Study of a common Cold and similar febrile states

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A Cold, or common Cold, though frequently met with, cannot be characterized as an important disease or one presenting much difficulty in its diagnosis or treatment. But it may be studied as the type of a fever, infectious or otherwise, as also as furnishing explanations of other pathological as well as certain physiological conditions.

Briefly stated, it may be regarded as a reaction of the organism caused by certain poisons circulating in the blood. In seeking to show the grounds for such belief, the subject will be considered under the following heads.

I. Health, a state of equilibrium.

Temperature of the body as an index of health.

II. Fever

A. Micro-organisms & fever
B. Animal cells & fever

III. Micro-organisms & animal cells—a comparison

IV. Reaction of the tissues to poisons circulating in the blood.

V. A Common Cold, with explanations from foregoing.
Health, a state of Equilibrium

The condition of health may be said to depend on a state of equilibrium, this equilibrium, or harmony, existing not only between the body and its surroundings, but also between its several constituent parts. If an upright object be suddenly and violently tilted, it may fall; but, if merely rocked, it will probably adapt itself to circumstances, or when the rocking ceases, it will tend to regain its former position. During all states of activity, the body seeks to adapt itself to circumstances; during increased activity, increased energy is developed by certain tissues, and as a result there is increased secretion of the products of such activity. But should one or more of the bodily functions be suppressed or overtaxed, as by sudden or prolonged increase of its work, then the equilibrium which normally exists in the organism becomes upset and, sooner or later, all parts share in the derangement.

The Equilibrium of health also depends to some extent on the environment of the body, such as atmospheric conditions; and when this is altered, especially when the change is sudden, we are liable to have altered functions as a consequence. Yet it
will always remain a remarkable, even if an explained fact, that with the perfect extremes of atmospheric temperature usually met with, the body temperature of health never varies more than two degrees; this is the more remarkable when we remember that it may depart from normal as many as ten degrees, in a few hours, when there is arraignment of function. The temperature of the body is therefore an important indicator of health or disease.

Fevers. The average temperature of the body is maintained under different conditions of external circumstances by mechanisms which permit of variation in the loss of heat. Variation in the production of heat.

In healthy persons the equilibrium between these two processes is so invariable that under all circumstances an uniform temperature within a degree or two is preserved. The heat of the body is produced by various tissues, the muscle, secreting glands (notably the liver), the brain.

It is lost through the skin, by the lungs, with secretions.

So well balanced is the production and loss of heat that we are able at once to detect any inflammatory
change or fever by its existence, to judge of the course & estimate the change of such changes, & adopt suitable treatment. In every form of fever, as in every kind of inflammation the temperature of the body or of the affected part rises, therefore, if the blood rises. There are also various types of fever which are all more or less characteristic of the causes at work, though at times the course of fever affords an explanation of its production. There is likewise a daily variation of the temperature in most fevers, just as there is in health, higher in the evening & lower in the morning, which would suggest that the mechanism which controls the heat of the body in health retains its influence in fevers in inflammatory conditions also.

When we bear in mind how many various are the causes of fever, between injury to the nervous system on the one hand & the activity of micro-organisms on the other, it will certainly appear difficult to offer an explanation which will account for all. Recent knowledge is wanting, & most explanations are largely hypothetical. One may observe here that anything which causes fever does so by acting on the tissues, either directly or through the nervous system. In those fevers which are attributed to germs we have a
part of the increased temperature due to the life of these organisms. A new original view has been put forward by Dr. Harley to explain the cause of hyperpyrexia in the same class of infections, contagious and incalculable diseases. He is not satisfied to attribute merely a part of the hyperpyrexia to germs, but would appear to deny any role whatever to the nervous system or even the tissues themselves except a passive one. He relates cases in which the temperature was maintained but actually increased for some time after death. The case, a girl aged 20 years, who died of acute pericarditis supervening on scarlet fever, with cerebral symptoms, in which the temperature was between 100°F and 102°F about ten hours after death. In another of "Rheumatic tetanus," in which the temperature rose 1.3°F after death, from 102.5°F to 113.8°F. This he regards as proof positive that nerve influence is not the sole cause of the temperature of the body being increased in all forms of disease. He understands that the temperature in such cases as these is probably due to the presence of microorganisms in the body which continue to live and exhibit physical
Signs of their activity, so long as there is sufficient habitation & suitable environment for their active existence. He therefore supposes that in the case of some diseases, nerves, blood & tissues alike "merely play the part of passive agents, the abnormal heat of the body being produced by a totally depending upon the development, growth & multiplication of the forms engaged in producing the disease." These forms, "by virtue of their own vital activity, develop among other things, heat at the expense of their hot component parts & as a natural consequence, raise the temperature of its body." The same thing would take place "when the forms' heat happened to be a milk can or a soup tureen." He then proceeds to substantiate his assertion by analogy. He explains the nature of fermentation, pointing out the great amount of heat which may occasionally be developed in this process, gives an account of the fermentation of rice into the formation of Koji, drawing attention to two interesting facts (a) a reduction in the temperature of the mass on the second day after the mixture of the rice with the
From the shores, this probably furnishing a clue to the chilliness experienced by patients at the onset of many fever diseases. (b) a daily variation in the temperature of the fermenting material, which is similar to the variations observed in cases of fever diseases.

