

TEMPERATURES IN CONSUMPTION

— THESIS —

BY

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Body-Temperatures in Pulmonary Consumption.



(Explanatory note —

When starting in practice in a small town in Wales about the beginning of the year 1880 my attention was specially directed to the subject of Pulmonary Consumption by the rapid progress of the disease in a girl of 12 years who during an attack of Measles developed a cough which never again left her. She came under my notice for the cough at the Dispensary some little time after the attack of measles and on examining her Chest I found scattered signs of lung consolidation + Catarrh in both lungs. The special feature in the progress of the case however was the rapidity with which excavation took place at the apex of the

right lung for hardly had any impairment in the percussion note been recognised there on physical examination when the note became more resonant and ultimately hyper-resonant with other signs of a large cavity.

The child lived only a few weeks after I first saw her.

I was led by this case to ask myself what was the nature of the process by which the lung tissue was destroyed.

In the opinions of authorities at that time accessible there was the widest divergence as to whether Pulmonary Phthisis was 'tubercular' or no - all using that term as implying certain specific characters; and in my notes made at that time after comparing the various forms of Pulmonary Phthisis recognised by Meigs Jones & Sierking (Pathological Anatomy), Bristow (Theory & Practice of Medicine), Sanders

(Notes of Lectures), Hamilton (Articles on Bronchitis
in the "Practitioner"), & Grainger Stewart (Notes
of Lectures), I go on to say - "Although
there is considerable difference in classification,
the term "Phthisis" has evidently three
distinct meanings, viz: -

1st It is always Tubercular. (Bristowe)

2nd It is sometimes Tubercular, sometimes
Inflammatory. (Jones & Seething, Grainger Stewart)

3rd It is never Tubercular (Hamilton) "

(Referring here of course to ordinary Phthisis)

This conflict of opinion led me to examine
carefully the microscopic appearances of such
specimens of morbid changes in the
lungs as I had by me, as also specimens
of 'Tubercle' in other organs especially in
the Spleen which organ I had made the
subject of special study under Dr
Hamilton in the Pathological Laboratory
of Edinburgh University. The result

+ From this definition are excluded cases of loss of substance from arrested nutritive supply.

of my examination of the subject was certain definite conceptions as to the pathology of pulmonary consumption which may be briefly stated thus, —

1. — The phthisical process as it affects the lungs is essentially a process of ulceration.

2. — Ulceration is a consequence of a more powerful stimulus being applied to the tissues than their nutritive capabilities can respond to — death of certain tissue elements resulting. (* See opposite page.)

3. The healing of lung ulcers is a result either of diminished activity on the part of the stimulus, or, of increased nutritive capabilities on the part of the tissues, or of both, by which organisation of hyperplastic tissue

elements is enabled to take place.
5-. The character of the stimulus, that is whether it be organic or inorganic, is of importance in relation chiefly to the intensity and duration of its activity and probably not to any special feature in its action on the tissues.

6-. While ulceration is the important feature in the pathological progress of ordinary cases of Pulmonary Phthisis, the same hyperplastic changes which then result in ulceration, if they occur at a rate commensurate with the nutritive capability of the tissue in response to a moderate stimulus acting through a long period of time, may by converting lung tissue into cicatricial tissue cause serious

functional insufficiency - but the whole character of the disease is changed it is no longer a case of Ordinary Phthisis but one of Fibroid Phthisis, or Chronic interstitial Pneumonia.

Such changes do however occur in ordinary Phthisis to a salutary degree in the healing of damaged tissue; to a greater degree in cases of Ordinary Phthisis of very long standing as a result of repeated more acute processes with subsequent healing.

From these views as to the pathology of the lung changes in Phthisis, the clinical unity of the disease and the paramount importance in treatment of attention to the

general nutrition of the patient naturally followed.

With these ideas as to the nature of Phthisis Pulmonalis I begged Resident Medical Officer to the Ventnor Consumption Hospital in March 1881 and have continued in daily observation of cases of Consumption until now -

During the four years more than two thousand patients have passed through the Hospital their period of residence varying from four to fourteen weeks usually, a few remaining for longer or shorter periods.

In all cases where abnormally high temperature exists during the first few days after admission two daily observations of temperature

are recorded with New verified thermometers until a normal temperature is found to exist for a considerable time, or until the patient leaves the Hospital. Similar observations are taken in cases where pyrexia develops during residence. The observations are taken at 10 a.m. and 7 p.m. a thermometer being given to each patient about ten minutes previously, and each observation is the result of keeping the bulb of the thermometer under the tongue with the mouth closed from 5 to 7 minutes. Where a doubtful temperature is obtained a second or third observation is made.

Temperatures in Consumption.

A slight acquaintance with the progress of a case of 'Consumption' is sufficient to shew that very considerable deviations from the normal limits of body temperature may occur during its course. And as week after week we continue our observations we become impressed with the opinion that these abnormal deviations must have some relation to the progress of the disease itself. We find alterations for better or worse in our patient shewing themselves in our temperature records; but we find also probably so many deviations which we cannot explain satisfactorily that it is difficult to understand the meaning of temperature variations. Nor is the

difficulty lessened by our knowledge of the fact that even in health a tolerably constant body temperature is maintained in spite of very considerable variations of the temperature of the surrounding atmosphere.

In trying to reach more satisfactory conclusions as to the significance of temperature variations in Phthisis therefore, it is necessary to endeavour to gain some insight into the meaning of Body temperature in health, and the means by which a degree of heat which may exceed that of the surrounding medium by $20-60^{\circ}$ Fahr: or more is maintained in tolerably stable equilibrium. There must under such conditions be a constant loss of

heat by the body to cooler surrounding air and the loss will vary, ceteris paribus, in rate according to the magnitude of the difference between the temperature of the body and that of the adjacent air. The air temperature may vary in 24 hours as much as 30° Fahrenheit and yet the body temperature will scarcely in health vary more than 1 or $1\frac{1}{2}$ degrees Fahrenheit in that time. The body temperature of an inhabitant of the tropics is practically the same as that of an inhabitant of the Arctic regions.

(That this difference between air and body temperature is not a human peculiarity is shown by the following table of air & blood temperatures in

different animals taken from The
Nadyn Dictionary of Science, 1871 edition.

<u>Animal</u>	<u>Temperature of Air</u>	<u>Temperature of Blood</u>
Chicken	77° Fahr.	111° Fahr.
Pigeon	78° "	109.5° "
Sparrow	80° "	108° "
Jackdaw	85° "	107° "
Hog	75° "	105° "
Sheep	78° "	104.5° "
Monkey	86° "	104.5° "
Elk	78° "	103° "
Ox	80° "	102° "
Cat	79° "	102° "
Rat	80° "	102° "
Jackal	84° "	101° "
Bat	82° "	100° "
Porpoise	72° "	100° "
Elephant	80° "	99.5° "
Horse	80° "	99.5° "
Man -	79° "	98.6

(taken under the tongue)

Source of Heat of the body.

The ultimate source of the heat of the human body is the food ingested, and attempts have been made to estimate the value of a given weight of various articles of food as heat producers by Prof: Frankland and others. It has been calculated by Frankland that in undergoing complete combustion within the body -

10 grains of dry flesh will raise	11.23 lbs of Water	1° Fahr.
10 " " Albumen	10.94 lbs	" " "
10 " " Lump Sugar	8.61 lbs	" " "
10 " " Arrowroot	10.06 lbs	" " "
10 " " Butter	18.68 lbs	" " "
10 " " Beef Fat	23.32 lbs	" " "

(See Sir Rison Bennett - "Book of Health" page 164)

Thus as Dr Smith puts it - "One ounce of fresh lean meat if entirely burnt in the body

would produce heat sufficient to raise about 160 lbs of water 1° Fabr.;, or a gallon of water about 16° Fabr.:."

We cannot of course calculate from such heat equivalents the amount of heat which would be produced in a given time from the digestion of a known quantity of these articles of food for we cannot estimate the rate at which complete oxidation of that food will go on in the body; but such observations enable us to speak with some definiteness as to the total heat value of the food to the organism before it is completely oxidised "For the sum of all the heats developed in the individual successive oxidations or decompositions of any kind which a body undergoes before it is completely"

"burned is equal to the heat which is directly developed by perfect Combustion"

(Gan-gee's translation of Hermann's Physiology 5th Ed. page 216)

Again - if animals are altogether deprived of food, after a certain time the body temperature falls - death resulting from this fall of temperature, since, as shewn by Chossat, if a starving animal in the state of torpor preceding death has its temperature raised by artificial warmth a restoration of consciousness and muscular power takes place.

