GENERAL CONSIDERATIONS

It is not clear how liver therapy influences the asthmatic state. The fall of the red cell count observed in cases which responded favourably to liver therapy might suggest that the effect was due to lowering the number of red cells, thereby diminishing pulmonary congestion from the polycythaemia. Stephan¹² has noted a decrease of erythrocytes in a series of five cases of symptomatic polycythaemia in non-asthmatic subjects by the administration of liver substance. But it has already been mentioned that the reduction of polycythaemia noted in the present series of cases has been interpreted as a sign that the patient had improved, and not as a direct effect of liver therapy. Such variations and falls in the red cell count have been observed in seasonal cases of asthma quite independently of liver treatment, and also in a few cases which have improved with some other form of treatment. For instance, a marked fall in the red cell count occurred in one case of asthma after the treatment of an antrum infection. It is also unlikely that liver treatment may act by lowering the blood pressure, as the great majority of the cases responding to liver therapy had a normal or low normal blood pressure. Similarly, other effects of liver substance, such as diuresis and lowering of the blood sugar, do not offer any satisfactory explanation as to how they may influence asthma. Liver therapy may provide a substance which plays a part in the antigen-antibody reaction in man, and which is lacking in patients suffering from asthma. On the other hand, the beneficial effect may be due to a process of desensitization in virtue of the rapidly assimilable amino-acids present in the liver extract.

Skin sensitivity to an intradermal injection of a 1 in 1,000 solution of liver extract has been tested on ten normal control cases, on six cases of asthma with positive skin tests, and on four cases of asthma with negative skin reactions. A reaction, consisting of a wheal and erythema, occurred in all three groups of cases, but was most marked in the cases of the second group.

The same series of cases has been tested also against an intradermal injection of hepatex P.A.F. In the normal control cases blanching of the skin was observed, but no wheal formation occurred. In the asthmatic groups, however, and especially in cases with positive skin tests, a definite wheal with surrounding erythema appeared five to fifteen minutes after the injection, and lasted about an hour. In a case of asthma with positive dermal reactions to a pollen extract and to hepatex P.A.F., 0.1 c.cm. of the latter was repeatedly injected intradermally at two-hourly intervals into the same area of skin. It was found that after the fourth injection the skin had become desensitized and ceased to give a reaction. These observations suggest that the liver fraction active in pernicious anaemia may have antigenic properties.

SUMMARY

1. Polycythaemia frequently occurs in true spasmodic asthma, especially in the allergic type.

2. It is often found after a severe attack, or a series of attacks, and may last for varying periods. Usually after a free interval of a month the count tends to fall to a normal level again.

3. Seasonal variations in the red cell count have also been noted to occur, the count being highest in the summer in the pollen-sensitive cases and in the winter in the infective type of asthma.

4. A fall in the red cell count has been found to correspond with the lessening in the frequency and severity of the attacks, and may therefore be considered as an indication of therapeutic improvement.

5. Liver therapy has been tested in fifty-three cases of asthma, and has proved beneficial in 60.3 per cent. of

the cases. It has been found to be most effective in the allergic type of asthma and in those cases showing an initial high red cell count.

6. In the course of liver therapy a fall in the red cell count has been noted to occur in those cases which have improved on the treatment.

