I must express my great indebtedness to Dr. Guest, who first demonstrated the organism in the sputum. I must also thank Dr. P. W. Hamond, who took the x-ray photographs.

CASE II.

A hawker-green grocer, aged 65, stated that he had enjoyed good health up to March, 1927, except for occasional bronchitis in the winter; in March, however, he had a severe attack of bronchitis. He returned to his work in May, but his cough persisted, and in August he began to expectorate blood-stained sputum. He had never had severe haemoptysis, but up to the time when I first saw him (September 29th, 1927) he had brought up a little blood nearly every day. He complained of great weakness and said he had lost weight. His doctor had had his sputum tested for tubercle bacilli on several occasions, but with negative result. While sitting in the consulting room he coughed up about a drachm of dark, almost "prune-juice" coloured, blood. I thought of neoplasm as a likely diagnosis, but an examination of his chest showed nothing but a slightly impaired note at the left base and a few scattered rhonchi. A radiogram did not help much, the condition being suggestive of an indefinite diffuse fibrosis.

On October 6th Dr. Southgate reported long granular Gram-positive organisms in the sputum suggesting a streptothrix; some of the filaments showed true branching and many pus cells were present. A second specimen showed a streptothrix predominating, and Dr. Southgate expressed himself as having no doubt as to this being the causative organism.

The patient was admitted to hospital and 20 c.cm. of lipiodol (Lafay) was administered intratracheally by the crico-thyroid route, the patient being turned over on his left side. The radiogram showed diffuse bronchiectatic dilatations over the left lower lobe, but no actual cavitation was apparent. I am of opinion that the procedure was of some therapeutic value in this case, as the lipiodol was carried widely through the bronchial tubes of the left lung. This patient, being afebrile, and able to get about, was only kept an in-patient for a few days, treatment being continued in the out-patient department; this was essentially the same as in the previous case—namely, lipiodol intramuscularly and tincture of iodine 5 minims in milk thrice daily (French Codex).

In January the patient reported that he was feeling well, had very little cough, had brought up no further blood, and was putting on weight. A specimen of sputum contained no streptothrices. At the present time he is at work and in good health.

I am greatly indebted to Dr. Southgate, pathologist to Croydon General Hospital, for giving me the diagnosis. I must also thank Dr. Herniman-Johnson for his co-operation in the radiological department; and Dr. Easton of Thornton Heath, who sent me this case in the first instance.

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THE TEMPERATURE IN PULMONARY TUBERCULOSIS.

BY

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ALTHOUGH the importance of a rise or fall in the body heat as evidence of disease was recognized by Hippocrates its true significance has, curiously enough, rather fallen into the background, and that in an age in which accurate thermometry has become possible (Wunderlich, 1851). Now we require that if the temperature is to serve as a reliable criterion, it must be determined with exactness; various extraneous influences which may modify the correctness of measuring it have to be eliminated.

In view of the long-lasting discussion as to the best way of taking the temperature I investigated the different methods in several series of patients. By taking the oral and rectal temperatures simultaneously, twice daily for three weeks in one series, I found the tracings on the charts to be almost parallel, the rectal being the higher by about half a degree. The rectal temperature is probably the most accurate, its determination being unaffected by external influences; it is therefore recommended by many, but more time is required for taking it, and the procedure is not pleasant either for the patient or for the nurse. I found similarly that the oral and axillary temperatures were almost parallel, with an interval between them of about 0.4 of a degree. The axilla must be thoroughly dried for the reading to be accurate, and great care is necessary in the case of patients with a tendency to perspire, as is common in tuberculosis. Taking the temperature of a stream of urine I found most unreliable in practice; the temperature was at least a degree above that of the oral method.

The oral method of determining the temperature seems to me to be the most suitable, but the patient must remain indoors for fifteen minutes before it is taken, and keep his mouth closed, otherwise it is cooled by the surrounding air. The thermometer should be left for at least five minutes in the mouth, since even though it is marked as a half-minute or minute thermometer registration is frequently not complete in this time. If the temperature is about normal it is often three minutes before the mercury begins to move at all, though in the case of a temperature of 100° F., or more, this will be recorded within a minute usually. Each patient should have his own thermometer so that these precautions can be observed and the nurses be enabled to read off the results in rapid succession. When there are only two or three thermometers in a ward with eighteen or twenty patients temperatures near the normal are hardly ever recorded accurately, although marked rises are sufficiently well indicated to be registered sufficiently correctly. An additional reason for having separate thermometers is to prevent one patient from being infected by another, the thermometers being often hastily and imperfectly sterilized in carbolic lotion. There is also more chance of teaching patients to take their own temperatures, so that on returning home they may use the thermometer when they feel out of sorts and be guided as to the need for rest.