We must not forget, however, that there are other modes of expenditure of energy by the body than in the production of heat, which energy is supplied to the organism in the food consumed, and that thus neither the amount of food taken nor

its heat value can have a precise relation to the heat produced or to the body temperature maintained. Thus, the total amount of force expended daily by a man weighing 11 stones (154 lbs) has been estimated at 3400 foot-tons and of this 2840 foot-tons are represented by the heat produced, the remainder being assigned to production of visceral and muscular work.

(Cantlie "Book of Health" page 412.)
Fluctuations in body weight also have a relation to the amount of food consumed which will to a small extent affect the ratio of heat produced to food consumed. And in the same way variations in the extent of oxidation of the excreta of the body will affect the

absolute heat value of the food consumed to the organism.

Development of heat in the body.

We have seen that while the primary source of the body heat is the food ingested the amount of heat thus supplied to the organism cannot yet be definitely estimated. The question of localisation of heat development in the body is even more complex.

In the preparation of the food for assimilation by the tissues heat will be developed during oxidation processes & when complex substances are broken up into simpler ones. And as the blood is the channel by which the newly digested food is conveyed to the tissues, as it

also receives the products of the activity of many of the glands of the body and the effete detritus of the tissues generally, it is highly probable that chemical processes take place within the blood which are attended with heat development.

Heat is also produced by friction in the passage of the blood through the vessels. The amount of work done by the heart in driving the blood through the vessels is estimated by Hermann as sufficient to raise its own weight 10,788 metres in an hour, the whole of this work being converted into heat by friction in the vessels. A heat unit is equivalent to 424 grammetres of work and the weight of the Heart.

is given as 292 grammes, therefore, —
($10.788 \times 292 \div 424 = 7429$)
7429 heat units per hour will
be added to the blood heat as
a result of friction on this cal-
-culation.

Heat is developed in the lungs in
the combination of oxygen with Haemoglobin.
It is however in the tissues generally
that the potential energy of the food
is mainly expended and the develop-
-ment of heat goes on directly in
all organs of the body in which
processes of oxidation occur, i. e. in
all except the horny tissues.
The glands generate far more
heat than the parenchymatous
tissues owing to the removal of
their oxidation products. Increased
generation of heat takes place in

glands and muscles with the increase in their muscular activity. Heat is also derived from the degradation of other forms of energy in the body when at rest.

Amount of Heat produced in the body.

We have noticed the estimate given by Lantier of the amount of heat produced daily by a man weighing 11 stones, estimated in units of work, as equal to 2840 foot-tons. Dr Woodman in his translation of Wunderlich on Temperature in Diseases (page 87) expresses the amount generated in this way - "Every pound of bodyweight produces heat enough in every 24 hours to make six gallons of water 1° Fahr: hotter than before."

Losses of Heat by the Body.

Seeing that we live in a medium of constantly varying temperature and that the body temperature necessary for healthy human life is about 50° Fahr: above the average temperature of the air in our climate, in order that health may be maintained provision is necessary against excessive loss of heat and against excessive accumulation. For, as under similar conditions the rate of flow of heat from the hot body to the colder objects around it would increase with the increasing difference between them in temperature, it would be impossible to maintain a fixed body-temperature when the air temperature may vary as much as 30° Fahr: in 24 hours without some means of counteracting

the effect of variable air temperature.

Loss of heat by the body occurs mainly in three ways —

1st By radiation to colder objects.

2nd By contact with colder objects.
(i. e. by Conduction).

3rd By vaporisation of secretions especially of the sweat glands.

(In addition loss takes place by the introduction of cold air & food into the organism.)

In moderate air temperatures all three of these ways of loss are acting; in extreme cold perspiration is nearly suppressed and all the heat is carried off by radiation and contact with cold air; when the surrounding air and other objects are at a temperature of 98° Fahr. loss of heat can only take place by

sweating as loss by radiation and contact of air is suppressed.

"It is estimated that from 60 to 70 per cent of the heat lost must be assigned to radiation and conduction from the surface, from 20 to 30 per cent. to evaporation of water, from 4 to 8 per cent. to loss through the air respired, 1 to 2 per cent. to loss in the excretion of urine and faeces, and about 2 per cent. to the introduction of cold articles of food" (Wunderlich. page 88.)

Regulation of Temperature.

With an enormous daily production of heat by the body and a rapid and varying rate of loss of heat to surrounding bodies how is the specific human temperature maintained? It may obviously be affected in two

ways — either the production of heat may be controlled, or the elimination of heat must be under regulation.

As to the production of heat — ~~it~~ has been seen that the source of heat is the food consumed, & that it is liberated in the oxidation processes of the body — the production may be influenced, therefore, by the amount of food supplied, and in this way probably remotely only, or, it may be controlled by direct effect upon the rapidity of the oxidation processes; and, as the expenditure of other forces such as muscular work and brain work can be regulated, in a measure by direct action of the will through the nervous system on the mechanism concerned in their production, there seems no a priori ground for rejecting the

notion that the oxidation processes concerned in heat production may in some degree be under the control of the nervous system.

The activity of glands & muscles, which has so much to do with the production of heat, has certainly a relation to the nervous system besides that dependent on vaso motor action.

"Muscles removed from the body are hotter during contraction and during rigor than when in a state of rest" (Hermann p 268).
And in the case of the Salivary gland it has been found by Ludwig that secretion may be brought about, under nerve stimulation, after the cessation of the blood stream through the gland. (Hermann p 95)
With regard to the other parenchymatous tissues, however, the evidence of direct control by the nervous system of their

activity, is less definite. Injuries to the spinal cord which interrupt its continuity have been attended by a rise in body-temperature and a division of the spinal cord would by its influence on the Vasomotor nerves cause a lowering of temperature, the rise which occurs has led to the belief that nerve fibres exist in the cord capable of inhibiting the production of heat. (Hermann. p 228).

There is no uncertainty, however, as to the control of the elimination of heat. By his sensations of cold and heat man is led to clothe himself with such materials as will affect the rate at which he parts with heat to the surrounding medium.

The rate of loss of heat is chiefly affected however by the condition of the surface of the body. The effect

of Cold upon the skin is to check sweat secretion, and to limit the loss of heat by radiation and conduction, also, through the contraction of cutaneous blood vessels which it causes by reflex stimulation of the vaso-motor apparatus. When the external temperature rises the heart's action is quickened the circulation in the vessels of the skin takes place more briskly - reflex inhibition of vaso motor apparatus occurs, cutaneous vessels dilate, and thus the amount of blood exposed to cooling influences is increased; at the same time increased secretion of sweat and increased vaporisation of liquid take place so that, although

the temperature of the surrounding medium is less favorable to loss of heat it is more than compensated, or at least sufficiently compensated, by the provisions for increased loss by the organism. By the frequency of respiration also some influence is exerted on the elimination of heat, the amount of cooler air which is heated in the lungs varying to some extent with the rate of respiration, as does also the amount of aqueous vapour given off by the lungs. The frequency of respiration increasing with increasing air temperature.

Mobility of Body Temperature in Health.

It has been noticed that for man as for other animals there is a specific body temperature subject in health to variations within very small limits, yet, in considering the deviations that may take place from these normal limits in Pulmonary Consumption it is desirable to understand the nature and extent of normal variations as well as the conditions determining them as far as possible in order that we may better grasp the significance of the very variable departures from normal types of temperature in that disease. According to Wunderlich the temperature in the axilla in health under the

most varied circumstances and influences does not fall below 97.16° Fahr: nor exceed 100.4° Fahr: except in very rare instances (p. 95). In children and in women & persons generally of a delicate organisation greater mobility than what is common may be found even in health. Ordinarily the daily range is between 98° & 99.5° Fahr: but observations seem to show that the range even within these narrow limits is special to the individual.

Usually the lowest temperatures occur in the night time or in the early morning - between 2 and 6 a.m., and highest temperatures between 2 and 9 p.m.; but here again idiosyncrasy may affect the general rule and modifications peculiar

to the individual appear.

In some observations on my own temperature I found the evening record lower than that of the morning. The thermometers were verified at Kew and the temperature taken under the tongue for seven minutes.

Temperature 98.2°F . at 8 a.m. (in bed)

" 97.6° - - 7 p.m.

" 97.5° - - 7.30 p.m.

" 97.7° 8.15 p.m. (after eating)

" 97.4° 9.30 p.m.

A basin of Hot Bread & milk was then taken.

" 98.4°F . at 9.45 p.m.

" 97.6°F - 10 p.m.