While admitting the interest and importance of the facts mentioned, one is inclined to doubt the deductions which are made. In the first place, Dr. Stanley barely underestimates the influence of the nervous system in fevers, even if infectious or contagious. The fact he makes use of, the high temperature which may be met with after death, is similar to hyperpyrexia seen in the course of various fevers and very well be used to support the argument that irregular and higher fever denotes loss of nervous control. One has observed such an occurrence, for example, in the course of typhoid fever it has been seen disappear with stimulant tonic treatment.

We know that in health there is a nervous mechanism especially concerned in heat regulation, consisting of a centre or centres which may be influenced directly or reflexly. This mechanism, one
is generally taught, may be instrumental in the appearance of hyperaemia, whether the stimulaton be applied to the Corpora Striata or other Nuclei, or to the terminal endings of particular nerves. There are numerous facts of disease or experiment which point to the conclusion that such processes as oxidation & tissue growth are controlled by the nervous system, the loss of this influence, as already said, being illustrated in hyperpyrexia. There is nothing to show that these functions, the regulation of heat & oxidation, are totally abolished in fever; or, if they were, why are any of the other functions left in power? One might also consider how the rise of body temperature which follows the administration of such a drug as Cocaine, but it seems unnecessary. The nervous system may be hampered in its work by poisons circulating in the blood, just as it would be by any injury to itself; but damage of the kind we are considering, sufficient to abolish several of its functions would be most likely to kill outright.

Dr. Harley appears, further to overestimate the passive condition of the
tissues of the body. He admits that the tissues may play some part in pyrexia of idiopathic or traumatic origin, but it is difficult to believe that they will remain inactive when the cause is a form which irritates just as readily, for example, as the teeth do in the fever of dentition.

Organic reaction is the law of disease, i.e., "parasitic forms, by virtue of their own vital activity, develop heat;" it is equally, if not more probable, that the tissue elements in their reaction to disease, are able to do the same thing. By the laws of heredity the cells of our body have parts to play, just as each soldier in an army has; but one may believe that, under stress of circumstances, these laws may be relaxed and the cell may develop new functions. In one instance its altered life may lead to a victory, whilst at another time confusion may follow the change, with disaster and rout as consequences.

Micro-organisms & Animal Cells. If micro-organisms, minute masses of protoplasm, are capable by their active existence of elevating the temperature of their surroundings, it is legitimate to suspect that a similar property may be possessed by animal cells also; it, in following
out this idea, one may, having the subject of pyrexia for the moment, consider briefly some points of resemblance between a micro-organism and an animal cell. It has been found that if a septic diffusible fluid, a fluid containing no bacteria but only their decretions, be injected into the body pyrexia is set up. Can a similar fluid be the result of the activity of animal cells? One is able to discover a very considerable similarity between the life and actions of a micro-organism and of an animal cell. It is found that they are governed by similar laws. The difference in protoplasm is really one of degree only. Bacteria need a suitable environment, the absence of which either kills them or alters their characters. The temperature of their surrounding is a matter of importance, also the presence or absence of Oxygen. Oxygen is necessary for the life of some, unnecessary for that of others, and with others still it, presence or absence modifies the nature of their activity. Besides water and inorganic salts, bacteria require Carbon and Nitrogen; these they obtain by breaking up organic compounds or, while doing so,
produce certain chemical substances which are, as a rule, poisonous, both as regards their own & the vitality of other plants & animals. Such poisons, or enzymes, are formed most readily when there is a limited supply or an absence of oxygen. This is true not only of bacteria but, as we shall see, of animal cells also. The same rules hold good in the formation of most of the products of the lower vegetable organisms & the individual cells of animal tissues with complete oxidation & the formation of Carbonic Acid gas & water; when incomplete oxidation takes place, various specific products make their appearance; but even in a full supply of oxygen, protoplasm under certain conditions cannot bring about complete oxidation & as a result, some of the intermediate products of fermentation & decomposition may be formed. Many or most alkaloidal poisons are manufactured from dead material by microorganisms, but their existence is not by any means limited to this source. Substances similar to, some of them identical with these are to be found in both plants & animals. They occur as products of the normal life of our
body is really excretory matters which have to be got rid of; if allowed to accumulate they act on the tissues with which they come in contact with results which vary with their nature.

