supple end that will bend at once before the obstacle, he makes an instrument that bends slowly along a good part of its length, and so fails to accomplish the intention of the supple end, which is to change the direction of the point quickly, that it may slip by an obstruction and pass on. The "olive" or swell at the tip also is often made much too large; it should never approach the thickness of the stem, but be just sufficient to remove all sharpness from the point. The French tapering bougie can be made to preserve any desired curve against a moderate strain by running down the interior of the bougie a leaden wire, or by filling it with shot. In this way, they are almost as useful as English bougies in the cases where a fixed curve is desired.

When compared with each other, the following are the chief characteristics of rigid and flexible instruments. Rigid instruments are far more difficult to pass, more capable of injuring the patient, and, unless passed with proper skill, more painful to him. On the other hand, they are more durable, can be easily kept in good condition in hot climates, can be made more smooth and, being rigid, their points can be guided by the hand past pouches and other obstructions. Of flexible instruments, the great advantage is their suppleness. This enables them to accommodate themselves to the urethra without strain; but, as their points cannot be easily directed away from an obstruction or false passage, they often slip where a rigid sound readily gains the bladder.

RESEARCHES

ON THE

TEMPERATURE IN PHTHISIS AND SOME OTHER DISEASES:

WITH REMARKS ON THE GENERAL VALUE OF THERMOMETRIC OBSERVATIONS IN DISEASED CONDITIONS.

An Address delivered at the Opening of the Session of the Liverpool Medical Institution, October 1878.

By A. T. H. WATERS, M.D., F.R.C.P.,

Physician to, and Lecturer on Medicine at, the Liverpool Royal Infirmary; President of the Institution; etc.

OF the many symptoms of disease, there is no one more interesting or more worthy of attention than the temperature of the body. The wonderful power which the human economy possesses of maintaining in health an uniform, or almost uniform temperature under varying conditions of external heat, is a phenomenon interesting alike to the student of natural history, the chemist, the physiologist, and the physician; and it is nowise remarkable that the variations of temperature produced by abnormal conditions should have attracted the notice of early observers. As far back as 1638, Sanctorius applied the thermometer to the determination of temperature; and a century later Van Swieten, by improved instruments, made observations which proved that in fever the temperature was higher than in health. De Haen, a colleague of Van Swieten, made further observations, and became aware of the morning remissions and evening exacerbations which characterise fevers; of the rise of temperature in febrile rigors; and of the discrepancies between the pulse and the temperature. He used his knowledge of these changes as a guide to his therapeutics and regarded the return to a normal temperature as a proof of convalescence. No observations of any great value to practical medicine seem to have been made after De Haen's time, until Currie made his important researches; but, although Currie's work on this subject went through three editions, it influenced his contemporaries very slightly. From the time of Currie to the year 1840, but little may be said to have been done in medical thermometry.

At that time, there was commenced a series of painstaking investigations which have never been interrupted. It was not, however, till 1851 that Wunderlich began his researches, which resulted in the treatise so well known to the profession; and thus it appears that, with a few exceptions, to some of which I have referred, it was reserved for the practitioners of the latter half of the nineteenth century to bring to bear instruments of precision in the investigation of this particular phenomenon of disease, and to study it scientifically.

Those who, like myself, began the practice of the profession a quarter of a century ago, well know that at that period no regular temperature observations were made in our hospital wards, and the clinical thermometer was not the constant accompaniment of the practitioner in his rounds. It is, indeed, only within the last twelve or fifteen years that, in this country at least, the instrument has become of daily use, and that, from an accurate record of temperature observations in disease, attempts have been made to generalise on this symptom.

That in the early days of the introduction into practice of a novelty, its value should be either overestimated on the one hand, or somewhat doubted on the other, is only what might be expected. Possibly the use of the thermometer by the inexperienced may have been to some extent productive of error. The recognition of the fact that the temperature had risen a few degrees above the normal may have led to an exaggeration of the patient's danger, and the fear that some serious pyrexial condition was present; whilst, on the other hand, a fall of temperature below the normal may have given rise to the notion that collapse was threatened. The prolonged use of the thermometer has, however, enabled us to avoid errors of this kind—errors which, as they were on the side of caution, were of a very venial kind.

The facts to which I wish to call your attention are the outcome of a long series of careful observations, made either by myself, or under my supervision. They may, I believe, be implicitly relied on. I have thought, therefore, they might be worthy of being made the subject of a discourse which it is my duty, as your president, to address to you on this occasion.

