A RECENT EPIDEMIC OF TYPHUS FEVER,

with notes on the urinary condition

by

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Typhus Fever has been described under many and varied appellations. It has been designated "Febris Nautica", "Febris Castrensis", "Maladie des Prisons" &c. These synonyms indicate how widespread the disease must have been in past times, whereas in later years it has been almost completely stamped out, due very largely to improved sanitary conditions amongst the populace.

As recently as the year 1890 two wards were permanently reserved for typhus fever in Belvidere Hospital, Glasgow, and it was very seldom, if ever, that they were unoccupied; but in more recent times such accommodation has been found unnecessary since, as a rule, only a few cases occur annually. This is evidence that, in Glasgow, during even the last twenty years, there has been a marked reduction in the number of cases.

The causal organism of typhus fever has not as yet been detected, but it is a generally accepted fact that overcrowding, dirt, absence of fresh air, in a word bad

bad hygienic surroundings are very important if not essential factors in the production of the disease.

The average patient admitted to hospital suffering from this fever is in a filthy condition, as likewise is his house and all that pertains to him. Sanitar authorities therefore have endeavoured to create an improved hygienic environment for the poorer members of society to which class this disease is almost entirely confined. The efforts of these authorities have been directed along many lines, such as the clearing away of slums, the prevention of overcrowding &c., and as a result of these efforts and compulsory notification, one can now classify typhus fever among the rare diseases of Great Britain.

Notwithstanding all that has been accomplished much remains to be done in the future: the eradication o typhus as of tuberculosis, is very largely a question of housing, and until the housing problem is solved, until slums are a thing of the past, we must expect occasional limited outbreaks of typhus fever.

The

The following table shows the number of cases notified annually, from 1900 to 1911 in Glasgow, Edinburgh, Liverpool, Manchester, Birmingham, Sheffield, Leeds, Dundee and Belfast.

Year	Glasgow	Edinburgh	Liverpool	Manchester	Leeds	Dundee	Belfast
1900	72	35	42	5	2	50	
1901	41	14	55	39	0	15	15
1902	36	10	155	-	3	9	5
1903	32	1	272	-	-	8	10
1904	27	6	97	-	18	1	9
1905	53	1	98	-	1	4	1
1906	10	-	52	-	-	3	9
1907	5	1	116	1	-	-	-
1908	13	-	21	-	8	16	19
1909	26	-	17	20	7	19	6
1910	15	-	11	2	-	2	7
1911	7	-	26	10	-	4	12

In Birmingham and Sheffield there were no cases notified during these years.

These are very small figures, more especially when one takes into consideration the deplorable circumstances in which many of the people still live, and they also afford a very striking contrast to the numbers which obtained fifty years ago. One must assume, however, that cases of typhus fever occur which are never notified as such, since the average general practitioner of to-day has

has had no experience of the disease and frequently mistakes it for influenza, enteric fever &c.

During the months of June and July 1912 a small epidemic of typhus fever occurred in Glasgow. The outbreak was confined to a limited area on the south-side of the city, an area which one would expect "a priori" to be a good breeding ground for the disease. Mr.Peter Fyfe, Chief Sanitary Inspector of Glasgow, in his report for the year ending December 31st. 1912, states that 6.5 per cent. of the ticketed houses inspected during the night were found in an overcrowded condition, but that the grossest overcrowding was found in the southern district, in which 38.8 per cent.of the cases had to be brought before the notice of the police magistrates. He adds that this was the district in which typhus fever recently broke out.

During the epidemic thirty cases were under treatment, twenty-five of which were admitted to Belvidere Hospital.

The following list is of interest from the point of view of diagnosis:-

Patient	Date of Admission	Notified	Proved.
L.G.	1st.June 1912	Enteric	Typhus
J.G.	3rd. " "	Enteric	Typhus
M.M.	4th. " "	Enteric	Typhus
J.G.	4th. " "	Typhus	Typhus
J.B.	7th. " "	Typhus?	Typhus (Convalescent)
J.C.	10th. " "	Typhus?	Typhus
M.M.	10th. " "	Typhus	Typhus
A.J.	11th. " "	Typhus	Typhus
G.M.	13th. " "	Typhus	Typhus
J.S.	14th. " "	Typhus?	Typhus
T.S.	14th. " "	Typhus?	Typhus
A.S.	16th. " "	Typhus	Typhus
H.R.	16th. " "	Typhus	Typhus
A.S.	16th. " "	Typhus	Typhus
K.S.	16th. " "	Typhus	Typhus
R.R.	17th. " "	Typhus	Typhus
R.R.	17th. " "	Typhus	Typhus
J.M.	18th. " "	Typhus?	Typhus
F.T.	20th. " "	Typhus	Typhus
J.H.	29th. " "	Typhus?	Lobar Pneumonia
A.R.	29th. " "	Typhus?	Typhus
M.R.	2nd.July "	Typhus	Typhus
B.R.	14th. " "	Typhus	Typhus
J.D.	16th. " "	Enteric	Typhus
J.D.	16th. " "	Enteric	Typhus
M.D.	17th. " "	Enteric	Typhus
E.M.	27th. " "	Typhus	Acute Osteomyelitis
J.C.	31st. " "	Typhus	Lobar Pneumonia
M.H.	9th.August"	Typhus	Enteric

These details show what is of frequent occurrence viz. that the first cases in an epidemic of typhus fever

fever are usually wrongly diagnosed, and also that when such an epidemic is well established or is drawing to a close cases are sent to hospital labelled incorrectly typhus fever.