All the temperatures mentioned subsequently in this article were taken by the mouth.

What Constitutes a "Temperature."

After looking through the case-sheets of the first 450 male cases admitted to Creighton Sanatorium (1910-16), where there was a complete after-history and a period of residence in the sanatorium of at least six weeks, I have formed the following conclusions concerning male patients in particular.

Some may have a temperature of 98.4° F. or less in the evening, with very little "swing" between the morning and evening figures for long periods, during which the disease in the lungs steadily progresses. The evening temperature may continue steadily 99.4° F. in a patient with tubercle bacilli in the sputum, and yet he may be alive and well ten years later. A temperature above 99° F. persistently, especially if accompanied by a pulse rate of 90 or over, is very unfavourable. This is often noted when the larynx is affected. Many cases with an evening temperature of 98.8° or 99° F. do well. Some regard a sub-normal morning temperature, below 97° F., as of unfavourable import, but the after-histories of patients with temperatures of 96.8° and even 96.6° F. do not bear this out; many are still alive after ten years.

It is probable that each individual has his or her particular type of temperature. If this could be obtained while health was good and kept as a permanent record the diagnosis, treatment, and prognosis of pulmonary tuberculosis would be made easier. Even with our present limited knowledge the behaviour of the temperature is a guide to prognosis. In 450 cases with tubercle bacilli in the sputum, the duration of sanatorium treatment being six weeks or more, and a definite after-history being obtainable, the results in cases of fever (over 99° F.) were noted and tabulated (see Table I).

TABLE I.—Positive Sputum Cases.
Prognosis of 450 cases from the type of fever.

Type of Case.	Total.	Died in Two Years.	Died in Three to Five Years.	Lived Six or More Years.
Cases with normal temperature	230	82 = 35.5%	34 = 13.1%	144 = 55.4%
Cases with one relapse	35	12 = 34.3%	4 = 11.4%	19 = 54.3%
Cases with fever on admission, later normal	50	26 = 52.0%	7 = 14.0%	17 = 34.0%
Cases with two relapses	25	15 = 60.0%	2 = 8.0%	8 = 32.0%
Cases with continued fever	60	50 = 83.3%	5 = 8.3%	5 = 8.3%
Cases with three or more relapses	20	17 = 85.0%	2 = 10.0%	1 = 5.0%

It will be noted that cases with only one relapse had as good a prognosis as those always normal (34.3 per cent. of patients died in two years, as compared with 31.5 per

cent.). Cases in which the temperature was raised for several days after admission were more serious (52 per cent. of these patients died in two years), and still more so for cases with two relapses (in 60 per cent. death occurred in two years). Cases in which the temperature is continuously above normal, or in which there are many relapses, but with intervals of normal temperature, are about equally serious (83 per cent. of these patients died in two years, as compared with 85 per cent.). These figures corroborate the conclusions of H. Brenton Porteous,¹ based, however, on the results of treatment on discharge from the sanatorium. Gillespie² has also given figures showing how much worse the prognosis is in febrile cases before admission to a sanatorium or treatment of any kind.

Ringer³ says that in phthisis "there is probably a daily unnatural elevation of temperature in all cases whilst a deposition of tubercle is taking place, and where the deposition of tubercle has ceased the temperature is normal"; and "where there is no elevation of the temperature we may conclude that the progress of the disease is almost insignificant, although the patient is exposed to the lurking danger that from some slight cause this comparatively harmless condition may be aggravated into a severe and dangerous attack."

This explains why the temperature rises in some cases of phthisis and in others it is normal, even though tubercle bacilli are present in both cases. But Ringer must have noticed some exceptions, because later he says: "A natural temperature must not lead us to conclude that the disease is not slowly progressing since the amount of tuberculization may be too slight to raise the temperature." It will be noted that in Table I 31.5 per cent. of the patients had died within two years, but, even so, the prognosis is reasonably good. On the other hand, no patient, however seemingly hopeless, should be given a hopeless prognosis, since 8 per cent. live five or more years.

In the female the rectal, oral, and axillary temperatures also run practically parallel, but the temperature readings differ from those of the male in three important ways. (1) Whereas the difference between the morning and evening temperatures in the male is nearly always 1° F. or more, in the female the difference is usually less than 1° F. (2) The normal temperature in the male is almost always level, but in the female the menstrual cycle is apt to cause a prolonged rise of temperature. (3) Even the normal temperature of a female is often much more irregular than that of a male.