The science of thermometry in disease, although at present but little developed, obviously rests on no uncertain basis. The practical value of thermometrical observations is capable of easy demonstration. The more we can introduce into our practice instruments of precision; the more we can bring into play, in the investigation of morbid phenomena, those senses on which we can most certainly rely;—the more easily will the mind be able to analyse the difficult problems which disease presents; the more shall we tend to raise medicine from the region of pure empiricism; the more easily shall we render the teaching of our art; and the more, therefore, shall we diffuse the knowledge of diagnosis, and of the practical application of therapeutics.

Although the normal temperature of the human body is placed at 98.4 to 98.6 deg. Fahr., this is liable to certain variations, which should be borne in mind in thermometric observations in disease. As regards adults, it is stated by Davy, Gierse, Fröhlich, and Lichtenfels, as the result of observations on themselves, that there is a daily range of about one degree. Sydney Ringer, as the average of a series of observations, makes the range about the same. My own observations on myself give 98.6 deg. as the highest reading, and 97 deg. as the lowest, thus giving a daily range of 1.6 deg.

In children, the daily range is greater; and it is a noticeable fact, that the range diminishes with increasing years; so that in the aged the range is very slight. There appears to be in all persons, of whatever age, a tendency to a fall of temperature in the evening; and in children this amounts to one, two, or three degrees, and begins usually from 5 to 7 P.M., and is rapid up to 9 or 10. The minimum is reached during the early hours of the morning, from 2 to 4 A.M.; and then a rise begins, which may reach its maximum at 9 or 10, but sometimes later. It is very important to bear in mind these alterations of temperature in the diagnosis and treatment of diseases of children; for, as there is a normal rise at certain periods of the day, a single examination at such times might possibly lead to error; and, again, inasmuch as there is a normal fall late in the evening, the recognition of a persistent high temperature at that time might aid us very much in the diagnosis of certain cases of tubercular and enteric fevers, often very difficult diseases to make out in children.

Another question with reference to normal temperature is, whether there is any difference in the temperature in different climates. Dr. John Davy, from observations made on himself, stated that in tropical climates the normal temperature of man was one degree higher than in temperate zones. This statement remained for a long time unchallenged; but of late it has been apparently confuted by the observations of two army surgeons, Drs. Johnston and Boileau. Without referring in detail to their observations, it may suffice to say they have found that the temperature of the human body does not rise under the influence of tropical heat. Dr. Johnston states that the mean of 320 readings was 97.74 deg. Fahr.; and it would thus appear that the normal temperature is rather lower in intertropical, than in temperate climates. At all events, we may, I think, safely conclude that it is not higher, and therefore we must be prepared to recognise a temperature of 99 to 100 deg. as abnormal in both climates.

The first disease to which I wish to call your attention in connection with this subject is phthisis. The development and progress of this affection are marked, as a rule, by elevations of temperature, sometimes of a very striking character. How far these are due to *tuberculosis* or *tuberculisatio*, to the phthisical diathesis, or to inflammatory or other changes incident thereto, or consequent thereon, I cannot at the present moment stop to consider. There are, I believe, no diseases, except *ague*, and *septicæmia*, including *pyæmia*, in which there are alterations of temperature so extreme, characterising the pyrexial and apyrexial

states, or the periods of exacerbation and remission, as in those which come under the designation of acute phthisis; and, as far as my own experience goes, it is in the pneumonic form of the disease that the most marked oscillations of temperature are observed.

Table No. I shows the temperature of a lady whom I attended. The case was one in which there was a rapid consolidation of the apices of both lungs, with all the characters of a scrofulous pneumonia, a rapid formation of cavities, and death. The temperature was taken morning and evening; the highest temperature recorded was taken at 9 P.M. of the 17th June, when it was found to be 106.6 deg. On the following morning, at 10 o'clock, it was 97 deg., giving a fall of 9.6 deg. The lowest temperature observed was 96 deg. on several mornings. This extreme oscillation—a very high evening temperature, and a low or subnormal morning temperature—is a marked characteristic of acute phthisis, especially of the pneumonic form. It is very rare, however, to find the oscillations as great as in the case now under consideration.

TABLE I.—*M. S., aged 30. Acute Pneumonic Phthisis.*

Date.	Morning.	Evening.
June 1	98.8	105.0
" 2	97.4	104.2
" 3	98.6	104.4
" 4	99.0	101.5
" 5	99.0	103.5
" 6	96.0	102.0
" 7	97.0	100.0
" 8	97.0	103.0
" 9	96.0	101.8
" 10	97.4	102.0
" 11	96.0	103.8
" 12	97.0	102.2
" 13	96.5	102.2
" 14	97.0	104.0
" 15	97.0	104.2
" 16	98.4	103.8
" 17	98.4	106.6
" 18	97.0	103.5
" 19	99.1	103.0
" 20	99.7	102.8
" 21	96.0	103.0

On looking at a table of this kind, it is easy to understand how grave must be the nature of this disease; how the existence of so high a temperature, even for a few hours daily, must tend to a destructive waste of tissue. It is only in consequence of the fact that the temperature is not continuous, that there are remissions—amounting, indeed, to intermissions (for the temperature frequently falls below the normal)—that we can account for the maintenance of life.