These observations were made in relation to the effect of hot food upon body temperature. On two other occasions the temperature was taken at 10 p.m.

(Note on the Influence of Exercise on Temperatures in health.

According to Dr. Bonnal of Nies (see Lancet '4/12/80) all muscular exercise, even if of short duration, raises the temperature of the rectum nearly however to a point exceeding 108°F . but the rise occurs invariably at whatever hour the exercise is taken, whether before or after rest and independently of age sex & meteorological conditions. The absence or abundance of perspiration has no appreciable influence on the variation of temperature during movement.)

it was found to be 97.2° and 97° Fahr: respectively.

In one other case I found the morning and evening temperatures somewhat similar in an adult convalescent from Acute Rheumatism who stated however that his temperature was always higher in the morning than in the morning in health.

Rudely exercise appears to occasion increased heat-development though in health provision for increased loss prevents any marked influence of work on the temperature "So that the final difference of temperature during rest and during labour is extremely trifling" (Wunderlich p 107). 'Hirn whilst at rest produced 155 heat units per hour and 251 whilst-

working at the treadmill? (W.)

Sleep appears to have no known influence in itself on the temperature of healthy people.

Hot baths (water temperature 95° to 104° Fabr.) have been investigated as to their influence on the Body Temperature of healthy individuals by D. Jakimoff and the results are noticed in the Lond: Medical Record (16/2/85). He found

1st The temperature rises, the rise going on uniformly in the external auditory meatus, axillary grooves, & rectum. After the bath the temperature in the meatus falls more rapidly than in the axilla, and the axillary temperature more rapidly than the rectal. The rectal temperature usually remains elevated, even at the end of two hours after the bath - therefore

the action of hot baths on the systemic temperature lasts not less than two hours.

2. The pulse and respiration increase in frequency; the arterial tension decreases.

3. Muscular strength becomes weaker.

4. The loss of bodily heat through radiation increases but in a slight degree.

5. Invisible cutaneous transpiration considerably increases, the increase lasting longer than half an hour.

In this relation two series of observations of the influence of hot and cold baths on the body temperature may be recorded - They are observations on my own person and were made to ascertain the probable effect of similar baths upon consumptive

patients.

1st Series (10/1/85)

Temperature in the mouth at 10.30 p.m. 97° F.

2nd Observation - taken for 20 minutes and
with another thermometer - $= 97^{\circ}$ Fahr.

— Hot bath at 11 p.m. —

Temperature in the mouth after five minutes
in the bath $= 99.8^{\circ}$ Fahr.

Temperature of water $= 105.6^{\circ}$ Fahr.

Temperature in the mouth four minutes later
 $= 101^{\circ}$ Fahr.

Cold water was now admitted until the water
felt chilly and the mercury of the
clinical thermometer would not rise
from the bulb in the water.

Temperature in the mouth $= 98.4^{\circ}$ F.

do 10 minutes later $= 98.4^{\circ}$ —

Temperature in bed at 8 a.m. next
morning $= 98.2^{\circ}$ F.

Second Series of Observations 4/3/85.

Temperature in the mouth at 10 p.m. = 97.2°F

About 10.15 p.m. the feet were inserted to 2 inches above the ankles in water at $112-114^{\circ}\text{Fahr}$, a degree of heat borne with difficulty. Body clothed.

Temperature in the mouth (after 5 minutes) 97.5°F

The Body was then immersed (with the exception of the knees + head) the water temperature being $110^{\circ}-112^{\circ}\text{Fahr}$:

At intervals of about four minutes the mouth temperatures recorded were 99.8°Fahr : and 100.6°F .

More water was admitted until only the head remained uncovered and the bath temperature stood at 106°Fahr :

Temperatures in the mouth at intervals of about four minutes = 101.2°F and 102.4°Fahr : (There was now a feeling of fulness in the head and a general sense

The surrounding medium, in less than 20 minutes rising from 97.5° Fahr: to 102.4° Fahr: nearly 5 degrees. It is also noteworthy that by conduction alone a fall in temperature to a similar extent was effected in about the same period of time.

Where the apparatus for regulating the production and loss of heat are free to act however application of heat and cold to the body in health have much less power to affect the body temperature. Thus Wunderlich records Liebermeister's results who found that during a moderate exposure to the influence of cold water the temperature in the axilla never sank at all. It seems probable also that the after effects of cold or hot applications are more than the effects produced

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at the time of their application, that in the case of a cold bath there is for some time after an increased production of heat and after a hot bath an increased loss of heat.

Icebags applied to the body lower the temperature of the abdominal contents and rectum; and the effects of drinking cold water are similar in their influence on the general body temperature.

According to Wundelich normal menstruation in healthy women is without any influence as a rule upon the general temperature of the body. Dr. Reiml, however, (Lond Medical Record 16/3/85, article 3770.) finds that in 11 out of 12 healthy cases the menstrual cycle could be accurately represented as showing a more or less

Steady wave of temperature. The crest of this wave that is to say the highest temperature represented the 'premenstrual' period.

In the first-half of the interval the temperature was at its lowest; it then steadily rose till the second half when the rise became more rapid and attained its highest point at the premenstrual period.

During the menstrual period it fell steadily but rather rapidly; the fall continued but became slower during the post-menstrual period and the first few days of the first-half of the interval.

Dr Reiml does not believe that the loss of blood is the cause of the fall of temperature during the Catamenia after it has reached its height at the premenstrual period.

Considerations as to Body Temperature in Health summarised.

From the foregoing remarks it appears —

1. That Man like other animals has a specific Body temperature, this being in health about $98\frac{1}{2}$ degrees Fahrenheit.
2. That the source of the heat of the body is the food consumed, but that neither the amount nor the character of the food consumed nor even the actual amount of heat produced bears a direct relation to the specific body temperature.
3. That the development of heat takes place in all the tissues of the body in which oxidation processes go on, i.e. all except the horny tissues.

4. That the daily production and loss of heat by the body is very great.

5. That the regulation of the Body temperature may to some extent be effected through the nervous system by direct control of the production of heat, but that it is mainly achieved by controlling the rate of loss through the vasomotor apparatus.

6. That while the Body temperature is tolerably stable in health there is even then a degree of mobility depending to some extent upon individual idiosyncrasies but affected to an appreciable extent by certain conditions such as menstruation in women, bodily exercise, thermal agencies

to which the individual may be exposed.

Body Temperature in Consumption.

What, then, are the features which the temperature records of a case of Pulmonary Consumption may present that distinguish them from the records which might have been taken of the same individual in perfect health? But, consumption is not a disease of such simple character and definite course that an answer can be given to this question in precise terms which would embrace all the possible eventualities of the progress of ~~a~~ patients affected

with it and their relation to body temperature. By a study of the temperature records which accompany this thesis, however, we may understand many of the possible variations from normal movements which may manifest themselves in the progress of the disease.

1. In the case of "G. M. H." the charts from page 1 to 27 inclusive give three daily observations of the temperature of a young lady about 24 years old during eighteen months of the time she was affected with pulmonary phthisis. Her illness began between 2 and 3 years antecedent to the date of the first Chart and terminated about two months after the

last. When she first came under observation of her attendant medical man, when these Charts were prepared, the left-lung was principally affected in its upper lobe, but the right-lung was not entirely free. The disease gradually extended in the left-lung and, later the affection of the right-lung became more pronounced and the right-posterior base- was during the later months the seat of pleuritic changes which were the source of a good deal of the pains she suffered. The progress of the case was unaffected by any important complication during the time covered by the Charts. The observations represent temperatures at 10 a.m. (black

3 p.m. (mauve) and 7 p.m. (red).

In Chart page 1 we have a period of three weeks during which the whole of the Temperatures recorded may be considered within normal limits, the maximum, $99.6^{\circ} F.$, and the minimum $97.8^{\circ} F.$, occurring on the first day.

$1\frac{1}{2}^{\circ}$ range - afterwards the greatest range being $1\frac{1}{2}^{\circ}$. But this is the only chart of the series of which this can be said. — In the two next Charts we see that the morning record is the only line that keeps within health limits; that the afternoon and evening records oscillate more, reaching occasionally subfebrile temperatures; and that the daily range is increased.

In later charts instability of the morning records are seen, in Chart "4".

for example the 10 a.m. temperatures ranging from $97.9^{\circ}F$ to $100.3^{\circ}F$, = 2.4° range for observations at the same hour. In Chart "7" we have another anomaly showing itself in the morning temperature forming the summit of a temporary exacerbation of temperature originating with the temperature of the preceding afternoon. Occasionally at this hour also we get as on charts "6" & "7" abnormally low temperatures 97.3° & 97.4° . Still another peculiarity in this line is shown in Chart "27" viz: the maintenance of temperatures above normal limits for several successive days.

