Study of a common Cold & Similar febrile States

Rupes Eaton Evans

Newcastleton Roxburghshire

A Chill, or common Cold, though frequently met with, cannot be characterised 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, infective or otherwise; & 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 shew the grounds for such a belief, the subject will be considered under the following heads.

I Health, a state of Equilibrium.

Temperature of the body as an indicator of health

II Fever

micro-organisms & fever

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, & 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 excretion 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; & 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 greatest 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 derangement of function. The temperature of the body is therefore an important indicator of health or disease.

Fever 1. 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 muscles, secreting glands (notably the liver), the brain.

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

So well balanced is the production & 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 danger of such changes, & to adopt suitable treatment. In every form of fever, & in Every kind of inflammation the temperature of the body or of the affected part &, therefore, of 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 no 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 & 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. Precise 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 & an original view has been put forward by Dr. Harley to Explain the cause of pyrexia in the Zymotic class of infections, contagious & inoculable diseases. He is not satisfied to attribute merely a part of the pyrexia to germs, but would appear to deny any rôle 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. One 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 & 102°F about ten hours after death, & another of "Rheumatic tetanus" in which the temperature rose 1·3°F after death, from 112·5°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 micro-organisms in the body which continue to live & Exhibit physical

signs of their activity so long as there is sufficient habulum & suitable environment for their active Existence. He therefore infers that, in the case of germ diseases, nerves, blood & tissues alike "merely play the part of passive agents," the abnormal heat of the body being produced by & totally depending upon the development, growth & multiplication of the germs engaged in producing the disease". These germs, "by virtue of their own vital activity," develop among other things, heat at the Expense of their hosts' component parts &, as a natural consequence, raise the temperature of its body." The same thing would take place "when the germs' host 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 the process, & gives an account of the fermentation of rice in the formation of Kôji, 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

form spores, this probably furnishing a clue to the chilliness Experienced by patients at the onset of many form diseases. (b) a daily variation in the temperature of the fermenting material, which is similar to the variations observed in cases of form diseases.

While admitting the interest & importance of the facts mentioned, one is inclined to doubt the deductions which are made. In the first place, Dr. Harley surely under estimates the influence of the nervous system in fevers, even if infective 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 & may very well be used to support the argument that irregular & high fever denotes loss of nervous control. One has observed such an occurrence, for example, in the course of typhoid fever & has seen it disappear with stimulants & tonic treatment. We know that in health there is a nervous mechanism specially 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 hyperexia, whether the Stimulation be applied to the Corpus Striatum or Optic Thalamus, or to the terminal Endings of particular nerves. There are numerous facts of disease & 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 shew that these functions, the regulation of heat & oxidation, are totally abolished in fever; & if they were, why are any of the other functions left in power? One might also consider here 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 over Estimate the passive condition of the

tissues of the body. He admits that the tissues may play some part in pyrexia of idiopathic & traumatic origin, & it is difficult to believe that they will remain inactive when the cause is a form which irritates just as really, for Example, as the teeth do in the fever of dentition. Organic reaction is the law of disease, &, if "parasitic germs, 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 & 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 & rout as consequences.

Micro Organisms & animal cells. If microorganisms, 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; &, in following

out this idea, one may, leaving the subject of pyrexia for the moment, consider briefly some points of resemblance between a micro-organism & an animal cell. It has been found that if a Septic diffusible fluid, a fluid containing no bacteria but only their secretions, 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 & actions of a micro-organism & those 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 surroundings 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, & with others still its presence or absence modifies the nature of their activity. Besides water & inorganic salts bacteria require Carbon & Nitrogen; these they obtain by breaking up organic compounds & 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 10. 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 intermediary products of fermentation & decomposition may be formed. Many or most alkaloidal poisons are manufactured from dead 11. material by micro organisms, 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 & are, 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.

12. By metabolism the animal cell assimilates & transforms for its own uses substances which it has received from its surrounding medium; & by metastasis 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 metastatic 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 separated 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 glands, but all tissues have", as

13. Brown-Sequard said, "besides their influence on blood resulting from the interchange of nutrition, an internal secretion." We

have seen that bacteria are aërobic & an-
aërobic, & such, as has been demonstrated
by Gautier[14], is also the case with the cells of
our body. "To the animal cell[15] may in
part be applied that which Pasteur said re-
garding the yeast plant, 'that in the
presence of the abundance of oxygen, it ceases to Exhibit the
properties of a ferment, & in the absence of
free oxygen it acquires these properties'."
In this the animal cell agrees with the bacterium,
since it requires a suitable Environment & a
difference in this alters its characters.