It will further be noted that of fifteen cases certified as typhus, thirteen were correctly diagnosed while of the remaining two, one was a case of enteric fever, and the other of acute osteomyelitis of the tibia. Of eight cases notified as typhus(?), six were cases of typhus and two of acute lobar pneumonia. Six cases notified as enteric fever were cases of typhus fever. The proportion of incorrect diagnoses therefore was small but pneumonia and enteric fever were the two diseases most commonly confounded with typhus fever.

Types. Epidemics of typhus fever simulate those of other infectious diseases in that they vary in severity from year to year. The majority of the cases in the recent epidemic were not of a severe type, although a few of the patients were acutely ill. They may be classified thus:-

(1) Ataxo-Adynamic. (2) Mild. (3) Typhus Febricula.

Ataxo

Ataxo-Adynamic. The members of this class exhibited marked nervous symptoms and suffered from weak cardiac action. There were seven such cases of which two are described in a summarised form.

(a) J.G., aet. 44. admitted 3rd.June.

"Illness began 29th.May with abdominal pain, pains in back and limbs, confined to bed on 30th.May with sickness, diarrhoea, headache".

On admission. Temp. 102.8°. Pulse 100. Resp. 28.

"Patient appears very ill but answers when spoken to, fairly well nourished, tongue fissured and covered with white fur, conjunctivae injected, on trunk and arms numerous pink-coloured spots, no subcuticular mottling, no distension or tenderness of abdomen, spleen impalpable, liver dulness "normal", heart sounds pure, sibilant rhonchi over lungs.

June 4th. Rash further developed, present on face, trunk, arms and to a less extent on legs, consists of dull red spots with mottling between, conjunctivae injected. Patient fairly acute mentally but less so than yesterday.

June

June 5th. Temp. 103.8°. Pulse 148. Resp. 52.

Has been restless and trying to come out of bed.

June 6th. 6 a.m. Temp. 102°. Pulse 144. Resp.40.

Slept from 10 p.m. till 12.30 a.m. - since then only for short intervals.

" " 6 p.m. Temp.103.6°. Pulse ? Resp. 60.

Pulse very small, and unable to be counted. Abundant rhonchi and crepitations over lungs. Patient died at 7.30 p.m.".

At the post-mortem examination the lungs showed well marked hypostatic congestion.

(b) S.C. (Case 15) aet. 16 yrs. Admitted June 10th. 1912.

"Illness dates from 3rd.June when patient complained of headache, diarrhoea, abdominal pain. Rash noticed on face, arms and neck on 9th.June.

On admission. Temp.104.4°. Pulse 116. Resp. 32.

Slightly emaciated and much neglected child, clear mentally but decidedly somnolent, drops into a dozing state whenever possible, pupils contracted,marked injection

injection of conjunctivae, typical typhus rash on trunk and extremities, consisting of maculae, petechiae and subcuticular mottling. Heart "normal". Rhomchi audible over lungs, tongue dry and fissured.

June	11th. 6 a.m.	T.104°, P.108, R.38.	Slept well last night
"	" 6 p.m.	T.101.6°,P.106, R.44.	Fairly comfortable day
"	12th. 6 a.m.	T.104°, P.108, R.38.	Slept well, cough troub-lesome. Rhonchi over lungs.
"	12th. 6 p.m.	T.104° P.112, R.44.	Restless and noisy, slept at intervals,not drinking well.
"	13th. 6 a.m.	T.103.8°,P.110,R.40.	Did not sleep
"	13th. 6 p.m.	T.104°, P.108, R.44	Restless.
"	14th. 6 a.m.	T.103.8°,P.112,R.46	Slept well.
"	14th. 6 p.m.	T.103.8°,P.112,R.48.	Restless and noisy, trying to get out of bed.
"	15th. 6 a.m.	T.104°, P.110, R.40.	Looks much worse,pulse and colour poor.
"	15th. 6 p.m.	T.103.8°,P.104,R.36	
"	16th. 6 a.m.	T.103°, P.112, R.38.	Restless all night, pulse and colour poor, not drinking well.
"	16th. 6 p.m.	T.101.6°,P.112,R.34.	Quiet during day but is now restless and noisy.