By metabolism the animal cell assimilates and transforms up its own uses substances which it has received from its surrounding medium; by metabolism these substances may be converted into other matters. Thus a cell may, by metabolic processes, convert dead matter into living matter like itself; or it may, by metabolic processes convert dead matter into another form.

The disassimilative processes occurring in the living cell consist in chemical changes in the substance of the cell itself, or of materials in contact with the cell. Certain materials are excreted from cells by a process which may be termed cellular excretion. Other cells may store up certain materials in their interior, a process called cellular secretion.

"Not only plants, but all tissues have," as Brown-Segard said, "besides their influence on blood, resulting from the interchange of nutrition, an internal secretion." We
have seen that bacteria are aerobic or anaerobic. It seems, as has been demonstrated by Pasteur, it is also the case with the cells of our body. "If the animal cell may in part be applied that which Pasteur said regarding his yeast plant, that, as in the presence of oxygen, it ceases to exhibit the properties of a ferment, and in the absence of free oxygen it acquires those properties," in this the animal cell agrees with the bacteria, since it requires a suitable environment and a difference in this alters its characters.

Pasteur has shown experimentally that while four-fifths of our internal combustions are the result of an aerobic process, the combustions, secretive or excretive that remain to the extent of one fifth—are produced at the cost of the tissues themselves, independently or exclusively of foreign oxygamous intervention; in other words, that a portion of our living tissues behave just as ferment, anaerobic or putrescent do. From this he was led to look for a mechanism in finding secretions or excretions similar to those put into the corresponding types of bacteria, a further and important
point of resemblance. The observation of this fact is not of chemical value only, for the elaboration of alkaloids cannot be regarded as depending solely on the presence of micro-organisms which derive their vital sustenance from the destruction of protein material; this is a function which is much more general, one common to all living cells, belonging as much to the inferior animal as to bacterial activities. For whether they be the product of the organs of plants, or elaborated at the expense of the albumen of animal origin by bacterial action, or the cell vitality of superior organisms, vegetable alkaloids, hemamines & leucamines have the same origin, the protein materials are identical in their genesis, protein disintegration. Similar alkaloids are thus produced in dead animal tissues undergoing proteosilastic disintegration or in the living animal tissues as products of normal vital activity. But it has also been ascertained — and it has special interest to us now — that in the living animal economy there are, in addition,
Elaborated, agitated, unresolvable substances, which are still undetermined, the extractive matters, of which are even more toxic than either amones or eucarines. Intoxication by the extractive matters is accompanied by hyperthermia, whilst intoxication by the animalalkaloids is accompanied by hypothermia; a variation of extremes may manifest itself in the living organism, according to the combination or alternation of poisonings by their deleterious physiological products.

Reaction of the tissues to poisons circulating in the blood.

It has been seen that bacteria by their life in an animal, or sometimes by the presence of their secretions only, are capable of setting up fever and other constitutional symptoms. Thus, the fever of Tuberculosis is probably largely due to the effects of poison secreted by the Tubercle Bacillus; for when, in an animal suffering from this disease, the poison is introduced artificially, we get increased reaction — increased fever. It has been seen also that animal cells are able,
by virtue of their vitality, to produce substances which are identical with those obtained by the action of bacteria. These substances are produced while the body is in health, but, if from any cause the functional play is interrupted, should there be emotional disturbance of the nervous centres, should sudden chills suppress the action of the skin, or insufficient aeration of the blood take place; or, finally, if from any less obvious cause, coca products are more abundantly formed within the cell, or be so deftively absorbed, excreted or utilised as that the blood becomes charged with them, they are carried to the nervous centres, which regulate the central life and function as a whole; immediately disorder becomes general, complete, it necessarily assumes progressive forms — in a word, disease declares itself and undergoes development. Numerous illustrations of this might be given. Many persons, the writer amongst others, have, after any prolonged fatigue, found
the body temperature to be increased,
reaching it may be 103°7, which entirely
disappeared with rest & few exercises.