1. Table II shows that in 90.1 per cent. of males the

TABLE II.—Analysis of 1,816 Consecutive Cases to show the Difference between Morning and Evening Temperatures.

	Difference of 1° F. or more.	Difference of less than 1° F.
Males (1,237 cases)	1114 = 90.1%	123 = 9.9%
Females (579 cases)	251 = 43.3%	328 = 56.7%
Female cases in more detail.		
Positive sputum (366 cases)	176 = 48.0%	190 = 52.0%
Negative sputum (213 cases)	75 = 35.3%	138 = 64.7%
Female cases with positive sputum.		
Temperature raised	128 = 72.7%	16 = 8.4%
Temperature normal	48 = 27.3%	174 = 91.6%
Female cases with negative sputum.		
Temperature raised	66 = 30.0%	9 = 8.0%
Temperature normal	34 = 34.0%	104 = 92.0%

Out of 360 patients with a normal temperature 278, or 77.2 per cent., had a swing of less than 1° F. Out of 219 patients with fever 194, or 88.6 per cent., had a swing of 1° F. or more.

difference between the morning and evening temperatures is 1° F. or more. But in 56.7 per cent. of the females the difference is less than 1° F. In negative sputum cases this is so in 64.7 per cent., as compared with only 52 per cent. in positive sputum cases. Where there is fever one would expect a bigger swing, and 88.6 per cent. of such cases have a difference of 1° F. or more. But when the temperature was normal 77.2 per cent. varied less than 1° F.; the difference is often only 0.2° to 0.4° F. This kind of temperature is probably common with healthy women.

2. In the literature on tuberculosis, midwifery, and the diseases of women there is very little mention of any variation of the temperature of normal women taken daily for the whole of a menstrual cycle. But Reim (1884) and Giles (1896)⁴ both found that "the temperature is at its lowest point about the middle of the menstrual period, rising then gradually to its maximum a day or two before the beginning of the menstrual bleeding, after which it drops suddenly." Other authorities maintain that the temperature remains unchanged or is altered only occasionally. Johnstone⁵ says: "There is some reason to believe that the general metabolism of women follows a definite monthly curve, the acme of which is just before menstruation." This could easily affect the temperature.

According to the records at Creton Sanatorium, in a considerable number of females diagnosed as tuberculous there is a definite premenstrual rise of temperature of considerable duration, the temperature being otherwise normal; after a menstrual period the temperature remains

fairly steady at about 97.4° F. in the morning and 98.4° F. in the evening, until seven or eight days before the next menstrual period, when it gradually rises to perhaps

98.4° F. (morning) and 99.2° F. (evening). It continues thus until the first or second day of the menstrual flow, when it falls quickly or gradually to the previous steady level. In a well-marked case the appearance on the chart is like a "valley" and a "plateau" (Chart 1). There is often 1° F. of difference between these levels. In others careful observation is needed to note the change, for the "plateau" is only 0.2° or 0.4° F. above the "valley."

This long premenstrual rise is present in only 34 per cent.

TABLE III.—Classification of 276 Female Cases, who were 15 to 40 Years of Age and had been under Sanatorium Treatment for at least Six Weeks, to show the frequency of the Long Premenstrual Rise of Temperature.

	Long Premenstrual Rise.	Level or Irregular.
Cases with positive sputum.		
Temperature normal	45	55
Temperature raised	6	44
	} = 34 per cent.	
Cases with negative sputum.		
Temperature normal	62	41
Temperature raised	4	19
	} = 52 per cent.	

of positive cases, but in 52 per cent. of negative cases (Table III). It is not often found when the temperature

CHART 2.

is always elevated. From these two data it may be supposed that a long premenstrual rise is probably frequent among healthy females. It was present in one (Chart 2) of

two nurses whom I induced to take their temperatures for a month. It would be interesting to get corroboration of this view. In a considerable number of females the tem-

CHART 3.

perature shows no alteration at all. Of course, in addition, there are the definite manifestations of tuberculosis given in the textbooks. There may be a definite febrile relapse before the menses (Chart 3), or the relapse may take

CHART 4.

the form of a menstrual or post-menstrual rise of temperature (Chart 4). One girl with a positive sputum had three rises of temperature at intervals of three weeks, but then her menstrual period and her temperature remained normal (Chart 5). Most of the relapses in females occur

about the time of the menstrual flow, and therefore at this time special care should be taken. Between the menses a temperature of 98.8° to 99° F. is probably febrile,

CHART 5.

whereas just before menstruation up to 99.4° F. may be considered normal. If a female patient is admitted to the sanatorium with a temperature of about 100° F. and a few days later the monthly period commences, the outlook for this patient is not as serious as if this temperature occurred midway between periods.*

3. In very few men is there any marked irregularity in the course of a normal temperature, but in women there are quite frequently fluctuations and irregularities. These women are usually of the nervous fidgety type. In febrile cases also there are often great variations in the course of the temperature.