June 17th. 6 a.m. T. 99.8°, P.98, R.28.

" 17th. 6 p.m. T.101.8°, P.120,R.64. Restless all day, drinking well".

The temperature settled finally within the next two days and patient thereafter made a good recovery and was dismissed well.

(2) Mild Typhus. This division includes those who neither lost consciousness nor were noisy, nor exhibited any evidence of cardiac weakness, yet suffered from insomnia and were moderately ill for a few days. Eight such cases were treated of which one is described.

R.R. (Case 2), aet.24. Admitted June 17th.1912.

"On 15th.June took to bed complaining of headache, dizziness, painful eyes. On 16th.June felt much worse and had several "shivering fits".

On admission (June 17th.)

T.104.2°, P.124, R.16.

Well nourished, lies comfortably in dorsal decubitus, marked proptosis, eyelids swollen, conjunctivae markedly injected, considerable mucoid discharge from

from eyes, pupils moderately dilated, react to light, tongue covered with thick yellowish-white fur, moderate degree of gingivitis, fauces slightly injected, no rash, no alteration in reflexes, heart and lungs "normal", no distension of abdomen, spleen impalpable.

June 17th. 6 p.m. Fairly comfortable since admission, sleeping heavily at intervals and muttering, complains of severe headache in frontal region.

June 18th.	6 a.m.	6 p.m.	
	T.101.6°, P.116, R.20	T.102, P.92,R.20	Slept at intervals, headache less severe, eyes painful.
June 19th.	T.100.2°, P.80 , R.20	T.100, P.76,R.20	Slept well, eyes and head much better, proptosis less marked".

Thereafter the temperature gradually progressed towards "normal" as indicated on chart (Case 2).

(3) Typhus Febricula, comprised of the cases which aborted, the temperature settling as a rule between the third and ninth days of illness.

There were nine such cases all of which at the outset, had the appearance of running the usual typhus course,

course, none of them, however, exhibiting a typical typhus rash.

The chart of Case 4 demonstrates the course of the temperature.

One patient was admitted in the convalescent stage.

While it will be observed that the cases of a "severe type" were in the minority, it is interesting to note that they were among the first to be admitted to hospital, the later ones being mild or "febriculoid" in type. There is no doubt that the occurrence of the "severe type" assisted materially in the recognition of the febriculoid type.

Age Incidence.

Under 5 years	3	cases.
5 to 10 "	3	"
10 to 15 "	8	"
15 to 20 "	5	"
20 to 30 "	3	"
30 to 40 "	0	"
40 to 50 "	3	"

The majority of the children were between the ages of five and fifteen years, this being the age period when children are most frequently attacked. Under five years the susceptibility is reckoned to be much less.

Sex

Sex. The sexes were almost equally affected, there being twelve males and thirteen females. The figures are too small to permit any conclusions of value to be drawn, but it is generally recognised that the two sexes are equally susceptible to the disease. This has been demonstrated in many larger epidemics, and where there has been any marked inequality some local factor has been found to account for it, such as the exposure to infection of a larger number of one sex.

Mortality. The mortality rate was four per cent., which contrasts favourably with the usual rate of from ten to twenty per cent. The case which terminated fatally, and mentioned previously as an example of the ataxo-adynamic type, died from hypostatic congestion of the lungs and cardiac failure.

It has been well established that age has an important determining influence on the mortality rate, the latter increasing with increasing years. Murchison, from cases in the London Fever Hospitals, calculated that the mean age of the patients who died was nearly forty-two years. Brownlee, in his annual report of the City

City of Glasgow Fever Hospital, Belvidere (Year ending May 31st.1901) showed that of 5,609 cases, treated there from 1870 till 1901, the largest number of deaths occurred between the ages of thirty five and forty, and almost equally between thirty and thirty-five. In the same report it is stated that in the fever hospitals of the Metropolitan Asylum's Board from 1875 to 1895 of 2,169 cases much the largest number of deaths took place between the ages of forty and forty-five.

Some cases treated in Belvidere Hospital in recent years may also be cited.

(1) In March 1910 five Jews were admitted, their respective ages being, forty-two, sixteen, sixteen, fourteen and thirteen years. The patient aged forty-two died.

(2) In December 1910, two patients were admitted, aged nineteen and forty-three years. The patient aged forty-three died.

(3) In December 1911 a father, aet.forty-one, a mother, aet.twenty-five and their child, aet.one year were admitted. The father died.

The

The age period, thirty-five to forty-five, must there-fore be considered a very fatal one for persons suffering from typhus fever.

Incubation period of typhus shows variations, but in the great majority of cases it is from eight to sixteen, or more particularly twelve to fourteen days. The history of one family is noteworthy.