Now let me call your attention to another case very similar to the last, but not marked by symptoms so acute. The patient whose temperature is represented in Table No. II was a woman twenty-eight years of age, who was admitted into the Infirmary under my care on December 28th, 1877. At that time, there was crepitation over the upper part of the left lung, and a temperature, three days after admission, of 103.6 deg. In this patient, there was rapid consolidation, and development of cavities, in the upper part of both lungs. The woman died on February 4th. You will observe that the case was characterised by oscillations of temperature, which, although not as great as those of the preceding case, were nevertheless well marked. From the evening of the 16th of January, at 5 P.M. to 9 the following morning, there was a fall of five degrees and a half, from 105 to 99.5 deg., and again from 5 P.M. of the 24th to 9 A.M. of the 25th there was a fall of four degrees, from 105 to 101 deg.

TABLE II.—*S. C., aged 28. Acute Pneumonic Phthisis.*

Date.	9 A.M.	5 P.M.	9 P.M.
January 16	103.0	105.0	104.6
" 17	99.5	100.8	102.0
" 18	102.6	103.6	103.6
" 19	102.4	105.0	104.7
" 20	103.4	104.7	103.8
" 21	102.3	104.7	104.0
" 22	102.4	105.0	104.6
" 23	104.0	104.8	104.0
" 24	103.0	105.0	102.5
" 25	101.0	103.5	104.7
" 26	103.0	104.6	104.0
" 27	102.0	103.4	103.0
" 28	100.5	102.6	102.0
" 29	100.0	103.0	104.0

As a contrast to these two cases, let me call your attention to the Tables Nos. III and IV. These represent the temperature oscillations of two cases of acute miliary tuberculosis of the lungs, *acute tubercular phthisis*.

The first case (No. III) is that of a man who was admitted into the Infirmary, under my care, on the 6th of February 1878, and died on the 14th. He was at work as a fireman on board a steamer twelve days before admission. On the following day, he was seized with dyspnoea and faintness, and gave up work. On examination, I found the physical signs of cavities, which I diagnosed as old, under the right clavicle, with subcrepitant *râles* all over both lungs. There was a somewhat congested state of the face, and a general condition not unlike that met with in typhoid fever. The case was diagnosed as one of acute tuberculosis with old-standing lung-disease. This diagnosis was verified by the *post mortem* examination. Some old cavities were found in the right apex; and both lungs were studded throughout their entire extent with semitransparent tubercles, with the usual engorgement of the pulmonary tissue around them.

As you will see, the temperature in this instance was not very high. It reached 105.6 deg. at 5 o'clock one evening; but a temperature considerably above the normal was persistently maintained. On no occasion—and it was taken three times a day—did it approach the normal; the lowest temperature marked being 101.4 deg. The oscillations were far less marked than in the previous cases.

TABLE III.—*J. K., aged 28. Acute Tubercular Phthisis.*

Date.	9 A.M.	5 P.M.	9 P.M.
February 6	—	—	104.0
" 7	103.6	103.8	103.0
" 8	102.4	104.4	105.5
" 9	103.2	104.1	104.0
" 10	102.0	101.2	101.9
" 11	103.0	103.2	103.5
" 12	102.4	102.8	103.0
" 13	103.0	105.0	103.0
" 14	104.0	104.8	—

The second case (No. IV) was that of a man who was admitted into the Infirmary, under my care, on April 5th, 1873, and died on May 16th. At the necropsy, the lungs were found studded throughout with miliary tubercles, and some small cavities existed in the lower lobe of the right lung. The case was diagnosed as one of acute tubercular phthisis. Here, again, the temperature did not rise to an extreme height, nor were the daily oscillations very decided; the greatest fall from exacerbation to remission being 3.6 deg.