Gautier[16] has shewn Experimentally that
while four-fifths of our internal combustions
are the result of an aërobic process, the
combustions, secretive & Excretive that remain —
to the Extent of one fifth — are produced at the
cost of the tissues themselves, independently &
exclusively of foreign oxygenous intervention;
in other words, that a portion of our living tissues
behave just as ferments, anaërobic or putrescent
do. From this he was led to look for
& succeeded[17] in finding secretions & Excretions
similar to those got with the corresponing
types of bacteria, a further & important

point of resemblance. The observation
of this fact is not of chemical value only,
18.
for the Elaboration of alkaloids cannot be
regarded as depending solely on the presence
of micro-organisms which derive their vital
nutriment from the destruction of proteid
material; this is a function which is much
more general, one common to all living cells,—
belonging as much to the superior 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, ptomaines & leucomaines have
the same origin, the proteid materials; &
are identical in their Genesis, proteid dis-
integration Similar alkaloids
are thus produced in dead animal tissues
undergoing putrefactive disintegration &
in the living animal tissues as products
of normal vital activity. But is has
also been ascertained — and it has special
interest to us now — that in the living
20.
animal Economy there are, in addition,

Elaborated, azotised, uncrystalisable substances which are still undetermined, the Extractive matters, & which are Even more toxic than either ptomaines or leucomaines. Intoxication by the Extractive matters is accompanied by hyperthermia, whilst intoxication by the animal alkaloids 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.

21.

Reaction of the tissues to poisons circulating in the blood

It has been seen that bacteria by their life in an animal, & sometimes by the presence of their secretions only, are capable of setting up fever & 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, & are got rid of by the ordinary Excretions; but, "if from any 22. 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 aëration of the blood take place; or, finally, if from any less obvious cause, leucomaine products are more abundantly formed within the cell, or be so defectively absorbed, Excreted or oxidised as that the blood becomes charged with them, they are carried to the nervous centres which regulate the central life & function as a whole; immediately disorder becomes general, complete, & necessarily assumes progressive forms — in a word disease declares itself & 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 & free Excretion.
23. Dr. 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; & was admitted to Hospital suffering from fever, prostration, muscular pain & back-ache. "His ailment," says Dr. Brown, "was merely the fever of over-taxation, brought on by the accumulation in the system of material elaborated in Excess, & consequently inefficiently eliminated; the temporary poisoning had let on 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 of diminished elimination.
24. Recovery when it takes place would appear to be in consequence of a breaking up of the crates & probably also of the extractive matters, followed by elimination.
25. 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, & 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 septic 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 suppose 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 hypo-thermia, that by the extractive matters is accompanied by hyperthermia. Through the medium of the nervous system growth & nutrition may be altered, as may be seen in the growth of the nails & hair; & through it secretion may be arrested, altered, or even rendered poisonous, as may be seen in the secretion of milk. So with many feverish states of the body, whether ~~fever~~ initiated by what may be termed traumatism, including the effects of heat, cold & other physical conditions superadded to exhaustion; or by the presence of micro-organisms the result is the same, reaction of the vital elements, with the production of pyrexia & other symptoms.

A Common Cold.

There are various conditions which are necessary, one or all, for the production

of "a chill". Depressed vitality or fatigue predispose to an attack, & generally precede it, whilst exposure to cold & damp, particularly the latter, may be the immediate cause. There would also appear to be a constitutional tendency in some individuals to "catch cold", & also a similar capability in others of resistence 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 shew that the condition is not due to the action of a micro-organism. It is just possible, & the belief is supported by observation, that there is a deficiency in the coagulability of the blood in those persons who are specially prone to such attacks, the significance 26.
of which will be referred to presently. Dr Richardson has shewn that certain inhalations, the vapour of Amyl nitrite or of Ozone, produce symptoms similar to those before us. Nasal catarrh, a feeling of chill, with malaise & nervous depression. These are followed by frontal headache, constriction of the breathing, soreness of the throat & 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 micro-organism. These are pretty much the symptoms we are considering.

A man who is worried & fatigued loiters in a cold street on a wet day. He goes home, feels depressed & chilly & may have a slight headache. His appetite fails him, but he tries to take a little food; & then, instinctively crouches over the fire. He goes to bed 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 catarrh of other mucous membranes, or may constitute a prominent symptom. Pains develop in the back & limbs. When morning comes he feels 'as if he had been beaten'. On Examination at this stage one discovers the usual symptoms of fever. Temperature 101°4 — 104°4. Pulse quickened. Skin hot & dry to the touch. The tongue is

Slightly furred, the pharynx is perhaps reddened, & there may be a slight cough. The urine is rather scanty & high coloured, the colour is mainly due to the destructive metamorphosis of red blood corpuscles. Specific gravity increased, often considerably, owing to the deficiency of water & to substances in solution or suspension. The excessive excretion of solids runs more or less parallel with the temperature. As a rule, the amount of tissue metamorphosis, as manifested by the excretory 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 & sometimes a few hyaline casts & epithelial cells. There is marked increase in urea & uric acid, which points to tissue waste. Urea owes its origin to retrograde tissue metamorphosis.