	H.R.	A.R.	M.R.	B.R.
Took ill	June 10 (?)	June 28	July 1	July 12
Admitted to hospital....	June 15	June 29	July 2	July 14.

A.R.became ill thirteen days and M.R.sixteen days after the last possible contact with H.R. B.R.became ill ten days after his last possible contact with M.R. and thirteen days after his last possible contact with A.R.

The incubation periods therefore ranged from ten to sixteen days.

Period of Invasion. The histories of the cases were unsatisfactory, inasmuch as many of the patients could give no account of themselves, while their friends likewise

likewise were unable to furnish much information. Where histories could be relied upon the patients were said to have suffered from headache, shivering, sickness,- all coming on suddenly. Headache was complained of in seventeen of the twenty five cases: in three no history of illness was given, and in the remaining five no complaint of headache was made.

These seventeen patients all suffered from frontal headache, except Case 2, in which the pain was situated in the occipital region, and in the back of the neck. It persisted during his first six days in hospital.

Case 1 presented an interesting ocular condition. This patient stated that his "eyes and his head were sore, that he could not see clearly, and that he felt dizzy". On admission his eyelids were swollen and oedematous, with a mucoid discharge exuding from between them. The bulbar and palpebral conjunctivae were markedly injected, while a number of small subconjunctival haemorrhages were also observed. The eyeballs were very prominent.

On the following day the eyes were still painful but

but the proptosis was then much less marked, and on the third day of residence was quite gone. The conjunctival injection disappeared gradually, but one of the larger haemorrhages in the right eye did not clear away completely until the patient had been more than two weeks in hospital. This patient's brother, who took ill at the same time, showed considerable suffusion of the conjunctivae, but no proptosis.

Curschmann[2] (Nothnagel's Encyclop, of Practical Medicine, English Edition 1902) states that haemorrhages into the conjunctiva are quite common in severe cases. The fact that Case 1 showed marked proptosis, a condition not mentioned by any of the authorities, and, although a mild case, considerable conjunctival haemorrhages, demands particular notice.

Shivering and Chilliness were complained of in seven cases. Case 1 had several "shivering fits", but the others apparently experienced a feeling of chilliness rather than true rigors.

Nausea and vomiting.

Nausea accompanied by vomiting was present in nine

nine cases, nausea only in three (in other three no history was given). In one patient the vomiting persisted for three days after admission to hospital or until the sixth day of illness. Murchison in his "Continued Fevers" writes that vomiting is a rare symptom, but others appear to consider it a fairly frequent one. Certainly in the epidemic under consideration it was not rare.

The onset of typhus fever resembles that of acute lobar pneumonia, both being ushered in by a sudden shivering, a feeling of malaise, nausea &c. There is therefore no difficulty in understanding why the two conditions are frequently confused with each other, more especially when in a case of pneumonia the physical signs of pathological changes in the lungs cannot be detected until the fourth or fifth day of illness. An illustration of this occurred recently in Belvidere Hospital. A woman, aet. 44, took ill on February 1st. 1911, and was admitted on Febriary 8th. as a case of typhus. She was very sharply ill and died on February 13th. from hypostatic congestion of the lungs and cardiac weakness. There

There was no doubt as to the diagnosis, a very typical typhus rash &c. being present. This patient's son, aet.16, who lived with her became ill on February 18th. with headache, nausea, vomiting &c. The temperature rose to 104.8° F. He was notified as a case of typhus, and was treated accordingly. After he had been four days in hospital, and while one was watching for the appearance of a rash, definite physical signs of consolidation were discovered at the base of the left lung. Patient on February 24th. or on the seventh day of illness had a sharp crisis. This was a case of acute lobar pneumonia with delayed physical signs in the chest.

Course of temperature. All the patients who were admitted early enough showed the rapid rise of temperature at the commencement of the disease.

(See charts appended).

As regards the period of defervescence, typhus fever is generally described as terminating by crisis. Roger[5] writes that "typhus fever is perhaps the disease which most clearly terminates by crisis. Its fever chart recalls fairly well that of pneumonia".

Osler

Osler[3] writes - "an acute infectious disease .. . . . . characterised by sudden onset . . . and a cyclical course terminating by crisis".

Murchison[1] quotes Wunderlich who states that the final defervescence is usually precipitous.

These statements must be modified, as in a large number of typhus cases the defervescence takes the form of a rapid or of a prolonged lysis, rather than of a crisis. Curschmann[2] remarks that it is not rare for the temperature to fall in one night from a considerable height to the normal level, but adds, that with almost equal frequency it may fall by lysis extending over three or four days, and in some cases over a longer period.

