a part of whose most important functions is the regular production of heat by their metabolism it is easy to suppose that the action of such a poison would itself stimulate that metabolism and give rise to increased heat production. At the same time the poison
acting on a peculiarly constituted tissue such as the nervous, which plays but a subordinate part in the general business of heat production, would produce peculiar effects of which one might be a perverted control upon heat production, as a perverted influence on the circulation might be another.

Thus these two facts might fairly be regarded as independent effects of the same cause acting on different tissues.

2. It is certain that the nervous system exerts a powerful influence over all the functions of the body; the manifestation of this influence may be often puzzling and mysterious, yet its existence cannot well be doubted. This being so it would not be irrational to suppose that the poison acting on the central nervous organs so severely
Their influence, that the increased tissue metabolism and other manifestations of fever are merely secondary phenomena dependent on a functional nervous disorder. In the same way a contrary theory might consider the nervous phenomena of fever to be secondary to the increased metabolism of nerve tissue.

These considerations seem at present to mark the boundaries of our knowledge of the nature of fever, but the phenomena discussed produce effects which although they must be considered secondary in relation to the essential processes of fever, yet practically and for clinical purposes possess an overwhelming importance. Of these effects I think those stand out above all others in their influence over the course of the disease and as rational effects for effective treatment. These are
(1) Disturbance of the circulation
(2) accumulation in the blood of waste products of metabolism, and
(3) defective performance of the functions of digestion and assimilation.

The disturbance of the circulation seems generally to take the
following course: First, a period of increased arterial blood pres-
sure, with tense pulse and regular forcible action of the heart; gradually
sparing way to relaxed arterioles, low blood pressure and rapid
feeble and even irregular action
of the heart.

This condition requires examination.

The high blood pressure of the early stage may be attributed
to one of two courses: either it is produced by a poison in the
blood acting locally on the vessel walls
of the arteries muscular fibre cells;
causing their contraction; or it is
due to the interference of the Central

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Nervous organs through the vaso-motor nerves.
The influence of kidney disease tends to the circulatation of certain poisonous substances in the blood, namely, products of tissue metabolism, acts powerfully in constricting the arterioles and this raising the blood pressure without any interference of the central nervous system.

We might at once conclude that in fever there is a perfectly analogous case, here also products of tissue metabolism are circulating in the system, and we may suppose that they act on the arterioles just as in kidney disease. But this analogy can hardly be maintained.

The rise of blood pressure in fever occurs only at the commencement of the attack before one could expect to find much of these substances in the blood, and at a
Later period when they are un-
Controll'dly in fever, the blood
pressure is abnormally and even
dangerously low.
There appears to be no evidence
of any special action of the fever
poison upon the arteries, or
upon any local nervous me-
chanism in connection with
them; neither is there any direct
evidence of interference of the central
nervous system.
But it must be remembered that
the nervous system gives evidence
of great and far-reaching interference
of function of the commencement
of fever. The rigor, vomiting,
and in children even convulsions
which constantly usher in these
attacks must surely be attributed
to nervous action.
Further the rise of blood pres-
sure has in most kinds of
fever only a very short duration,
it does not seem to depend on
any abiding cause, and in this may be
some resemblance to the rigor and other nervous phenomena.
In the rise of blood pressure depend on the presence of a poison in the blood, we might expect it to continue as long as the poison is there, but it has in most cases only a short duration, which itself may be regarded as evidence of nervous interference.

Whatever be the cause of this rise of blood pressure I think some cases occur in which its presence * and persistence constitute a grave danger to life.
Sometimes, notably in the so-called athereal forms of pneumonia * in fever which accompany acute brain affection the rise of blood pressure seems to be anything but a transitory affair. In such cases we see a fierce struggle for supremacy between
the heart on one side and the muscular film of the arterioles on the other. The latter, by their persistent contraction, obstruct the passage of the blood into the veins, the arterioles become over-full, and an extra strain is thrown on the heart, which redoubles its action, in order to overcome the obstruction. Thus the two antagonists, Reid on one another until both are exhausted by the conflict; the arterioles give way and a condition of low blood pressure remains.

The whole arterial system with the heart is left in a state of exhaustion and ill-calculated for the proper performance of its function, being a period extremely evil to the organism. A period of low blood pressure always follows the initial rise and may be considered the normal
Condition during the greater part of the course of fever. If it become excessively low to constitute a danger, and nothing is likely to cause an excessive fall as an excessive rise at the early stage. Then the condition of the circulation though it must be regarded as a secondary matter among the essential phenomena of fever becomes by its influence on the course & result of the disease a subject of the first importance. Of the presence & accumulation of vitreous matter in the blood and its importance of facilitating their removal: Of the disorder of digestion & assimilation, it is not my intention to speak. They are to be borne in mind & referred to incidentally. They are important subjects but have little direct to my present purpose.
By the light of the above remarks it is my intention to discuss the value of two methods of treatment which I have called the antiphlogistic and the antipyretic. The antiphlogistic method, after having been for a great length of time the almost universal method of treatment for acute diseases, has been deplored from its high position and is now treated with almost universal neglect. This neglect, I think, is largely undeserved; but it may be useful to consider under what circumstances benefit might be expected from the employment of antiphlogistic measures in fever.