Sulphates are increased, an additional proof of tissue disintegration. Hippuric acid is also often to be found, which may be due to the congestion 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.
Extractives are increased & various alkaloids & their salts are also present; both of these, however, are so variable in amount & 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 & worried. Fatigue cuts the first sod. The circulation becomes sluggish & a tendency to blood stasis develops. Persons in whom there is deficient coagulability of the blood, & who have been mentioned as specially liable to chills, show this tendency in marked degree. Exposure still further impedes the circulation, giving rise to imperfect aëration 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 & through the nerves, act on the tissues generally. The same thing probably happens when the vapour of Ozone or Amyl nitrite is inhaled; & though this may show 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; &, 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 Gautier says, that in the Event of interruption of functional play Emotional disturbance of the nerve centres, suppressed action of the Skin, deficient aëration 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 derangement of function & altered secretion, we have, from the same cause, diminished oxidising power of the blood, & diminished destruction of waste products. These are progressive developments, &, as a further 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 now the tissues react &, owing to the composition of the blood,

27.

Expend their energy in heat rather than growth. So is it also when a septic fluid circulates in the blood; the result is an attempt on the part of the system to get rid of the poison, & 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 & Reaction has been reëstablished, recovery begins. But the reaction has cost something. The cells composing the tissues have been living at their own expense & at that of the blood, with a proportionate loss in weight, weakness & anaemia as results.

One has sought to show that micro-organisms by their action & existence in the tissues of a living animal, may cause a rise in the body heat of that animal; &, 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 micro-organisms, & 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 micro-organisms — these products acting on the tissues, either through the medium of the nervous system or perhaps directly, & causing increased body heat & other phenomena. In support of this were mentioned the opinions of Gautier & others, that when the functions of the body are deranged, products of cell activity which are excreted during health tend to accumulate & give rise to fever & other symptoms. These products were viewed as poisons, & further, that a certain group of symptoms might be regarded as pointing to a reaction of the organism to various poisons, not necessarily organismal 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 oxidising power of the blood — & that the early symptoms were in accordance with these conditions. The reaction of the System was shewn by the temperature & by the secretions, notably the urine, which contained increased waste matters. Finally, resulting loss of weight, anaemia & weakness were mentioned as shewing 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

Rupes Lassan Evans

Newcastleton, Roxburghshire

12th. April 1897.

References -

1. Kirke, Handbook of Physiology p 352
2 George Harley, Diseases of the Liver p 433.
3 George Harley, ib. p 439.
4 George Harley ib. p 442.
5 W.H. Broadbent, Article in Quain's Dictionary of Medicine (1894) Vol I p 692.
6. George Harley, Diseases of the Liver p 435
7 A.M. Brown, The Animal alkaloids p 178.
L.S. Beale, Slight Ailments, p 280
8 George Harley, Diseases of the Liver p 442.
9 W.H. Broadbent, Article in Quain's Dictionary of Medicine (1894) Vol I p 574.
10 G.S. Woodhead, Bacteria & their Products p 141.
11 G.S. Woodhead, ib. p 363.
A.M. Brown, The Animal alkaloids pp 127 & 128.
12. McKendrick, Text Book of Physiology Vol. I. p 294.
13 Brown-Sequard British medical Jour. 1893 Vol I p 1145
14 A.C. Farquharson, Ptomaines p 73.
A.M. Brown, The Animal alkaloids
p XX & pp 117 & 137.
15 A.C. Farquharson, Ptomaines p 72.
16. A.M. Brown, The Animal alkaloids p 137
17. A.C. Farquharson, Ptomaines pp 69 & 75
18 A.M. Brown, The Animal alkaloids p 111.

References —

19. A. M. Brown, The Animal Alkaloids p 115

20 A. M. Brown, ib. p 146

21 A. M. Brown, ib. p 146

22 A. M. Brown ib. p 127 &
introduction by Gautier p XX.

23 A. M. Brown ib. p 152

24 A. M. Brown, ib. p 159

25 A. M. Brown, ib. p 151.

26 B. W. Richardson, Asclepiad 1892 p 24.

27 Bizzozero, Address before Medical Congress at Rome. 1894. British Medical Jour. 1894 Vol I p 729.