Of the afternoon and evening records we notice that while they often correspond pretty closely in their movements the lines take occasionally independent

Excursions as if the temperature is influenced by some cause acting for a very limited time (see Chart "17" June 7th - 3 p.m. Temp: 102.5°F. & at 7 p.m. 101.7°F. a rise of $2\frac{3}{5}^{\circ}$ for the former & a fall of $\frac{2}{5}^{\circ}$ for the latter as compared with the previous day). The relation of these lines varies also for although generally a higher temperature is recorded at 7 p.m. Sometimes the 3 p.m. line is the higher of the two (see Charts "13" and "24") It will also be noticed that as the case progresses not only does the mobility of these two lines increase but they take a higher level so that the daily range of temperature becomes much increased. Thus while the maximum daily range for the Chart June 19th to July 9th 1883 was $1\frac{4}{5}^{\circ}\text{Fahr.}$ for the same period in 1884 it was $3\frac{9}{10}^{\circ}\text{Fahr.}$

This case shews also the relation of the Catamenial period to temperature changes in this disease - The appearance of menstruation is recorded on 17 occasions but as there is a gap between the first two periods noted which is not explained there are only 15 complete menstrual cycles to consider.

The duration of the cycle varied from 23 to 33 days the mean duration however being $28\frac{2}{3}$ days.

Of the 17 recorded menstruations a decided increase in temperature occurred on only two occasions on the days immediately preceding the flow; usually a lower temperature was registered on one or more of the days before it appeared.

The appearance of the Catamenia

coincided with a rise in temperature nine times out of the seventeen, once the temperature was stationary and seven times a fall took place.

The greatest disturbance of temperature was usually manifested during the seven to fourteen days after the catamenia and commonly the maximum temperature of the whole cycle occurred during that time. In 12 out of 17 times there was a rise in temperature after the catamenial flow appeared; 3 times the temperature fell once oscillations increased but no rise took place, once there was no obvious change.

From the progress of this case then, as shown in the Charts pages 1 to 27, we learn—

- 1st There may in the course of the disease be a period in which there is no marked abnormality in the course of the temperature.
- 2^d That abnormal alterations occur most readily in afternoon and evening temperatures but that they also occur in morning temperatures.
- 3^d That as regards the morning records these alterations may be
 - (a.) increased mobility in the line connecting successive observations;
 - (b.) higher morning than afternoon or evening temperatures; - (c.) abnormally low temperatures; (d.) the occurrence of isolated temperatures above the normal range, or the occurrence of a succession of such temperatures.
- 4th That while afternoon and evening (3 p.m. & 7 p.m.) records may

correspond pretty closely in their movements there may be an exacerbation recorded in one or other line only, (b.) That while the 3 p.m. temperature may be usually lower than the 7 p.m., it may become for a time continuously higher; (c.) That with the progress of the case the mobility of these two lines increases and they take a higher range.

- 5. That as the disease advances the daily range of temperature may increase.

- 6. That Menstruation may be preceded by a rising or by a falling temperature.

That the onset of the Catamenial flow may be accompanied by a rise or by a fall in temperature.

That the first-half of the menstrual cycle is apt to be more disturbed as regards changes in temperature than the latter half. - Exacerbations of temperature occurring more commonly then. -

II. 2:- We have next a series of eight cases in some respects presenting similar features (see pages 28 to 53 inclusive.). They all illustrate the subsidence of an exacerbation of temperature and return to normal ranges. There are however certain special features in certain of them that deserve notice. Mr. Berry (page 28) suffered on admission from general bronchial catarrh and had travelled from London to Ventnor yet had no elevation of temperature - Elevation

of temperature became marked in association with the development of symptoms of genito-urinary irritation apparently owing to a peculiar susceptibility to the action of Turpentine. The appearance of blood in the Sputum was insignificant in amount and did not appear to have any relation to the pyrexia. It will be noticed that the descent to a stable normal range is more abrupt and unhesitating, so to speak, than in other cases, —

The cases of Ford, Ward, and Mitchell resemble each other in the presence of considerable lung affection in each case, and in the fact that the temperature exacerbation bore a relation to their journey to the Hospital, probably due to the fatigue or to a chill caught on

Travelling.

There was no complaint of thoracic pain suggestive of pleurisy in and no auscultatory evidence of special implication of the pleura in connection with the exacerbation in either case. Ford & Ward were treated with antipyretics Mitchell received no treatment directed to the reduction of temperature.

Henry Walker appears to have had active mischief set-up at the right apex in addition to the chronic mischief in the left lung about the time of the temperature exacerbation and to this rather than to pleuritic & lung changes on the left side the increased temperature must be assigned - The slight effect of his small haemoptysis on the temperature is also noteworthy.

W. Reid - This was a case of lung disease in its first beginnings - The patient had lain on the grass in the hot sun and a few hours later was attacked with pleurisy of the right side. Subsequently there was evidence of implication of the lung also and he came to Ventnor. On examination I found prolonged expiration slight increase in vocal resonance and occasional sibilant rones and crepitations over the upper half of the right lung in front - & less marked changes behind. A special feature in his Charts is that the temperature at 3 p.m. (mauve line) is higher than that at 7 p.m. (red line) as a general rule; there is also a transient

peculiarity in the inverted relations
of morning and evening temperatures
on the 10th, 11th, 12th, + 13th of June
A. Guerier - A case of limited
affection of right lung - signs
of consolidation with occasionally
catarrh over its upper third.

The chart shows an exacerbation
of more chronic character than
the other cases and a more
gradual subsidence of the temperature.
E. Cook - Temperature exacerbation
in relation to her journey was
subsiding from the 10th to 13th of
May when a new exacerbation
occurred in association with
the menstrual period lasting
for six days.

In these eight patients in addition
to the gradual subsidence of the

7

Disturbance of Temperature, we see again that the morning temperatures sympathize with the rise or fall of the evening ones but that the excursions are much more limited in the morning record. In the four completed Hospital cases also - Berry, Mitchell, Walker and Cook - it is to be observed that with the disappearance of pyrexia considerable gain in body weight occurred.

II.

Remittent In Chart "36" (The Postman) we have an example of the change from the 'Continued' into the type of temperature and it illustrates also the tendency to reaction in a morning temperature which has been

for a time above the normal range
(see also Walker page 42, & Cook page 53.).

Chart's pages 39 to 62 (Rowland)
Show an example of aggravation of
subfebrile & apyretic temperatures with
the development of fresh lung mischief -

Page 65 (Kentfield)

Increase in pleuritic & catarrhal symp-
-toms with an acute exacerbation
of morning and evening temperatures.

Pages 68 to 71 inclusive (Flatman 1880).

Subfebrile temperature aggravated by
more active pleuritic and pulmonary
mischief and gradual return to
subfebrile limits. Mobility of morning
record. Also noteworthy, & gain in weight.

Pages 74, 75, & 76. (Flatman 2 years later)

Subnormal morning temperature improving
somewhat with general improvement,
diminishing daily range & gain in weight.

Pages 79 to 83 inclusive (Copl)

Great mobility of temperatures associated with pleuritic complication mainly, low morning temperatures.

Pages 86 + 87 (Akhurst)

Subfebrile range becoming febrile with pleuritic exacerbation. Low morning range.

Pages 90 to 96 inclusive (Stinton.)

Febrile range - remittent type - with Acute pleuritic exacerbation (June 18th)

No action of the bowels occurred on single days 13 times out of 140 days and once was associated with a rise of temperature only + then to 15° above the adjacent days. Twice no motion occurred for two days but on each occasion preceded by a day in which the bowels acted twice - a rise of $\frac{2}{3}^{\circ}$ in the one case + a fall of $\frac{1}{5}^{\circ}$ in the other conceded - Once no motion

occurred for 14 days the bowels acting twice on the preceding day. As this period coincided with the pleuritic exacerbation (June 20th to 28th) the influence of Constipation if any may have acted in retarding the decline in Temperature. These comparisons of action of the bowels are with evening temperatures
Pages 99 + 100. (Mrs Kelly)

Advanced lung mischief shewing gradual reduction of a moderately febrile range to normal limits and then a slight rise for seven days preceding menstruation ($1\frac{1}{2}^{\circ}$) -

A rise of $1\frac{1}{2}^{\circ}$ took place on the day the Catamenial ^{flow} appeared. and a subsequent fall of 1° Fahr. in six days though menstruation lasted only two days. Then without any recognised cause for it a sudden rise in the evening temperature of nearly 3 degrees took place.