The most important antiphlogistic measure, and that around which the whole question of this method has centred, is of course blood-letting. Few will dispute the value of local blood-letting by leeches & so on in the early
Stage of various inflammations. The way in which it acts is not equally explained, but the benefit in many cases is so marked as to be indisputable. The benefit, however, to be derived from general blood-letting is a much more problematical affair. It is partly regarded as a formidable remedy. Many theories of its action have been evinced of unsoundness, and physiologists having found that in the healthy individual it produces little effect on the circulation unless carried to a dangerous point; many have concluded that it can under no circumstances be beneficial, if not pernicious entirely.

It is absurd to suppose that by the abstraction of blood the febrile process can be cut short or its severity mitigated by removal from the body.
of a portion of its motion, or
that its violence will necessarily
be checked by resort to cooling
measures. He remarks that the
feverish process itself is far
removed from reach of such
measure as bleeding; if this
remedy can have any effect
on the course of an attack of
fever, that effect must be
looked for among the secondary
phenomena or results of the
process. Blowing is it affect
anything in the body affects the
circulation, and if it affect
any of the phenomena of fever
it affects the circulatory
phenomena. If it act in any
way upon the circulation it
must be by lowering blood
pressure, and if there be any
danger in fever from too high
blood pressure we might
respect to counteract this
danger by blood-letting. It has
been said that the blood pressure is raised in the early stage of fever, and I believe that this is always so. Though in the case of the continued fever, the condition is very transitory. In other such as the fever which accompanies inflammation like Pneumonia or Peritonitis it is often persistent and constitutes a danger. These attend to show that a persistently high blood pressure with abnormal distension of the arterial system must necessarily produce exhaustion of the muscular fibers of the heart and small arteries. When this exhaustion reaches a certain point these fibers give away, their efficient contraction being no longer possible, a period of low blood pressure follows, which may be suspected to be the mean. Moreover, in proportion as the previous overstrain of the arterial system has
been measured.
A state of abnormally low blood pressure, with great exhaustion of heart and arteries during the later stage of fever, when all the organs and functions of the body are enfeebled, seems to be a condition to be avoided if possible, being fraught with danger to life. Here I think we might hope that an early blood letting by checking or controlling the excessive rise of blood-pressure would prevent the subsequent dangerous state of exhaustion and in this way prove the means of saving life. Cases of the kind I have mentioned are no doubt rare, but I am convinced they do occur, if I have been one case of Palpitation failed at an early period, in which a very loud moderately quick pulse with forcible heart's action, giving way to one exceedingly faint irregular seemed to favor this view.
Physiology objects that bleeding within moderate limits has no lasting influence on blood pressure in the healthy body. To this it may be answered that the processes of health are carried on and its maintenance secured by a vast system of compensations, and any obvious change at one point is rapidly offset by compensation of the whole energy of the economy. From this system of compensation it is disturbed, and the high blood pressure of only fever is itself a result of this disturbance. Upon these circumstances, it is reasonable to suspect that a measure which can influence only slightly when compensation is perfect, a normal blood pressure might be affected in lowering an abnormally high one when it is so to speak thrown out of gear.
Space will not permit a discussion of the action of other antiphlogistic measures, such as vomiting, fasting, their action though less powerful is further reaching and of wider application than that of bleeding and hence their use is more readily admitted. It must not be forgotten however that one of their results is a lowering of general blood pressure. They relax the walls of the abdominal vessels into which a great quantity of blood can be collected and from this blood they abstract a quantity of watery fluid. Such an action may be subjected to exert a considerable influence over general blood pressure. It may then be concluded that owing to the very short duration of the high pressure period and to the lowering nature of the fibrin process the employment of other antiphlogistic measures if
bleeding is as a rule inadmissible
but that in certain cases of Pleurisy,
Pneumonia, and other inflammatory
disorders it offers a fair prospect
of benefit.

But if it be done at all it
must be done early in the attack
and not left as it usually
is until every other remedy
has failed and the patient is
obviously beyond the reach of ordinary
measures. To perform phlebotomy
then, is to my mind only to
hasten the inevitable end, by
slowly a remedy at a time when
the circumstances under which it
ought to be beneficial has long
passed away.