TABLE IV.—*W. H., aged 24. Acute Tubercular Phthisis.*

Date.	Morning.	Evening.
April 20	102.2	104.2
" 21	103.4	102.2
" 22	102.8	103.3
" 23	102.8	103.5
" 24	102.8	103.0
" 25	101.5	101.0
" 26	102.2	103.5
" 27	103.6	104.5
" 28	103.2	103.8
" 29	103.7	103.3
" 30	102.0	102.5
May 1	107.5	103.2
" 2	102.8	103.0
" 3	101.5	102.5
" 4	100.0	103.0
" 5	102.4	103.2
" 6	100.0	103.0
" 7	99.4	103.0
" 8	100.5	103.0
" 9	102.2	103.6
" 10	101.6	103.8
" 11	102.5	103.8
" 12	101.8	103.3

In the first two of these four cases of acute phthisis, there was a rapid destruction of tissue going on, extensive softening and excavation of deposits thrown out into the lungs, and extreme exacerbations, and remissions of temperature occurred. In the two latter, the destruction of tissue was little or none, but there was extensive deposit of tubercle—*tuberculation*; and this, although it raised the temperature considerably, and maintained it at a high level, was not attended by very great defervescence.

It is interesting to note these phenomena, but not easy to account for them. The cases of acute pneumonic phthisis, in their daily alternations of temperature, come to resemble very closely cases of septicæmia and pyæmia; but here, again, there is a difference. In pyæmia, the exacerbations and remissions may occur three or four times a day; whereas in acute phthisis there is, as a rule, a steady rise of temperature from the morning to the evening—the maximum being reached at five,

six, seven, or nine o'clock—and then there is a steady fall. Table No. v shows the oscillations of temperature in a well-marked case of pyæmia, in which, after death, numerous abscesses (pyæmic) were found in the liver. The rises of temperature in pyæmia are attended with rigors; and in this respect the disease resembles an intermittent fever. But in pyæmia, as is not the case in ague, there may be several rises and falls of temperature—exacerbations and remissions—in the course of the day. The Table represents the variations of temperature during four days. The patient, a woman, had suffered from abscess behind the ear, which had been opened. Hæmorrhage had occurred, for which the occipital artery was tied. She came under my care on the 22nd of March 1878. At 11.30 A.M. on that day, the temperature was 106 deg.; at 9 P.M., 101.4 deg. The following day, at 9 A.M., it was 101.8 deg.; and at 9 P.M., 98.2 deg. The next day the temperature was taken frequently, and you will observe that there were two distinct exacerbations followed by remissions, amounting, indeed, to a cessation of fever—intermission.

TABLE V.—*M. C. Pyæmia.*

March 22	..	..	..	11.30 A.M.	..	..	106.0
"	"	"	"	9 P.M.	..	..	101.4
"	23	..	..	9 A.M.	..	..	101.8
"	"	"	"	9 P.M.	..	..	98.2
"	24	..	..	9 A.M.	..	..	102.5
"	"	"	"	11.30 A.M.	..	..	104.2
"	"	"	"	4.30 P.M.	..	..	100.5
"	"	"	"	6 "	..	..	98.5
"	"	"	"	12 "	..	..	104.0
"	25	..	..	9 A.M.	..	..	99.5
"	"	"	"	5 P.M.	..	..	101.5
"	"	"	"	9 "	..	..	101.5
"	26	..	..	9 A.M.	..	..	100.0
"	"	"	"	12 noon	..	..	101.0
"	"	"	"	3 P.M.	..	..	102.5
"	"	"	"	6 "	..	..	103.0
"	"	"	"	9 "	..	..	101.5
"	27	..	..	9 A.M.	..	..	101.0

Table No. VI shows the temperature of a case of septicæmia after excision of the breast. The patient was under the care of Mr. Bickersteth, and was operated on by him on November 13th. I am indebted to the resident medical officer of the Infirmary, Mr. Damer Harrison, my present house-physician, but at that time Mr. Bickersteth's house-surgeon, for this chart. On November 19th, six days after the operation, the temperature rose to 105 deg. During the following day, nineteen observations were made. There were two rigors and two distinct exacerbations of temperature, followed by remissions. You will observe that there is rise of temperature reported of 4.4 deg. in ten minutes—viz., from 102.6 deg. to 107 deg. I am told that this great rise was carefully noted at the time, and that such rises are occasionally met with in septicæmia. The patient died on November 22nd. No deposits of pus were found.