Page 103 (Hart-)

Chart shows exaggerated mobility of temperature of a boy, the increasing daily range of progressive disease along with slight but steady increase in weight.

Pages 106 to 109 inclusive (Alley)

Remittent type (might almost be called intermittent) with progressive general deterioration + loss in weight.

Page 112 (Jones)

This chart shows graphically how great the daily excursion may be in pulmonary phthisis amounting here at its maximum to $6\frac{1}{2}$ degrees Fahr. It shows also how the daily range may become narrowed after a time and then again expand - One such contraction of the daily range here took place after an attack of hemoptysis

and probably the activity of the local processes became considerably reduced by local depletion thus affecting the break manifested in the width of the daily excursion of temperature -

Pages 115 to 118 inclusive (Green)

A similar case to the preceding but with low morning range. Weight fairly maintained.

Pages 121 to 124 inclusive (Wilson)

Absence of all troublesome symptoms - no cough - gain in weight - of 14 $\frac{1}{2}$ lbs, and insignificant lung damage with typical remittent type of moderately febrile range.

Pages 127 to 129 (Webber)

Persistent subfebrile temperature with absence of bad symptoms and great increase in body weight.

Page 137 (H. White)

High fever of Acute Phthisis with high morning temperature - Remittent type.

Pages 140 to 143 inclusive (Costell)

Remittent type in a case of advanced disease with 5 daily observations of temperature at intervals of three hours. The lowest record is at 9 a.m. the highest at 6 p.m. and these are also the least variable lines. The temperature rises from 9 a.m. to 6 p.m. & then falls a little by 9 p.m.

Pages 146 and 149 (Morey and Duggan)

Two cases of subnormal morning temperature with very moderate evening elevation.

In the series of charts just noticed we have fairly well illustrated the temperature phases of uncomplicated phthisis pulmonalis in its progressive

form. There is this difference between the series and those first noticed that although the widest divergence is exhibited in the extent of the departure from normal limits there is no return to normal limits except as a merely temporary modification in the Chart of W. Kelly ('99'). In the exacerbations which occur as in the cases of Kentfield, Stinton, & Flatman '80', there is no subsidence such as in the cases of Mitchell, &c, in the first series to a normal range in a few days, - at best after a prolonged acme there is a return to the condition of things previous to the exacerbation such a tendency being shown in Flatman's Charts - More often we find that as in Stinton's case there is an

increase in the daily range of temperature as compared with that previously shown before the occurrence of the exacerbation.

Yet while this is true of the daily range of temperature it will be observed that this does not hold as regards the morning and evening records taken separately - that there is no tendency to return to normal ranges exhibited. On the contrary the morning record generally exhibits the tendency to return to a normal standard as is seen in Stinton's case; it is the line of evening observations which is apt to acquire a continuously higher level after exacerbation in these cases. This difference in the tendency of the temperature

at different periods of the day is characteristic of the common type of pulmonary consumption which most of these cases belong to and determines the "remittent" form of Phthisical pyrexias.

The case of H. White is an exception. Here the progress of the case is so acute that its temperatures are more like those which are seen in temporary exacerbations in other cases, for although the type is still remittent the morning temperature is itself a febrile one.

The tendency to disappearance of pyrexia in the morning record is exaggerated in certain of the cases, as in those of Green, Akhurst,

Mossy, Duffan, + Hatman - 84,
and a subnormal morning
line is produced.

The absence of emaciation
with a considerable daily
excursion of temperature which
the cases of Jones, Green, and
Wilson typify is not a little
remarkable. In Wilson's
case with moderate febrile
range there was a gain
in weight of $14\frac{1}{4}$ lbs during
her period of residence. (Webber's
Case with a gain of 24 lbs.
in ten weeks is an anomalous
one and had it ~~not~~ been for
the presence of decided lining
mischief with signs of some
activity on admission and
occasional greater variations in

the daily range of temperature it would be difficult to believe that the case was not one in which the normal temperature limits were higher than usual.

That emaciation may occur, however, without any special temperature characteristic to distinguish the case from others where it is absent, is shown in Alley's case.

Of the causes of exacerbations of temperature which these cases illustrate the predominating one in every serious increase in fever is increased activity of the local changes in the lung.

Pleuritic pain causes so much distress when it occurs that it is probable that this alone fires

rise to elevation of temperature, but whether pain be present or not or the signs of pleurisy be recognised or not we find that advance of the lung mischief occurs if the lung itself be affected with disease. Unless the exacerbation be prolonged it may not be possible to confirm this view by evidence of increased destruction of lung tissue. but the existence of signs of catarrh, especially of alveolar catarrh, in the neighbourhood of the pleuritic pain is significant of the fact that the active processes are not confined to the pleura.

In Huntfield's case with the exacerbation pleuritic pain was complained of and an increase of the crepitations in the lung itself was noticed over the affected area. In Stinton's case

the same occurred. In the case of Postance (54) an advance in the lung mischief was recognised. In Walker's case pleuritic pains were commonly felt over the diseased left lung but though these existed with the exacerbation the development of catarrhal signs at the apex of the comparatively unaffected right lung seemed to have more to do with the aggravated condition.

Of course it is not desired to minimise the influence of pleuritis in causing temperature disturbance, that it is potent in this respect is beyond all doubt, but what it is necessary to insist on is that with the symptoms and signs of pleuritis occurring in a case of pulmonary consumption.

Changes in the lung substance also occur and it is the invasion of fresh areas of lung tissue that it is most important to bear in mind.

Menstruation may be associated with the occurrence of an exacerbation. In McKelly's case (100) the temperature declined in the intermenstrual period rose a little ($1\frac{2}{3}^{\circ}$) in the week preceding menstruation and with the appearance of the flow and then, although arrested on the 2nd day (usually nearly a week in duration), the disappearance of the flow + four subsequent days show a slight decline in temperature. On the 7th postmenstrual day a rise of nearly 3 degrees Fahr: occurred and from then a much greater daily excursion began.

Constipation is so much a matter of habit that it is not easy to tell the significance of it in the Charts given - The absence of action of the bowels on a particular day if free action occurred on the preceding day would be of less importance than continued daily but imperfect action. Hence contradictory evidence as to the influence of this condition on temperature. In Flatman's case a slight fall in temperature occurred on two days when no action of the bowels took place, - but after the absence of action for 4 days a rise of $\frac{3}{5}^{\circ}$ Fah: occurred - In Kelly's case a slight fall on five days & a slight rise on five days when no action is recorded. In Stinton's case a slight fall in temperature occurred

seven times with absence of action, & a rise on six occasions, on three of these $1\frac{1}{2}^{\circ}$, $1\frac{2}{3}^{\circ}$, $1\frac{1}{2}^{\circ}$ Fahr: respectively.

Rest - In the case of H. White a marked influence on the temperature is seen to result from being confined to bed wholly (see 137 & 137a) on several occasions when the previous record was unusually high and this difference of "bed" or "up" was in the latter case represented only by sitting up for a few hours in the afternoon in his bedroom.

Blisters - In White's case also the depressing effect of the application of a blister is exhibited; on one day as the first was ineffectual a second blister was applied and a fall of $3\frac{2}{3}^{\circ}$ Fahr: in the evening temperature is shown; on a second occasion after one blister a fall

of $1\frac{3}{5}^{\circ}$ F. occurred but this depression was not maintained for on the succeeding days the temperature rose again.

But the depressing influence of small blisters is not always so marked as is shown in Cope's case (79)

III.

In the first series of cases slight blood-spitting occurred in Walker's Case with slight elevation of the succeeding evening temperature (1°), In Jones's case (2^d Series) more serious hemoptysis resulted in an elevation of the morning temperature temporarily for $2\frac{1}{2}^{\circ}$ F. and the evening temperature $\frac{4}{5}^{\circ}$ during the succeeding 4 or five days - but afterwards in two days the evening temperature fell four degrees and the morning temperature nearly three degrees. The

development of this complication in a case of phthisis may be attended with a fatal result immediately as a result of loss of blood, from syncope, or from suffocation when owing to the rapidity with which the blood is poured out it cannot be expectorated quickly enough. Or it may prove fatal as a consequence of the exhaustion ensuing in an already much enfeebled patient. It may also more remotely prove fatal by diminishing seriously the resisting power which the constitutional state possesses in a case of progressive disease. If it does not more or less rapidly induce a fatal result, the patient may more or less completely recover from

its effects the completeness of the recovery, where it takes place depending greatly on the secondary changes which it may have originated in the lungs.