Of the cases under consideration twelve were available for observation of the character of the defervescence. In only two could the temperature be described as falling by crisis. In Case 7 the temperature dropped to normal within eight hours, i.e. between 6 a.m. and 2 p.m., and though it rose again slightly above the normal line for a few hours, it finally settled down within twenty four hours. This patient showed

showed a sudden marked improvement in his clinical condition synchronous with the fall of temperature. In Case 11 the termination took place by crisis, the temperature falling to normal within sixteen hours. In the other ten patients the fall was by lysis, persisting for varying lengths of time - in one for eight days, in three for six days, in one for 5 days, in two for four days, in one for three days, and in two for two days.

Defervescence usually commences between the twelfth and fourteenth days of illness, but is occasionally delayed until the seventeenth. Of the twelve cases mentioned, in four defervescence began from the tenth to the twelfth days, in one on the fourteenth, in one on the fifteenth, in one on the eighteenth, in two on the eighth, in one on the seventh, in one on the fifth, and in one on the third day. All the patients whose temperatures began to fall before the eighth day were cases of mild typhus or of typhus febricula.

A fall of temperature on the evening of the seventh day which is regarded by some as of fairly frequent occurrence, was not noted. Case 1 showed a fall from the fifth to the eighth day. A pseudo-crisis, generally

generally considered a rarity, was present in one case (Case 11).

Charts twenty and twenty-three may be taken as typical of what sometimes occurs in children, viz. an irregular temperature curve, while chart five represents the almost afebrile form of typhus, a form of the existence of which there appears to be little doubt.

Complications. Many of the patients suffered from bronchitis, but if it be included among the symptoms of the disease, the only complication met with was retention of urine. It was present in two cases and had to be relieved by catheterisation.

Urine. The urines were tested daily as long as the patients were confined to bed. In Cases 1 to 9 they were examined from the time of admission, but in the others not until after varying periods of residence. Needless to remark, the specimen for examination was taken from the total amount of urine passed in the twenty-four hours.

Quantity. In typhus, as in the other acute exanthemata

exanthemata, the amount of urine excreted is diminished during the febrile period, more especially towards the beginning of that period. The tabulated results given below demonstrate this reduction.

Case 1. (aet.24)

Day of Illness	Quant. of Urine	Fluids taken
5	17 oz.(in 18 hrs.)	
6	19 oz.(in 24 hrs.)	
7	30 oz. "	4 pts.4 oz.
8	40 oz. "	3. " 15 "
9	48 " "	3. " 16 "
10	56 " "	5 " 12 "
11	63 " "	5 " 9 "
12	65 " "	5 " 7 "
13	44 " "	5 " 8 "
14	79 " "	5 " 8 "
15	20 " "	3 " 28 "
16	71 " "	5 " 11"
17	69 " "	4 " 9 "
19	86 " "	5 " 4 "
23	88 " "	4 " 4 "
24	68 " "	4 " 15 "

Case 2 (aet.27)

Day of Illness	Quant. of Urine	Fluids taken
4	12oz.(in 12 hrs.)	
5	36 " (in 24hrs.)	
6	34 " "	6pts.10 oz.
7	68 " "	6 " 14 "
8	88 " "	7 " 8 "
9	27 " "	6 " 18 "
10	74 " "	7 " 10 "
11	82 " "	6 " 10 "
12	24 " "	6 " 7 "
13	57 " "	5 " 10 "
14	66 " "	4 " 12 "
15	57 " "	4 " 8 "
16	59 " "	6 " 4 "
18	74 " "	4 " 10 "
21	81 " "	4 " 12 "
23	66 " "	4 " 18 "
25	90 " "	4 " 6 "

Case 3 (aet.12)

3	16 oz.(in 20 hrs.)	
4	36 oz.(in 24 hrs.)	3 pts.12 oz.
5	55 " "	3 " 12 "
6	59 " "	2 " 16 "
7	62 " "	4 " 16 "
8	39 " "	3 "
9	38 " "	3 " 18 "
10	44 " "	3 " 14 "
11	46 " "	3 " 2 "
12	52 " "	3 "
13	48 " "	2 " 2 "
14	49 " "	3 " 14 "
15	67 " "	3 " 18 "

Case 4 (aet $13\frac{1}{2}$)

3	10oz.(in 12hrs.)	6 oz.
4	25 "(in 24hrs)	2 pts.4 oz
5	28 " "	1 " 18 "
6	26 " "	2 " 2 "
7	19 " "	3 "
8	28 " "	2 " 9 "
9	28 " "	3 " 2 "
10	46 " "	2 " 12 "
11	51 " "	3 " 3 "
12 "	68 " "	3 " 6 "
13	63 " "	3 " 13 "
14	58 " "	3 " 18 "
15	58 " "	5 " 4 "
16	78 " "	3 " 8 "

Colour and Specific Gravity were such as one would expect in any febrile condition. The results found in two cases may be taken as typical. In every case at first the reaction was highly acid.