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THE MEAN TEMPERATURE IN NON-FEBRILE HOSPITAL PATIENTS

BY

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Although changes in body temperature in disease have been recognized for many centuries, it was not until the nineteenth century that the clinical thermometer came to be generally used in medical practice. The convenient modern instrument was first introduced to medicine by Sir Clifford Allbutt in 1867. Before this date the clinical thermometer was an unwieldy object, and was not adapted for ordinary practice. Since we are not concerned here with the temperature in febrile diseases, it may be of interest to refer to a few of the observations on body temperature in healthy individuals which were made by some of the pioneers in medical thermometry. The whole subject of medical thermometry was very ably expounded by Wunderlich in his classic treatise published in 1868. Prior to this, in 1845, John Davy¹ made a large number of observations on himself over a period of eight months, and found his mean temperature to be 98.4° F. taken in the mouth. Bärensprung² gives the figure 98.93° F. as the mean axillary temperature in healthy active individuals between the ages of 21 and 70. This reading has since been considered to be too high, and the error is thought to have been due to the employment of a defective thermometer. Other authorities have obtained varying results for the mean axillary temperature. Ringer and Stuart found 99.1°, Liebermeister 98.4°, Billet 98.06°, and Billroth 98.8°. More recently M. H. Whiting³ carried out investigations on the mean temperature in a large prison population. She found the mean temperature to be 98.37° for the whole population and 98.38° in those who were apparently in perfect health. It must be clearly understood that all these figures quoted represent the mean temperature in healthy *active* persons, and not in individuals confined to bed.

As a result, probably, of Davy's experiments the figure 98.4° has come to be regarded in English-speaking countries as the "normal" temperature in man. This fact is evidenced by the way in which clinical thermometers and temperature charts are marked, for it is common knowledge that these have engraved upon them a

heavy line corresponding with the figure 98.4°F . A reference to the illustrations of temperature charts in various authoritative textbooks⁴ goes further to show that 98.4° is now the accepted "normal" temperature in man. On the Continent, temperature charts are marked with a heavy line opposite the figure 37°C . (98.6°F .), as may be seen from the illustrations of charts in French and German medical literature.

DIURNAL TEMPERATURE VARIATIONS

It is an accepted fact that the body temperature in man shows considerable variation during the twenty-four hours. Sahli⁵ showed that the minimum temperature occurs in the first few hours after midnight; a first maximum is reached during the forenoon and a second maximum between 5 and 8 p.m. Liebermeister⁶ found that the daily variation amounted to 1.8°F . comparing the absolute maximum and minimum, and 0.9°F . when comparing the morning and evening temperatures. Again, it must be emphasized that these figures apply only to individuals in active life. Further, it should be remembered that the accepted "normal" standard of 98.4° is the mean or average temperature of a healthy active person, and not the maximum reading above which the presence of fever may be assumed. This point is emphasized, since it is apparent that 98.4° is now regarded in clinical work not as the mean body temperature in man, but rather as the upper limit of normality, and the reason for this misconception would appear to be the purely arbitrary markings on thermometers and charts. If the readings rise above the heavily engraved line on the temperature chart the patient is considered to be febrile, if below the line the temperature is usually stated to be subnormal, although little importance is attached to low readings unless they are extreme. Temperature charts may be misleading in another direction, since they fail to allow for the fact that the patient is usually confined to bed when frequent temperature records are being made. The "normal" reading of 98.4°F . is the mean temperature in active life, and cannot be regarded as an accurate standard in patients confined to bed for long periods.

RATIONALE OF INVESTIGATION

The reason for this communication is the frequent observation that non-febrile patients and patients convalescing after a febrile illness show consistently low temperature readings when lying in bed, as may be seen from the records on the charts. In fact, it is the exception in such individuals for the temperature ever to reach the "normal" line, even over comparatively long periods. An endeavour has been made, therefore, to determine the average or mean temperature, when lying in bed, of a number of patients who were admitted to hospital suffering from non-febrile complaints. Many of these were suffering from some gastric disorder and were admitted to hospital for investigation; others suffered from debility, neurasthenia, hypertension, etc. All were apparently afebrile on admission. Although these patients were not "normal" within the strict meaning of the word, in that they were all suffering from some disability, the troubles which beset them are generally regarded as being unassociated with an alteration in body temperature. Similar observations regarding body temperature in healthy persons would be very instructive, but it is felt that it would be extremely difficult to persuade a number of individuals in perfect health to remain in bed over a long period for the purpose of having their morning and evening temperatures recorded. The thermometer readings which are analysed in this paper were recorded in the usual routine method adopted in a large hospital.