Elizabeth Marriott's case (page 150). was on admission an apyretic one but there was a good deal of moist sounds over the affected portion of the lung and she had had serious hæmoptysis a fortnight before, so that though not very active the processes in the lung which had led to hæmoptysis were still un-arrested. Her general health improved for a time after admission. Then preceded by an aggravation of the cough hæmoptysis to 8 oz occurred and on the succeeding day two attacks amounting to 30 oz, or altogether in two days a loss of nearly a quart

of blood was experienced. The effect on the temperature was to produce a rise to 103.8° after the last attack in the evening temperature & to 102.8° in the next morning temperature. From these observations a rapid decline took place and on the 8th day after the last hæmoptysis the patient had regained her previous apyretic state - from which there was no subsequent departure of moment during her stay.

Carter's case (page 153.) was one of rather advanced disease of comparatively recent origin - on admission the amount of pyrexia was not great but after three moderate hæmoptyses on the 24th, 25th & 26th of Dec. the evening temperature had reached $103.2^{\circ}7$ on the evening of the 26th. On the 4th day

after the last hemophysis the temperature had fallen to 99.2° at 7 p.m.. This low record was maintained for five days with slight variation on the sixth day it was a little higher than on the preceding day, Hemophysis occurred on the 7th day (or 11th from last attack) and the temperature continued to rise until the day after two subsequent attacks reaching 102.8° . - Then another descent in the evening records occurs until 99.8° was reached on the 4th day after the last bleeding - Then a slight rise and another hemophysis without effect on the record. Two other slight attacks occurred but did not produce much effect on the temperature the first being followed by a fall & the next by a slight elevation of temperature.

The effect of these repeated bleedings on the subsequent record was to

produce great mobility of range. The patient became much weaker, very breathless, & increased development of moist-sounds over the lungs generally became evident on auscultation. The evening observations gradually assumed a higher level until the maximum temperature (103.7°F) was reached six days before death. From thence a steady fall in the temperature occurred until the last day of life when the morning observation (10 a.m.) was 96.8°Fahr : and 98.5°Fahr at 7 p.m.

He died seven hours after the last observation. Wm Osborne's case (page 160) was a very advanced one on admission and the course of the disease had been rather rapid hastened probably by two or three severe bleedings before he was admitted. His chart during the

First three weeks of residence shows the occurrence & subsidence of two exacerbations of temperature. Then a severe attack of Hemoptysis occurred (or) the blood being lost very rapidly - A very slight rise in temperature followed by a considerable fall occurred and then extensive oscillations in morning and evening temperature - Eleven days later another slight attack occurred producing a fall in the evening temperature of that day to 96.4° Fahr. : The patient gradually sank and died 17 days after the serious attack first noticed.

Ridley's Case (Page 164) is one of Acute disease in an advanced stage terminating rapidly (2 days after) in consequence of profuse hemoptysis. The special feature in the charts in relation to the hemoptysis is the fall in evening & rise in morning level preceding it.

Francis and Kenny's cases (pages 172 & 173) are instances of advanced disease of rather acute progress terminating suddenly, and apparently by syncope in attacks of lung hemorrhage.

Francis was sitting in an arm chair when he gave a slight cough and noticing blood on his handkerchief said to another patient in alarm "What's this" & then grew pale & died a little frothy blood appearing at his lips -

Kenny had just risen from the tea table when he commenced bloodspitting & he had only brought up a few mouthfuls when he fainted and died. Both cases shew a slight fall in temperature at 7 p.m. on the days preceding death.

John Rigby (page 178) was admitted in an advanced stage of disease of the lungs and probably tubercular ulceration of the intestine. Chronic diarrhoea became a marked symptom soon after admission accompanied by rapid emaciation. In the sixth week of residence with a previously falling temperature an attack of hæmoptysis occurred and the temperature rose 3 degrees in the evening - A slight fall occurred next day and purpuric eruption on the legs appeared and the passage of blood at stool commenced. The loss of blood at stool continued and the temperature fell to normal rising on the day previous to death one degree in the evening.

From these cases we see that the tendency of hæmoptysis is to produce

an exacerbation of Temperature within a short time after its occurrence the pinnacle of the exacerbation being speedily reached, and a decline commencing very soon after. The fall is a little slower than the rise but it is still rapid.

This exacerbation differs from those due to more active processes in lung and pleura hitherto considered chiefly in the duration of the exacerbation being shorter and the decline more decided the latter character sometimes modifying for a time the previous daily range of Temperature.

Probably the immediate effect of hæmoptysis is a depression in Temperature to which an elevation succeeds more or less speedily according to the Constitutional Vigour and

irritability of the patient.

IV.

The influence of approaching dissolution on the temperature curves in a disease like Consumption where there is a gradual reduction of strength as the disease progresses would on à priori grounds appear to be that while up to a certain point weakness is marked by an increasing irritability of constitution and a rise in temperature from diminishing resistances to the action of pyrexia factors, that beyond that point failing vitality and diminished response to stimulation would be indicated by a decline in temperature.

Puddle's case (page 183) shows some thing like this. It had been of

rapid course prior to admission to the Hospital and continued to progress rapidly. The evening line of temperature ascends until the 3rd week before death and the maximum of 104°F . is maintained for a few days, and then steadily falls until the fatal issue.

Fuller's case shows the same thing (page 190), but to a less marked degree. It is peculiar in the increasing oscillation of the morning temperature as the end approaches with a fall to 95.3°Fahr : on the morning before death. The post-mortem rise in temperature (or maintenance at any rate, for the exact temperature was not ascertained) led to comment by the undertaker 22 hours after death and to an inspection of the

body by me. I found post-mortem rigidity well developed and the left side of the Chest sensibly warm although the body had been in the mortuary at least 20 hours.

Fordham's Case (page 192) exhibits a rise in morning and evening temperature for three days before death.

Baker's Case page 196 shows a general decline with marked mobility of the records for a fortnight before death and a rise in morning and evening temperatures during the last two days of life.

Massey's Case (page 200) also shows a gradual decline in temperature during six weeks preceding death with a more abrupt fall to sub-normal temperatures on the last two days of life.

Whitworth's case (205) shows oscillating lines with maintained febrile morning range during the last weeks of life and a fall in temperature a few days before death -

Lovell's case (212) - also exhibits a preagonistic decline in temperature range.

V.

Donovan and Moffatt's cases (pages 213 & 217) were instances of termination of Pulmonary Phthisis by the supervention of Tubercular Meningitis. The records do not unfortunately continue to the last days of life the restlessness of the patient in his hopeless condition having probably led to the abandonment of temperature observations - It is shown

however that in this condition there is great mobility of morning and evening temperatures with febrile or subfebrile morning elevation - and that, there is also a decline in the temperatures as the end approaches. In Donovan's case this decline is ended by an abrupt ascent a day or two before death of $5\frac{3}{5}^{\circ}$ Fahr: in three days.

VI.

Abdominal complications may modify the course of pulmonary Consumption and affect the temperature records - We have seen in Rigby's case (178 page) that loss of blood at stool may prevent the occurrence of pyrexia to some extent and doubtless the preceding records are

modified by the Chronic diarrhoea which existed, for it will be noticed that the range is a low one for a patient suffering from advanced disease in an active condition.

Dawkins (page 130). This patient had not very extensive or advanced lung disease but he suffered from chronic diarrhoea of rather severe kind with abdominal pain coming on after taking food, the ingestion of food at times leading to a more or less speedy action of the bowels. Probably therefore he had tubercular ulceration of the intestine in addition to his lung trouble. His charts give an example of 'sub continuous' rather than 'remittent' type. The morning temperature is afebrile one, the daily range small and a

peculiarity of the oscillations in the evening record is that they present a certain amount of regularity in duration and extent.

Spencer's case (page 221) was also one of comparatively limited lung disease - The development of diarrhoea and consequent weakness was in his case the immediate cause of unfitness for work though there had probably been some lung mischief during three years previous to that attack. There was no albuminuria and no other reason to suspect amyloid disease & the abdominal pain and diarrhoea were attributed to intestinal tuberculosis. In this case also we have febrile & subfebrile morning temperatures.

Kall's case (page 224) was distinguished

by great emaciation. Abdominal pain had existed for eight months on admission and although the action of the bowels was not frequent the motions were always loose. The charts shew a very low temperature range with occasional excursions.

L. Mason's Case (Page 230) is another instance of intestinal tubercle with probably ulceration, and comparatively limited lung mischief. Abdominal pain was occasionally absent - but when present it was worse after taking food, and exacerbations occurred independent of food, with which exacerbations of temperature coincided.