Case 1

Day of Illness	Colour	Sp.Gravity.
5	Amber	1028
6	Deep amber	1025
7	"	1026
8	Amber	1017
9	"	1019
10	"	1029
11	Straw	1014
12	"	1018
13	"	1012
14	"	1017
15	"	1013
16	Pale Straw	1015
17	"	1015
18	"	1017
19	"	1017
20	Straw	1018

Case 2.

Day of Illness	Colour	Sp.Gravity.
4	Deep amber	1027
5	"	1032
6	Amber	1030
7	Deep Amber	1028
8	"	1026
9	Amber	1012
10	"	1012
11	Straw	1012
12	"	1012
13	Pale straw	1009
14	"	1007
15	"	1015
16	"	1013

Albumen. The test employed for the detection of albumen was the heat test. For the purpose of indicating differences in the quantity of albumen these descriptive terms were utilised:-

(a) Minute trace, (b) Trace, (c) Haze (d) Considerable haze, (e) Moderate amount, (f) Large amount.

The findings from thirteen of the cases are indicated on the accompanying table: the urines of the other patients were examined as a matter of routine by the sister-in-charge, but not by myself, so that they are left out of account, as, naturally, the personal element bulked very largely in the classification given.

Albuminuria.

Day of Illness	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Case 1							T		T											
" 2							C.H.	C.H.^{x}	M^{x}	M^{x}	H	CH	H	H						
" 3																				
" 4	L	(a) L(b)	L(b)		CH	CH	H	H												
" 5							T		H	T	T	T				CH		T		T+
" 6		MT		H	T		T	T	T		T	T		T		T	T	T		
" 7													T	T	T			T	T	T
" 8											MT	H	T			MT	MT	MT	MT	
" 9								M	M	M						MT	MT			

Day of Illness	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	31	37	48
Case 17	Not examined						T	T	T	T			T	T	T	T							
" 18	Not examined		T		T	T	T	H	CH	CH	CH	CH	CH	H									
" 19	Not examined			MT						MT						H	T	T		T	T	M	T
" 20	T	M	M	M	M			H	H	M	M	M											

M T = Minute trace
T = trace
H = haze
C H = considerable haze
M = moderate amount
L = large amount

x = blood

(a) Esbach = .15 per cent
(b) Esbach = .025 per cent

It will be noted that of thirteen cases, twelve were found to be suffering from albuminuria during either the course of the fever or during convalescence. No doubt in most of them the albumen was in small amount, and its presence temporary, but in cases 2, 4 and 20 the quantities were classified as moderate and large.

In the severe types of typhus the urine as a rule at some time contains albumen, but the above findings suggest that albuminuria is of frequent occurrence in the mild forms also, although its prognostic significance is almost negligible. This albuminuria must be considered a "febrile albuminuria", probably resulting from changes (temporary) in the epithelial cells lining the glomerular capillaries of the kidney. In the urine of Case 4, in which there was a large amount of albumen many granular casts were also found, but this is compatible with a "febrile albuminuria".

Only one patient (Case 2) out of twenty five was noted as suffering from haematuria, the urine being macroscopically bloody on three successive days. This appeared suddenly on the tenth day of illness, during lysis

lysis, persisted for three days, and then disappeared as rapidly as it had come. The sudden appearance and equally sudden disappearance of the blood were very striking. Where haematuria is present to such a marked degree, one would expect some permanent damage to kidney tissues; sections of the kidney made during the time that blood was present in the urine would probably have revealed a condition of acute parenchymatous nephritis, (there was no evidence of disease of bladder &c.) but since all albuminuria and haematuria cleared up in a comparatively short time, one must suppose that the cells of the kidney returned to their "normal condition". It is interesting to observe that Welch and Schamberg[4] state that "true parenchymatous nephritis evidenced by pronounced albuminuria, epithelial and hyaline casts and at times blood is fortunately an uncommon occurrence."

Sugar. Fehling's test was employed with negative result on every occasion, although in several of the cases, at the beginning of the fever, a yellowish-green discolouration was obtained. This, however, is obtained in almost any febrile condition, very notably in acute lobar

lobar pneumonia. Buchanan found sugar in nine out of fourteen cases of typhus fever, but no other investigator has been able to verify his results.

Chlorides were examined for quantitatively, but time did not permit the performance of the Sutton-Mohr process, the ordinary qualitative test being employed instead. By means of it any marked reduction or increase could be appreciated.

Test. To 10 c.c. of urine in test tube a few drops of dilute nitric acid, and 10 c.c. of a 3 per cent. solution of silver nitrate were added. An abundant thick curdy precipitate was taken as "normal".