D. Brown quotes the case of a young man
who, in a state of destitution, had walked
a considerable distance, sleeping by the
wayside & obtaining such food as chance
supplied; he was admitted to Hospital
suffering from fever, prostration, muscular
pain & back-ache. "His ailment," says
D. Brown, "was merely the fever of over-
toxication, brought on by the accumulation
in the system of material elaborated in
excess, & consequently not sufficiently eliminated.
The temporary poisoning had set in the
fever of prostration." Such effects are
more readily produced & are more lasting
in those who are weakened by age or fatigue;
not so much, it may be, because of increased
production of poisonous substances, as because
derinished elimination. Recovery when
it takes place would appear to be in
consequence of a breaking up of the creatine
probably also of the extractive matters,
followed by elimination. Their destruction
consists largely in a continuous combustion by the oxygen of the blood, elimination is accomplished by the kidney & liver. Since the difference, as has been seen, between the protoplasm of the animal cell & that of the micro-organism is one of degree rather than of kind, a both react to environment in a similar manner; it is reasonable, under certain circumstances, to expect results which have many points of resemblance. We may believe that abnormal environment, taking the word in its fullest meaning, leads to reaction of the vital elements, sometimes directly, but more commonly through the medium of the nervous system; whereby we get altered vitality with altered secretion & excretion. The Equilibrium of health becomes upset, the functions of the body are impaired, the products of cell activity accumulate & give rise to symptoms. If, to repeat a statement already made, a selective diffusible fluid, containing no bacteria but only their products, is capable of setting up pyrexia & other symptoms when introduced into the body,
it is reasonable to expect that a similar material produced by the tissues of the body may be sufficient to bring about similar phenomena. We have seen that, while intoxication by the animal alkaloids is associated with high temperature, that by the extractive matters is accompanied by higher temperature. Through the medium of the nervous system growth or nutrition may be altered, as may be seen in the growth of the nails and hair; through it secretion may be arrested, altered, or even rendered poisonous, as may be seen in the secretion of milk. So with many other states of the body, whether initiated by what may be termed traumatism, including the effects of heat, cold, or other physical conditions superadded to extravasation; or by the presence of microorganisms the result is the same, reaction of the vital elements with the production of symptoms.

**A Common Cold.**

There are various conditions which are necessary, one or all, for the production
of a chill.

Depressed vitality or fatigue predisposes to an attack, and generally precede it; whilst exposure to cold and damp, particularly the latter, may be the immediate cause.

There would also appear to be a constitutional tendency in some individuals to "catch cold," and also a similar capability in others of resistance to it, both of which may perhaps be acquired. It is well known that many persons can bring on a cold at almost any time, a fact which would seem to show that the condition is not due to the action of any micro-organism. It is just possible that the belief is supported by observation, that there is a deficiency in the coagulability of the blood in those persons who are especially prone to such attacks, the significance of which will be referred to presently. Dr. Richardson has shown that certain inhalations, the vapour of Argyll nitrite or of Ozone, produce symptoms similar to those before-named. Nasal catarrh, a feeling of chill, with malaise and nervous depression. These are followed by frontal headache, constriction of the breathing, swelling of the throat and increased nervous depression. In lower animals, in which
the experiment was carried still further. There
was found to be congestion of the lungs, brain,
kidneys & liver. This demonstration would
also seem to indicate that the essential cause is
not necessarily a microorganism. These
are pretty much the symptoms we are considering.
A man who is worried & fatigued rosters in
a cold street on a wet day. He goes home,
feels depressed & chilly & may have a slight
headache. His alphabet fails him, but he tries
to take a little food & then, instinctively,
crouches over the fire. He feels hot but though
he feels drowsy, obtains no rest. He becomes
hot & restless, tosses about, with only an
occasional snatch of sleep. His headache
soon becomes severe. His throat feels dry or
sore & he complains of thirst. There may also be
a starchy of other mucous membranes, or may
constitute a prominent symptom. Pains de-
velop in the back & limbs. When morning
comes he feels as if he had been beaten. The
examination at this stage one discovers the
usual symptoms of fever. Temperature
100° F. - 104° F. Pulse quickened. Skin
hot & dry to the touch. The tongue is
Slightly fevered, the pulse may be quick, tender, or there may be a slight cough. The urine is rather scanty and highly coloured, the colour being due to the destruction of red blood corpuscles. Specific gravity increased, often considerably, owing to the deficiency of water and substances in solution or suspension. Excessive excretion of solids occurs more or less parallel with the temperature. As a rule, the amount of tissue metabolism as manifested by the excretion of waste in the urine of fevers, affords a good indication of the severity of the attack. The urinary sediment consists of uric acid crystals, urates, and sometimes a few hyaline casts and epithelial cells. There is marked increase in uric acid, which points to tissue waste, and gives its origin to retrograde tissue metabolism.