The cases of Atkins and Woolhouse are instances of Peritoneal tuberculosis

In Atkins's case Chronic tubercular peritonitis had probably existed for some time before admission but had not been recognised until the exacerbation of temperature associated with what appeared to be Rheumatic symptoms confined the patient to bed - The modifications of temperature coincident with diarrhoea and the Symptachy of morning and evening temperature in the condition are the noteworthy features of the Chart.

In Woolhouse's case (page 239) Rheumatic symptoms also first appeared with the development of a temperature of Typhoid characters; the abdominal symptoms - pain, tenderness, tympanites & diarrhoea - appearing later. The subsidence of the exacerbation and subsequent lower range are noteworthy.

Case of Broncho-pneumonia. (Phillip Kelly 248)

This case illustrates the oscillations in temperature in a case of simple inflammation of the lung due to inhalation of irritating fumes in a burning house. The progress of the case was not sufficiently prolonged to give much value to the record yet it is of interest in connection with the subject of temperature in relation to lung changes.

VIII

Pneumothorax is a comparatively rare accident in the progress of cases of consumption as seen at the Ventnor Hospital yet the modification of the temperature exhibited in acute cases is important.

Case of Ed. Furniss (page 249) was one

of disease affecting mainly the right-lung. Pleurisy attacked the left-lung. (probably associated with lung changes) and a subfebrile temperature subsiding to normal underwent a sudden exacerbation. Orthopnea developed coincident with an equally sudden fall in the temperature.

Facer's case was one of rather acute phthisis pulmonalis with considerable daily excursion of temperature and high evening range. There was a sudden change in the character of the temperatures with the onset of symptoms of pneumothorax - the morning temperature rising - the evening temperature falling and oscillating markedly from that time as compared with their previous course. The decline of evening temperature continued with

oscillations till death a fortnight after perforation of the lung.

Pulmonary Thrombosis - Crosby's Case (page 259).

This case is interesting in consequence of the sudden termination and the nature of it after the active lung symptoms had subsided and the temperature reached a range of normal limits. The exacerbations and depressions of temperature, which coincided with the development of fatal symptoms are very striking.

Venous Thrombosis + Pulmonary Embolism

Mann's Case (page 260).

This case shows depressions of temperature coinciding with frequent action of the bowels. Pulmonary embolism and oedema consequent

on the embolism caused a speedily fatal result owing to the extensive disease of the lungs pre-existent.

Pulmonary & Laryngeal Phthisis

Brooke's case (263) is remarkable for the extent and rapidity of the fall in temperature which preceded the fatal termination.

Wilkinson's case (267) is chiefly noteworthy for the very decided improvement in temperature records under treatment.

Pulmonary Phthisis and Ague

Lambert's case illustrates the temperature developed in a case of consumption with moderate pyrexia by the supervention of an attack of Ague.

Evidence of Cases and Charts summarised,

1st - During the progressive destruction of lung tissue which takes place in Pulmonary Consumption ^{very} considerable deviations take place in the morning and evening records of temperature beyond what occur in health.

2nd - These deviations may be -

- (a.) - A higher evening temperature.
- (b.) - A higher or lower morning temperature.
- (c.) - An inverted relation of morning and evening temperatures, the morning being higher than the evening.
- (d.) - Higher morning and evening temperatures.
- (e.) - An increasing daily range of temperature.

- (f) Increased mobility of temperature - not only increased daily mobility (i.e. daily range or excursion) but increased mobility in the lines joining observations taken at the same hour.

3rd - Just as, if it were possible to exclude all causes of disturbance, we might imagine an ideal healthy temperature record to be represented by two parallel lines, the upper one joining successive evening observations the lower one successive morning ones, so, we may, excluding disturbances, conceive of an ideal temperature in a case of progressive Consumption. Such a temperature record would be represented by a ^{horizontal} straight line within normal limits for the morning observations, and by

for evening temperatures
a gradually ascending line, from
health limits to about 104° Fahr.,
and after this point both lines
would take an abrupt downward
inclination.

(It must be remembered that this
excludes all disturbing causes,
but one characteristic of temperature
in this disease would by so doing
be lost sight of, viz: - its mobility.)

4. Commonly the progress of a case of
Consumption shews temperature
exacerbations, apyretic periods,
and, ultimately, pyrexia of a
remittent type;
5. The exacerbations may occur
with otherwise apyretic records,
or when the remittent type

has developed.

6. Temperature exacerbations are usually symptomatic of exacerbations of lung mischief, but minor aggravations of temperature either of morning ^{or evening} or both, may be due to other causes. When associated with increased activity in lung disease it ^(the exacerbation) may be attended by pleuritic and catarrhal signs & commonly is; it may be due to the irritation of lung tissue consequent upon Hemoptysis and in this case may be of shorter duration and less permanent effects.

7. Periods of apyrexia occurring in the course of a case of consumption are commonly observed in the earlier part of that course and

probably have a definite relation to the constitutional vigour of the patient. Maintenance of weight - or gain in bodyweight - is usually observed along with general improvement in other symptoms during these apyretic periods.

8. The remittent type of temperatures may begin in an exacerbation of morning and evening temperatures (remittent, sub continuous, or continued according to the closeness of the relation of morning and evening ranges) and gradually disappear in normal limits; instead of disappearing the daily remissions may increase in extent; or, though the remissions may not increase in extent, the whole daily range takes a higher

level. The first is the kind of course which occurs in Chronic cases with periods of interrupted activity; the second is seen in cases of subacute course or as a termination to Chronic cases; the last is found in cases of acute disease, and in periods of acuter progress in more Chronic Cases.

g. Gain in body weight may occur with remittent temperatures if the morning range is about normal limits - even with a gradually rising evening temperature & consequent increase in daily range - but during the occurrence of exacerbations & with 'acute' remittent type emaciation usually

occurs with more or less rapidity.

10. Usually preceding death, unless this occurs suddenly from accidental causes, there is a period of declining range in which the mobility of the records increases, probably that of the morning temperatures becoming relatively more mobile. The decline is apt to become more abrupt as death approaches.

These are the general conclusions as to the relation of temperature to the progress of Consumption. There are in addition certain other points brought out in the cases given deserving notice.

1. Generally the line of evening temperatures shows greater mobility than the line connecting morning observations - (excepting probably immediately before death).
2. An isolated aggravation of morning or evening record may occur, or the aggravation may last for a time - This may be, perhaps, in relation to the time of action and the duration or intensity of action of the disturbing cause.
3. Morning temperatures when raised tend to return to normal limits; exaggeration of this tendency produces subnormal morning records.
4. The daily range of temperature may amount to 6 or 7 degrees.

Fahrenheit.

5. Exacerbations of temperature subside more slowly the more seriously the general condition of the patient is affected.

6. Exacerbations of temperature may be succeeded (after subsidence) by temperatures similar to those before they supervened or the general character of the temperatures may become more aggravated.

6. Haemoptysis may be the cause of an exacerbation of temperature, and may lead to subsequent aggravation or improvement in the general record.

7. Constipation may cause a little elevation of temperature.

8. Diarrhoea (& still more potently loss of blood by the bowel) may produce depression of temperature.
9. Rest in bed often for a time produces a lowering of the febrile evening temperature.
10. Blisters according to their size & severity of action give rise to a fall in temperature but the result depends also upon the individual patient.
11. Tubercular meningitis, intestinal tuberculosis, laryngeal tuberculosis and tubercular peritonitis mainly modify the course of phthisical temperatures by causing a higher morning range (if they do not cause an exacerbation of temperature if they do this then evening temperature is higher also.) - Approaching

dissolution is heralded by a declining temperature when these complications exist - as in un-complicated Pulmonary Phthisis, 12. The Supervention of acute Pneumothorax in the course of a case of Consumption manifests itself in the temperature records by a fall in temperature and greater mobility of morning and evening range.

(13. Pulmonary thrombosis except during the rigors & immediately after occasions depression of temperature so far as the progress of a single case may warrant a conclusion).

14. In the occurrence of an attack of ague during the course of subfebrile phthisical pyrexia

the course of the phstusical temperature
was not materially altered on
the days of intermission of the
ague fever but it assumed
subsequently, a somewhat more
aggravated form.

Significance of Temperatures in Consumption.