Chlorides

Day of Illness	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Case 1			N	N	N	N	N	N	N	N	N	Temperature settled on 14th.day of illness						
" 2			T	T	N	N	N	N	N	N	N		"		"	" 16th.	"	"
" 3	N	N	N	N	N	N	N	N					"		"	6th.	"	"
" 4			Nil	T	N	N	N	N					"		"	7th.	"	"
" 5	N	N	N	N	N	N	N	N				Almost afebrile						
" 6	N	N	N	N	N	N	N	N				Temperature settled on 7th.day of illness						
" 7		N	M	T	T	T	T	M					"		"	8th.	"	"
" 8								M	M	M	M	N	N		"	14th.	"	"
" 9									M	T	T	M	N	N	"	12th.	"	"
Case 18			Not examined							T	T	T	T	T	M	M	N	N
" 20					M	M	N	N	N	N	N	N	Temperature settled on 17th.day					
" 21			M	T	T	T	T	M	M	N	N	N	"		"		"	"

N = normal (abundant flocculent precipitate)
M = moderate (milky with slight, precipitate)
T = trace (milk with no precipitate)
Nil (no turbidity)

Of the cases examined, all showed a reduction of chlorides at some period of the illness, with the exception of cases 3, 5 and 6, and in all probability, with a more delicate test these exceptions would have been found to conform to the others. The reduction was found in cases 1 and 2 for a few days at the beginning, while the temperature was high, but in 4, 7 and 8 during the decline of temperature. Case 7 alone showed very marked reduction.

Many theories have been propounded to account for the lessened excretion of chlorides in the urine during the acute fevers. For long it was thought to be due to the small quantity of sodium chloride in the diet, but this supposition has been proved inaccurate. Recently it has been demonstrated that the withdrawal of the salts from the serum by dialysis inhibits the action of "complement", it is possible that this phenomenon may have some bearing on the reduction of chlorides

Urea. A "normal" amount of urea is generally estimated at two per cent or thirty to forty grammes in the twenty-four hours, but a so-called "normal" amount must vary, depending on diet, age, weight, exercise and temperature, so that what appears to be an abnormally small

small quantity may be in reality "normal" in a particular individual. However, the figures mentioned may be taken as "normal" for all practical purposes.

Opinions differ as to the quantity of urea excreted in typhus fever, so that the results obtained in the present cases are noteworthy. The estimations were made with the Doremus-Heinz Ureometer which was considered to give sufficiently accurate results when used with the usual precautions. The results obtained are represented graphically on the charts (green ink).

Case 1. During first week output high (4%) - fell with fall of temperature from fifth to eighth day - during second week remained about 2% - subnormal amount (1.15%) after decline of temperature.

Case 2. During first week output high (3.8%) - in second week tended to be subnormal (1.8%) - gradually rose during convalescence - corresponds very much with Case 1.

Case 3. Output high (3.2%) in early stages.

Case 4. Increased output (3.2%) during first few days, but during the rapid lysis as much as 4.7% - thereafter a subnormal amount. In this patient there must

must have been great increase in the Katabolic processes at the commencement of the disease, but the attack being aborted, suitable conditions were provided for a rapid excretion of the waste products.

Case 5. Initial increase 2.2%) - subsequent abnormally low amount (.6%) - followed by a gradual rise

Case 6. Very little if any increase - an abortive attack.

Case 7. Very high output (3.6%) during first week and during crisis but immediately thereafter a rapid fall to a subnormal amount (.7%)

Case 8. High output (3.5%) during first twelve days - abnormally low quantity (.7%) following lysis.

None of these cases showed the marked typhoid condition which sometimes supervenes in the second week of typhus, but they are of interest, apart from Cases 1 and 2, as showing the output of urea during the lysis or crisis. In Cases 4, 7 and 8 an increased excretion was observed during the decline of temperature, but in the others a diminution.

In the cases which follow (15, 17, 18, 20) which were mostly of a severe type, the urines were unfortunately

unfortunately not examined until the patients had been in hospital for some time.

Case 15. Shows the small amount (.7%) at the termination of lysis - thereafter a gradual rise.

Case 17. (First examined on fourteenth day of illness). Shows a large amount (2.6%) at the termination of lysis - thereafter a fall to a subnormal amount (.5%)

Case 18. Large amount 2.4 to 3%) during first week - later a gradual fall accompanying a similar fall of temperature.

Case 20. High output (3.8%) during first week - less high output (2.6%) in second week.

These results may be summarised thus:-

(a) It was a constant feature that during the first week of illness the output of urea was markedly increased in spite of great diminution in diet. This corresponds with Murchison's and Rosenstein's findings, but differs from those of Lanceraux, who never obtained more than from eleven to twenty four grammes in the twenty four hours.

(b) The amount excreted during the second week of illness was observed in six cases, and in these there was a

a reduction in quantity as compared with the first week, but in four of the six the quantity was still above "normal". Of the remaining two, one gave a "subnormal" and the other a "normal" quantity.

(c) During the period of defervescence the output of urea was in some cases increased, and in others decreased.

(d) In the post-critical period an abnormally small quantity of urea was excreted for varying lengths of time, even although a liberal proteid diet was being allowed.