TABLE VI.—*M. W., aged 48. Septicæmia after Excision of the Breast.*

November 13	..	..	Evening	99.8
"	14	..	Morning	99.5
"	"	..	Evening	100.0
"	15	..	Morning	99.4
"	"	..	Evening	99.7
"	16	..	Morning	99.8
"	"	..	Evening	100.9
"	17	..	Morning	101.6
"	"	..	Evening	101.0
"	18	..	Morning	100.5
"	"	..	Evening	101.5
"	19	..	Morning	102.8
"	"	..	Evening	105.0
"	20	..	8 A.M.	103.6
"	"	..	11 "	104.0
"	"	..	12.15 P.M.	105.0
"	"	..	(12.30 P.M., rigor)	
"	"	..	1 "	106.2
"	"	..	1.30 "	105.7
"	"	..	1.45 "	104.5
"	"	..	2 "	104.0
"	"	..	2.45 "	103.0
"	"	..	3 "	102.8
"	"	..	4 "	102.6
"	"	..	4.30 " (rigor)	102.6
"	"	..	4.40 "	107.0
"	"	..	5.15 "	105.2
"	"	..	5.30 "	104.5
"	"	..	6 "	104.0
"	"	..	6.30 "	103.5
"	"	..	7 "	103.4
"	"	..	7.30 "	102.5
"	"	..	8.50 "	100.5
"	21	..	Morning	100.4
"	"	..	Evening	105.0
"	22	..	Morning	103.0

Table No. VII shows the temperature-oscillations in a case of septicæmia connected with phlebitis. The patient was a woman who was admitted under my care into the Infirmary, and was discharged, well, after several weeks' residence in the institution. Her symptoms, except as regards the rises of temperature, were not acute. Her pulse, except at first, was not very quick, and the elevations of temperature were not attended with marked rigors.

TABLE VII.—*M. J. Phlebitis: Septicæmia.*

November 21	..	..	5 P.M.	103.0
"	"	..	9 "	101.0
"	22	..	9 A.M.	97.2
"	"	..	1 P.M.	98.7
"	"	..	1.40 P.M.	101.2
"	"	..	3 "	102.2
"	"	..	5 "	101.0
"	"	..	9 "	102.0
"	23	..	9 A.M.	99.2
"	"	..	9 P.M.	103.0
"	"	..	9 P.M.	100.0
"	24	..	9 A.M.	101.2
"	"	..	5 P.M.	102.2
"	"	..	9 "	102.8
"	25	..	9 A.M.	102.0
"	"	..	5 P.M.	104.8
"	"	..	9 "	102.8
"	26	..	9 A.M.	101.0
"	"	..	5 P.M.	103.0
"	"	..	9 "	101.8
"	27	..	9 A.M.	100.9
"	"	..	5 P.M.	102.8
"	"	..	9 "	101.8
"	28	..	9 A.M.	101.0
"	"	..	5 P.M.	100.5
"	"	..	9 "	100.8
"	29	..	9 A.M.	100.5
"	"	..	5 P.M.	101.5
"	"	..	9 "	102.8
"	30	..	9 A.M.	101.9
"	"	..	5 P.M.	103.0
"	"	..	9 "	101.2
December 1	..	..	9 A.M.	100.9
"	"	..	5 P.M.	103.0
"	"	..	9 "	100.4
"	2	..	9 A.M.	100.9
"	"	..	5 P.M.	103.8
"	"	..	9 "	101.5
"	3	..	9 A.M.	101.0
"	"	..	5 P.M.	103.9
"	"	..	9 "	100.8
"	4	..	9 A.M.	104.2
"	"	..	5 P.M.	103.7
"	"	..	9 "	100.6
"	5	..	9 A.M.	104.0
"	"	..	5 P.M.	103.7
"	"	..	9 "	99.9
"	6	..	9 A.M.	102.8
"	"	..	3 P.M.	104.6
"	"	..	5 "	103.0
"	"	..	9 "	99.5
"	7	..	9 A.M.	101.2
"	"	..	5 P.M.	103.5
"	"	..	9 "	98.6
"	8	..	9 A.M.	99.5
"	"	..	5 P.M.	98.5
"	"	..	9 "	99.0
"	"	..	5 P.M.	98.0
"	9	..	9 "	101.3
"	10	..	9 A.M.	98.6
"	"	..	5 P.M.	99.0
"	"	..	9 "	97.0
"	11	..	7.30 A.M.	104.6
"	"	..	8 "	101.1
"	"	..	9 "	98.6
"	"	..	5 P.M.	98.0
"	"	..	9 "	

It is not my intention to enter into any speculative considerations. I wish rather to confine myself to facts. But, in comparing the extreme exacerbations and remissions met with in septicæmia, and some cases of acute phthisis, it is impossible not to ask oneself the question how far these pyrexial phenomena in the latter disease may be due to some condition analogous to that which obtains in the former—how far, indeed, they may be the result of some poison introduced into the blood from the diseased, and often suppurating pulmonary organs.

[To be continued.]

MR. HENRY LAWRENCE, the recently elected Public Vaccinator for Bristol, has been appointed by the Local Government Board to the office of Teacher of Examiners in Vaccination for that city, vacated by the retirement of Dr. H. A. P. Robertson, under circumstances of distressing bodily illness.