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* A menstrual cycle of about three weeks seems to be fairly common for females in a sanatorium.

CUTANEOUS ALLERGY FOLLOWING DIPHTHERIA ANATOXIN ADMINISTRATION.

BY

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URTICARIAL eruptions are a frequent sequel of injections of therapeutic serums and constitute the most prominent symptom of serum fever. On the other hand, they are rarely seen following injections of toxin-antitoxin (serum) mixture, even with three injections at fortnightly intervals, as in diphtheria prophylaxis. For instance, Wahl (1927), with a personal experience extending over four years of several thousand children immunized by injections of toxin-antitoxin, has recorded only one such observation.

It is not, I think, so well known that urticarial symptoms—evidence of an allergic state—may arise in connexion with diphtheria immunization with anatoxin. The following case lends itself to interpretation in this way.

A children's nurse, aged 17, received three prophylactic injections of diphtheria anatoxin (Institut Pasteur) subcutaneously on July 4th, July 17th, and August 2nd, 1928. A thirteen-day interval separated the first and second injections, a sixteen-day interval the second and third. The doses given were 0.4, 0.8, and 0.8 c.cm. respectively. Apart from the usual local redness at the site of inoculation no reaction accompanied the first two injections. On the evening of the third day after the last injection (that is, thirty-two days from the beginning) she felt slightly out-of-sorts and retired early to bed. The next morning she woke up with a swollen puffy face, and while attempting to dress she noticed that suddenly "everything went dark" (? vertigo).

She was put back to bed, and when seen shortly afterwards the eyelids were found to be markedly oedematous, and there was a widespread urticarial eruption present over the body, especially noticeable on the legs, thighs, and chest, attended by itching. This, she stated, had been present from the night before on her legs and chest. The temperature was 99° F., the pulse 80. The urine, of specific gravity 1024, was acid, and slightly cloudy; albumin and sugar were absent; marked excess of indican and excess of creatinine were present. The bowels were regular.

After two days in bed, with mild purgation and low diet, the attack completely passed; the eruption lasted from thirty-six to forty-eight hours; during two months since there has been no return.

The patient's past history included measles, chicken-pox, and whooping-cough—all before the age of 7—no history of diphtheria, or of any injections. She had a tonsillectomy at 7, and thereafter a healthy childhood. A personal history was elicited of a

dietary idiosyncrasy towards eggs, especially the yolk, which she said always made her feel sick. This idiosyncrasy appears to have been indirectly familial; an aunt on the father's side possessed it. It has, however, to be viewed in a mild and rather relative light in both, for the patient has been known to take eggs without inconvenience when served in dressings, custards, and other dishes, where she was unaware of their presence; the aunt late in life developed diabetes, and then eggs formed an important part of her diet.

The foregoing clinical picture is indicative of an anaphylactoid state. The question arises, Was it of alimentary origin or due to the anatoxin injections? The excess of indican and the personal intolerance towards eggs suggested that the condition might be alimentary. Inquiry in this direction revealed that at lunch the day before the eruption the patient had partaken of clotted milk (*lait caillé*), an article of diet to which she was unaccustomed; there was no history of eggs. It was concluded, however, that there was little to incriminate in this; a view which has been confirmed since, for she has frequently partaken of the same and other brands of clotted milk without inconvenience of any sort.

By elimination, therefore, a diagnosis of anatoxin allergy was arrived at, the responsible factor being clearly the albumin content of the anatoxin.

Albumin Content of Anatoxin.

Anatoxin being a formalized filtrate, from a bacterial culture in nutrient broth, its albumin content naturally depends upon the nature of the broth, and, according to Ramon (1924), also upon the luxuriance of the bacterial culture.

Tested from the point of view of albumin and albumin derivatives, the diphtheria anatoxin employed gave a well-marked positive Heller's test, indicating the presence of albumin. This was confirmed by precipitation with trichloroacetic and hydroferrocyanic acids. The biuret and xanthoproteic tests were positive. Millon's and Adamkiewicz's tests gave negative or indefinite results. Evaluation of the albumin present, with trichloroacetic acid in a Sicard and Cantaloube rachialbuminometer, revealed a content of approximately 0.01 per cent.

This represents a content of 0.0001 gram albumin per c.cm. The figure is significant; it is practically identical with the recognized albumin content of toxin-antitoxin mixture. Now, from the point of view of anaphylaxis,