I turn from a method whose
days are gone, to me, which
is at the present moment on its
trial, the antipyretic method.
Since the invention of thermony
the study of temperature in fever
has been a constantly increasing
Wright to mean minds until some how almost began to revere the temperature of fever as the disease itself. Its true importance seems to one to be clear; it is a most subtle and delicate indicator of the progress of the case, and according to its rise or fall the patient will generally be worse or better; but its rise or fall is an effect and not by any means a cause of the unfavourable or favourable progress of the case. The temperature though demanding the most careful study and consideration, I even to be looked as an oracle in gauging the effects of any Therapeutic agent, does not necessarily require treatment. To our knowledge the pulse was the grand indicator of the progress of fever; accordingly they set to work to treat it with hydromaphy, antiphlogistic measures, which becoming abroad led to diureti.
and sudden revolution.
May not some of us be treating
our great indicia be running
but similar danger? are
antipyretic remedies open to? 
Two kinds, internal application
of cold and internal employment
of certain drugs; their mode of
action is different and they must
be separately considered.
Internal application of cold can
reduce temperature in fever only
by increasing the loss of heat
from the body. If it have any
influence on heat production it
must increase that also by driving
blood into the superficial tissues
where it, however, will favor rapid
oxidation & production of heat.
Now if the principle formerly
laid down be true, no process
which will not
effectually secure rapid death
coro, leaves production unaffected
can be regarded as of much
value as an antagonist to the actual progress of fever. If it does not strike at the citadel itself, can it be made effective against any of the outworks? I think perhaps it may be beneficial in two ways. 1st. The application of cold to the skin for short periods of time at considerable intervals seems to have an influence over the circulation. After the initial rise, the blood is spread throughout the rest of the attack, to keep the arteries relaxed and the heart acting poorly. This is probably chiefly due to exhaustion of the vaso-motor nerve mechanism.

The application of cold to the skin appears to counteract this exhaustion; the vaso-motor nerves are stimulated to fresh action, the pulse becomes firmer, the death action stronger.
who simply external cold in
the routine treatment of moderate
cases of fever the improvement
of the circulation is not
generally visible before; I think
it is reasonable to admit that
the measure has this beneficial effect.
That this amount of benefit is
sufficient to warrant the use
of the cold bath in every case
of agy thyroid fever, where
the temperature rises above 102.2°.

1st. The question arises on the
temperature itself. Though usually
to be regarded as a friendly
indicator of the progress of the
case in some incipient cases,
become itself a source of evil.
Is it possible that simple heat
of the body apart from any
other cause can impair the
functions of its various parts?
I think, it is possible, and that
As sometimes actually does so, the advocate of cold bathing have given us glowing accounts of delirious patients, who refused food & appeared to digest it badly after the bath, with their temperature lowered, ready to newspaper talking rationally of taking merely food which seemed to agree with them.

Patients with high temperature (104° F to 105° F) have shown some improvement in other respects, after the simple reduction of temperature, delirium has been checked, food taken with less difficulty & so on. When the recollect the extreme dullness of the various organs, especially the brain, it becomes no stretch of imagination to surmise that raising their temperature unduly might disturb the performance of their functions & disturbance of function in the
first instance gives more to successive heat-production &
Elevation of temperature; the
Elevation of temperature may
I think influence the organs
& produce further Disturbance of
function. We know at any
rate that elevation of temperature
favors the chemical action which
is itself the cause of heat.
The cold bath may thus be
of use in two ways & I think
it can be used with benefit
in cases of fever with very
high temperature, when there is
hearing much Disturbance of the
functions of the various organs.
In cases of Thready Hypothermia
I should invariably employ it as
the only remedy which can
give the patient a chance of
escape from what otherwise offers
to be inevitable death. The doged
continuous with which the temperature
Sore on rising in their cases, and the delirium, dementia, condition into which the patient rapidly sinks, present a really appalling spectacle, and justify the employment of any measure that offers even a chance of success. The futility of any internal remedies at present known is beyond question.

Of antipyrine drugs, neither the mode of action nor the efficiency is clear. Quinine, salicin, quinine and antipyrin have all been credited with the power of reducing temperature if ever been used with that purpose in mind.

The best question regarding these is: Do they increase, diminish, or diminish production, or do they act through the nervous system? They reduce the "pathological normal" temperature to a lower level?
I do not think that either of these two questions can at present be answered with any degree of precision. Two things, however, seem to be true of these drugs as their advocates only claim for them that they control the temperature and eliminate any evil results directly arising from that cause; they do not cure short the disease itself.

2nd. All screens seem to be powerful irritants. The one at present most in use is antimony and then i.e. to administer that it be given as a stimulant to be given with the counteract its depressing effect. The action constitutes a grave objection to the use of these drugs which is not counterbalanced by any evidence which I have yet heard in their favor. They are, however, on the trial if it is necessary to
to wait for further evidence before attempting to decide whether their mode of action is or to measure their therapeutic value.