The temperatures were taken at 7 a.m. and 7 p.m. in the closed axilla with a half-minute instrument, left *in situ* for three minutes. A total of 250 patients was investigated in this way, and morning and evening temperature readings were taken in each case over a period of fourteen days. The results are depicted in the graph, which shows the frequency distribution of the morning and evening temperatures respectively.

Graph showing frequency distribution of morning and evening axillary temperatures.

Mean temperature at 7 a.m., 97.2°F , ± 0.004 .
Mean temperature at 7 p.m., 97.45°F , ± 0.006 .

RESULTS AND DISCUSSION

It will be seen from the graph that the mean morning and evening temperatures in this series of cases are 97.2°F . and 97.45°F . respectively. The average of the two readings is 97.32°F ., which is slightly more than 1° below the "normal" temperature-reading.

It has been shown by Davy and many other observers that exercise will raise, and rest lower, the level of the body temperature, so that low readings were to be expected in these observations carried out on patients lying in bed. In this series the mean temperature taken at 7 p.m. is at a slightly higher level than the 7 a.m. temperature. This is in accordance with the results obtained in healthy individuals by most observers—for example, William Ogle⁷ in 1866 found that the maximum temperature occurred between 6.30 and 7.30 p.m. and the minimum between 6 and 6.30 a.m. On the other hand, Thierfelder⁸ found the morning temperature to be slightly higher than the evening temperature in a number of healthy adults, and Davy¹ has shown that his own temperature at 7 a.m. was 98.5° and at 7.30 p.m. 97.7°F . These figures quoted apply, of course, to healthy active individuals, and cannot therefore be compared with observations made on patients confined to bed for many days. In view of the well-known clinical fact that the evening temperature in many febrile diseases tends to be at a higher level than the morning temperature, it is interesting to note that some observers have found the reverse to be true in healthy active life.

In connexion with the results obtained in this investigation the interesting question arises as to whether the figure 98.4°F . can be regarded as the upper limit of normality in an individual confined to bed for several weeks. It is a not infrequent experience to find, in the case of a patient lying in bed, that the temperature record will fluctuate between 97° and 98° for a period of many days, and will

then rise suddenly to the "normal" reading of 98.4°, eventually falling again to the region of 97°. Since the temperature in such a case has not risen above the black line on the chart, little or no attention is paid to this variation, yet if the reading had overtopped the line by 0.2° or 0.4° the patient would be stated to have a "slight temperature," and a diligent search would be made for the cause. It would seem that there is a tendency, when dealing with individuals who are confined to bed, to forget that the temperature figure 98.4° F. is the "normal" for a healthy, active individual, and not for a patient who remains in the recumbent posture for a long period. If a patient calls at his doctor's house in the middle of the day and the temperature is found to be 99°, that patient is considered to be slightly febrile. It does not seem unreasonable to assume, therefore, that if the temperature of a recumbent individual suddenly rises from 97° to 98.4° that individual is also slightly febrile, despite the fact that the temperature has not risen above the conventional limit. Since the figure 98.4° represents the mean temperature of a person in active health, it need not also represent the mean temperature of a patient lying in bed. Further, if this figure be regarded, for the sake of convenience, as the upper limit of normality in active life, it does not follow that we are justified in regarding it thus in individuals who are confined to bed. It is possible, therefore, that there is some danger in the emphasis laid on the temperature reading of 98.4° by marking this figure with a heavy line on clinical charts, since, by so doing, no allowance is made for individual variation nor for the fact that the patient is physically inactive.

SUMMARY

The mean body temperature in a series of 250 non-febrile hospital patients who were confined to bed was found to be 97.2° F. at 7 a.m. and 97.45° F. at 7 p.m.

It is suggested that the heavy line marked on clinical thermometers and temperature charts corresponding with the figure 98.4° F. is misleading, since this figure represents the mean temperature in active life and not the upper limit of normality in a patient lying in bed.