Sulphates are increased, an additional proof of tissue disintegration. Hippuric acid is also often to be found, which may be due to the excretion which affects the liver along with other organs. Chlorides are reduced; and, since they are chiefly absorbed from the food, this would appear to
mean deficient digestion or absorption.

Exhaustion is increased by various alkali salts and their salts are also present, but of these, however, are so variable in amount and so difficult of estimation that no definite statement may be made regarding them.

We have seen that, before the development of symptoms, the man was tired and worried. Fatigue is the first sign. The circulation becomes sluggish and a tendency to blood stasis develops. Persons in whom there is deficient coagulability of the blood, who have been mentioned as especially liable to chills, show this tendency in marked degree. Exposure still further impedes the circulation, giving rise to imperfect circulation of the blood, deficient elimination of the products of metabolism, to congestion of internal organs. These changes in their turn are succeeded by others; poisons accumulating in the blood affect the nerve centres; both directly and through the nerves, act on the tissues generally. The same thing probably happens when the vapour of ozone or ammonia is inhaled; through this way shows that the nervous system must be primarily affected, yet the action of these poisons
and vapours, like that of irritants, is ultimately on the tissues themselves, or, whatever vascular or nervous changes may have taken place, "vessels & nerves can only constitute a medium — that which lives, that which feels the action of irritants & that which reacts to them is always the (vital) element." We are now able to appreciate what Santor says, that in the event of interruption of functional play, emotional disturbance of the nerve centres, suppressed action of the skin, deficient direction of the blood, there is a tendency to the appearance of disease & its progressive development.

In addition to the congestion of internal organs with consequent arraignment of function & altered secretion, we have, from the same cause, diminished oxidizing power of the blood, & diminished destruction of waste products. These are progressive developments, & as a later stage in the process, we have what may be termed reaction of the tissues. Until this stage, the temperature may have been only slightly elevated; but here the tissues react, owing to the composition of the blood,
Expend their energy in heat rather than growth. So is it also when a noxious fluid circulates in the blood; the result is an attempt in the part of the system to get rid of the poison, a reaction will last so long as the poisons continue to be manufactured, whether by the tissues or by micro-organisms, or are introduced by inhalation or otherwise. So is it, lastly, in the case of a Common Cold. When the fever is past, the victim has been re-established, recovery begins. But the reaction has cut something. The cells composing the tissues have been living at their own expense and at that of the blood, with a proportionate loss in weight, weakness, and anaemia as results.

One has sought to show that micro-organisms by their active existence in the tissues of a living animal, may cause a rise in the body heat of that animal; or, further, that there was reason to attribute a part at least of this rise in temperature to the action of the secretions of these micro-organisms on the
tissues of the animal.

Animal cells were seen to be similar, in many respects, to microorganisms, and produced substances similar to or even identical with those secreted by the latter. It was, therefore, concluded that similar effects might be expected from the products of animal activity as from those of microorganisms—the products acting on the tissues, either through the medium of the nervous system or perhaps directly, and causing increased body heat and other phenomena.

In support of this were mentioned the opinions of earlier workers, that when the functions of the body are deranged, products of cell activity which are expected during health tend to accumulate and give rise to fever and other symptoms. These products were viewed as poisons, but further, that a certain form of symptoms might be regarded as pointing to a reaction of the organism to various poisons, not necessarily organism or animal, circulating in the blood.

It was believed that in a common cold the conditions for such an occurrence were fulfilled—lowered vitality, weakened circulation, deficient elimination of waste
products, with consequent diminution in the oxidizing power of the blood - so that the early symptoms were in accordance with these conditions. The reaction of the system was shown by the temperature & by the secretions, notably the urine, which contained increased waste matters. Finally, resulting loss of weight, anaemia & weakness were mentioned as showing that the waste was at the expense of the tissues, these tissues probably reacting to the poisons circulating in the blood.

I hereby certify that this thesis has been composed by myself

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