It has been seen that in health the maintenance of the body-temperature depends partly on the rate of production and partly on the rate of loss of heat by the body, and that the maintenance of a nearly stable temperature in a constantly varying medium is effected by a mechanism the nice adjustment of which to the circumstances is essential to and characteristic of health; that as regards the limited and definite variations which do take place in the normal daily temperatures there

are due in part to the natural response to the circumstances and surroundings, in part to individual peculiarity.

The source of the heat of the body in health being certain chemical processes occurring in the body, attended with heat development it is necessary to ask regarding increased temperature in Consumption is it due to exaggeration of these natural processes, or ~~is~~ is it dependent on new processes which the existence of the disease determines?

To what extent, also it must be asked, are the variations which occur due to defective regulation & loss of heat; and, how far are

the variations which occur in the temperature in this disease the natural response of the organism to altered conditions of existence.

Going back to the days of Cullen we find (First Lines of Practice of Physic Vol I page 452. Edition of 1812) that the conclusion then reached was that the hectic fever of pulmonary phthisis was always due to the effect of an acrimony absorbed from abscesses or ulcers. And today, though expressed in a different way, this view is very generally held as to the significance of pyrexia in pulmonary phthisis. Thus, Dr James E Pollock says — (Harveian Lectures. See Brit. Med. Jour

Vol I 1881 page 110) "High Temperature" (in pulmonary phthisis) "means The presence in the blood of febrific materials the result of caseous degenerative changes in the lung". Again (page 39) "The fever is high for the blood is constantly charged with the detritus of inflammatory and tubercular products. Local morbid processes manufacture the fever; for febrific substances the result of their necrosis, are constantly being added to the blood."

More recently Dr. Saccard. ("The curability & Treatment of Pulmonary Phthisis" translated by Dr. Hubbard. 1885.) says - "hardly from the time that the stage of softening commences until the end of the

"disease, including that in which cavities are formed pyrexia may be connected with the absorption of products of destruction with which the lung is loaded, as well as with bronchial or cavernous secretions. These elements produce fever, being its most frequent cause, while the pyrexia is most serious on account of its duration which may be indefinite if it be not checked." "This form of fever, corresponds to what has been vaguely designated hitherto the hectic fever of tuberculosis. In my opinion it is the fever of absorption." "As regards the "absorption fever" which term I unhesitatingly substitute with its above mentioned characters, for the

"so called hectic fever of authors,
this indicates true septic infection?"

Iacoud recognises three other
forms of phthisical pyrexia as
due to & symptomatic of "local action"
viz: "pyrexia of granulation" or formation
of tubercle", pyrexia due to "develop-
ment of pneumonic or bronchopneumonic
foci" - "inflammatory fever", and
pyrexia due to ulceration and
formation of Caverns.

The view expressed by Cullen has
still more recently been brought
into harmony with the latest-
pathological doctrines by Dr
Watson Cheyne who in a discussion
on Pulmonary Tuberculosis at the
Royal Med: & Chirug: Society (see
Brit: Med: Journal Jan: 17/85 page 130)
says "The pyrexia of the condition

"was very possibly due to the poisonous products of bacilli".

The foundation for recent adhesion to this doctrine of septic absorption as the causation of phthisical pyrexia, is the results of experiments on the temperature raising effects of certain animal substances when introduced into the circulation by Billroth and others. E. Bergmann (quoted by Wunderlich page 141) "found that after the injection of a moderately small quantity of the deleterious material, there is always induced a very exact and identical typical alteration of the course of temperature: "all the experiments are parallel whether decomposing materials, or products of inflammation, or only the results of the customary tissue"

"Changes, are injected. Indeed it appears to this observer that after the injections of large quantities of water, or smaller quantities of irritating substances, there may be a very similar alteration of temperature, to that which occurs after the injection of solution of decomposing or inflammatory products."

Wunderlich goes on to express his opinion that - "Those unknown influences which excite specific morbid processes in the person attacked must have something in common with those results of experiments on the pyrogenic action of animal substances introduced into the system".

With regard to these experiments it cannot be said that the results

are definite beyond the production of pyrexia, the nature of the substances introduced into the blood is as uncertain as the mode in which pyrexia was induced by their introduction.

Absorption by an inflamed surface in the lungs may be practically the same in its results as the injection of substances into the cellular tissue or into the blood itself but it is as unsafe an assumption as it would be to conclude that the introduction of the fluids employed in the experiment into the rectum, in order that by absorption there they might reach the blood, would be attended

with similar ~~to~~ results to those obtained by the methods employed.

Certainly the teaching of recent pathological science lends support to the idea that deleterious products may result from the growth of bacteria in the secretions of an inflamed surface and by absorption there in some way be productive of harm to the individual. But this taken as an explanation of the pyrexia of consumption is at best, as Dr Watson Cheyne puts it, a possibility, and we have no right to assume that it is the explanation except provisionally and in default of a better one.

What is the teaching of the course of the temperature itself in relation to the clinical history of Consumption?

It has been noticed that the ideal course of the morning and evening records of a case of Consumption progressive and not acute in its manifestation, would be represented up to a certain point by a horizontal morning line and a gradually ascending evening line of temperatures. But practically this ideal course is modified by the very condition represented by the increasing distance between the morning and evening lines viz:- by the increasing mobility of the temperature records which

modifies the course of both morning and evening records.

It has been seen also that the influence of particular events upon the temperature record has a relation to the constitutional vigour and stability of the individual. That an exacerbation depending on increased activity of local processes, for instance, will subside rapidly, or slowly, or produce permanent changes in the record according to the recuperative power of the particular patient; or, that hæmoptysis may be recorded in the same way by evanescent or more permanent & serious effects. The influence of particular events also has a relation to the normal course

of the Temperature - Causes which tend to raise the temperature acting more readily on the evening record & producing greater mobility there, Causes which tend to lower the temperature - as the pre-agonistic state - acting more readily on the morning temperature and producing greater mobility there.

It is known also that as regards the general condition of a Consumptive individual from the onset to the end of the disease he manifests oscillations and periods of comparative rest in constitutional vigour and sooner or later a gradual but steady decline till the end comes, just as exacerbations, apyretic periods and an ultimate remittent

course and increasing departure from the normal standard of temperature is seen in the morning and evening records of body temperature.

Thinking of all this + bearing in mind the oscillations in temperature in health + the idiosyncratic modifications that may occur then, I am constrained to ask - Where is the necessity for the explanation of temperature elevation in Consumption by fermentative processes in the blood which are attended with increased heat development and which processes are the results of absorption of septic materials in the lungs? Where is the countenance for

such an opinion in the clinical history of Consumption?

Is not the temperature course in this disease simply the daily record of events to which an increasingly susceptible individual has been exposed?

This is indeed the deliberate opinion to which four and a half Years' acquaintance with the subject has led me.

To be amongst consumptive patients and to have the direction of their movements in a great measure, is above all other symptoms to be constantly impressed with the importance of 'temperature' to them and its relation to their daily life.

Thus then the conclusion reached is that altered body-temperature in Pulmonary Consumption is due, not to new processes which originate, increased heat production which the organism is unable to control so as to maintain normal limits of animal heat, but rather to the response of the normal mechanism to extraordinary conditions. As to whether altered temperatures are under these circumstances due to variation in the production ~~or in the~~ or in the loss of heat - we cannot speak more definitely in this disease than it is possible to do in health but emaciation and other evidences of increased tissue waste are suggestive of increased heat production.

Treatment of Pyrexia.

There is little to be said as regards treatment of pyrexia in Consumption for unfortunately we are unable to influence its course very materially.

The general principles indicated are those which experience shews to be of most value viz: - to improve the standard of nutrition of the patient - by all available means, and to avoid as far as possible all conditions which lead to aggravation of the pyrexia.

Dr Saccoud speaks with strong conviction of the value of antipyretic remedies especially of Salicylic Acid and two cases, (Ford and Ward), are given in which its employment coincided with decline in the pyrexia - Two

other Cases in which it was employed (H White 30 grains daily, & Mrs Kelly 15 grains daily) did not exhibit any improvement during its use.

The applications of blisters, or other counter-irritants, over the seat of active disease modify the course of exacerbations depending on more acute processes not infrequently.

"Antiseptic inhalation" has not yet exhibited any definite value in the treatment of pyrexia.

Theoretically it is conceivable that the activity of the local processes might be modified by introducing into the lungs some chemical vapours which would interfere with the rate of growth & development of the organisms which influence

the activity of those processes. But anyone acquainted with the vigorous measures employed in endeavouring to render a superficial wound on the surface of the body aseptic and often unavailingly will not be disappointed by the failure of antiseptic inhalation alone to produce marked improvement in the consumptive patient.

M.B., C.M.

— April 28th 1885. —