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A CASE OF CARCINOMATOUS GASTRO-COLIC FISTULA SIMULATING ENTERIC FEVER

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During the first two or three weeks after this patient came under observation the clinical picture was very suggestive of enteric fever. The insidious onset, the gradual rise of temperature with, at first, a relatively slow pulse, the foul tongue, the diarrhoea, and the tympanitis all pointed in this direction. The persistently negative bacteriological and serological findings, however, made the provisional diagnosis of enteric seem increasingly improbable. The finding of pus cells and of undigested red blood corpuscles in the stools on December 18th suggested the possibility of an acute ulcerative colitis, it being assumed that the ulcerative process involved the upper half of the colon,

and thus accounted for the absence of tenesmus and explained the constant tenderness below the right costal margin. The possibility of diverticulitis or of carcinoma of the colon was also discussed, but it was felt difficult to explain the long-continued pyrexia on this basis without there being any palpable tumour, or any evidence of subphrenic abscess, and whilst there was a normal blood count.

The possibility of a gastro-colic fistula was also discussed, but it was thought that the absence of any vomiting, and still more of any faeculent vomiting or belching, almost put this diagnosis out of court. However, there was no evidence of any perigastric or subphrenic abscess to explain the pyrexia.

In spite of the valued assistance of three consulting physicians and of three pathologists, the diagnosis remained a matter of speculation prior to the necropsy.

CLINICAL HISTORY OF CASE

The patient, a professional man aged 52, was seen by me on the morning of December 7th, 1931. He had always been delicate, inclined to be neurasthenic, and subject to frequent intestinal disturbances, comprising alternate states of diarrhoea and constipation, for which he had tried numerous remedies. His health had much improved during the last ten years since taking liquid paraffin.

The history of the present illness began apparently three weeks before he took to his bed on December 7th, with slight "colly-wobbles," followed by loose motions, usually twice daily. During the last twelve days he had felt sufficiently depressed and ill to remain in bed for half the day. He had no headache, nor did he feel feverish until the evening of December 6th, when his temperature, taken by a medical relative, was found to be 99° F.

When first seen by me on the morning of December 7th the temperature was 98°, the pulse 80. Examination showed him to be a man of spare build. He lay quite comfortably in bed. The expression was composed, and mentally he was quite alert. The breath was foul, and the tongue thickly coated with white fur. Abdomen: slightly tumid, but moved well on respiration. Tenderness was present below right costal margin, and to a lesser extent above the pubes. Liver and spleen were not palpable. No masses were felt. There were no spots. Nothing abnormal was found in the chest and central nervous system. The pulse was soft, and easily compressible. Blood pressure, 100/70. Rectal examination revealed some ballooning of the rectum, otherwise there was nothing abnormal. Routine urine tests were negative. At 6 p.m. the temperature was 101°, pulse 100.

During the next few days the temperature gradually rose to 104°, the chart exhibiting the "step-ladder" effect described as typical of enteric fever. The general condition became weaker, his frame more shrunken, and abdomen more distended. He complained much of nausea during the first few days, but there was no vomiting. Two or three "pea-soup" stools were passed painlessly each day. A pathologist's report, dated December 13th, was as follows: "Agglutination reactions against the enteric, dysentery, Salmonella, and Brucella groups negative in all dilutions. Blood cultures proved sterile. A differential blood count was normal."

PROGRESS

On the 14th the patient twice passed considerable quantities of blood and clots per anum. Two stools passed on the 15th resembled dark pea-soup, and contained curds. There was no recent blood. The motions remained limited to two or three per day, and on no occasion were they associated with tenesmus. The agglutinations and blood cultures were again tried on the 18th, with negative results. No pus or organisms were found in the urine. The faeces contained large numbers of pus cells and some normal-looking red blood cells. Cultures from stools were negative for enteric and dysenteric organisms.

During the morning of the 18th the abdomen became greatly distended and rigid, and the respirations were noticed to be entirely thoracic. The patient was rather collapsed, and complained of general abdominal pain. Pulse 130 to 140. A surgeon was called in consultation, but during the afternoon the abdominal distension largely subsided and abdominal respiration