The greatest controversy has arisen concerning the quantity of urea excreted during the second week. According to Parkes it was always increased. Keith Anderson[7] (Edinburgh Medical Journal 1866) found that in six cases of very marked typhus the amount during the second week was much below the normal. The results obtained in six cases of the present series have already been given. These differences in findings probably depend on variations in the type of the fever.

Urea, uric acid, ammonia, creatin, purin bodies &c., are the products of proteid katabolism taking place

place in the body. In health the amount of urea excreted represents the excess of nitrogen ir the food, which is unnecessary for the tissues of the body at that time. The greater the proteid intake, the greater is the nitrogenous output; and the less the intake, the less the output. This, however, does not hold in disease, as in the acute fevers. In these conditions the patient is, in all probability, on a diet consisting solely of milk, and yet as a rule the output of urea is much increased. One must remember, of course, that in the acute fevers the urine is reduced in quantity and concentrated, so that the amount of urea in 1 c.c. of concentrated urine would be greater than in 1 cc. of diluted urine, even although there was no actual increase. This, nevertheless, does not account for the large excess of urea found: it is generally said to be due to increased metabolism, but whether this increased metabolism is produced by the elevation of temperature or "vice versa" it is difficult to say.

It has been pointed out that in the post-critical period of typhus the quantity of urea excreted is,

is, as a rule very small. This may be explained by the supposition that all the nitrogen ingested (during this post-critical period) is necessary for the rebuilding of the tissues from which a large amount of proteid matter has been withdrawn during the illness. When the tissues return to "normal", in other words, as convalescence progresses, the amount of urea excreted gradually rises.

Acetonuria. Legal's test was used exclusively.

Reagents:-

(a) Solution of sodium nitroprusside (roughly 5%) made up daily.

(b) Glacial acetic acid.

(c) Liquor ammon.fort. (B.P.)

To 10 cc. of urine in test tube were added a few drops of (a) followed by a few drops of (b). The mixture was then shaken and a quantity of (c) poured gently down the side of the tube. If acetone were present a violet ring appeared at the junction of (c) and urine, - almost at once, or else after an interval of a few minutes, the length of time depending on the amount of acetone. The test tubes were allowed to stand for

for from 5 to 10 minutes in order that the violet colour might have time to develop in cases where there was merely a trace of acetone.

The "ferric chloride test" was applied for the detection of aceto-acetic acid. As a general rule this was found only when acetone was present in large amount.

Results of Legal's Test.

	Age	Acetone	Diet (during period of acetonuria.
Case 1.	24 yrs.	Nil	Fluids
Case 2	27 yrs.	Nil	Fluids
Case 3	12 yrs.	In diminishing quantity from 3rd. to 6th.day of illness. Absent on 7th. and thereafter.	Fluids
" 4	13½yrs.	In diminishing quantity from 3rd. to 9th.day. Absent on 10th.day and thereafter.	Fluids till 7th. day: Farinaceous diet on 8th. day.
" 5	7 yrs.	In diminishing quantity from 3rd.to 6th. day. Absent on 7th. day and thereafter	Fluids.
" 6	14 yrs.	In diminishing quantity from 3rd. to 5th.day of illness. Absent on 6th. and thereafter.	Fluids

	Age	Acetone	Diet
Case 7	13 yrs.	In diminishing quantity from 4th. to 9th.day. Absent on 10th. and thereafter.	Fluids till 8th.day. Farinaceous diet on 9th.day.
Case 8	7 yrs.	In diminishing quantity from 10th. to 17th day. Absent on 18th. and thereafter.	Fluids till 14th.day. Farinaceous diet on 15th.day.
Case 9	2 yrs.	In diminishing quantity from 10th. to 12th.day. Absent on 13th. and thereafter.	Fluids.

Cases 8 and 9 were not examined before the 10th.day of illness

The second table includes those cases in which the urines were not examined till the patients had been some days in hospital.

	Age	Acetone	Diet
Case 15	16 yrs.	Present on 18th.day of illness. Thereafter absent.	?
Case 17	11 yrs.	Present on 14th.& 15th.days of illness. Thereafter absent.	?
Case 18	17 yrs.	Nil	
Case 19	14 yrs.	In diminishing quantity from 14th. to 16th.day - absent on 17th. and thereafter.	?
Case 20	12 yrs.	In diminishing quantity from 5th. to 13th.day - absent on 14th. and thereafter.	?
Case 23	2 yrs.	Detected on 8th.& 13th.days.	?
Case 25	28 yrs.	Nil	Fluids.

Thus

Thus thirteen of the seventeen cases gave a positive reaction to Legal's test. The ages of these thirteen ranged from two to sixteen years, while the remaining four were aged respectively twenty-four, twenty-five, seventeen, and twenty-eight years. The urine from the patient aged seventeen not having been examined until the eighteenth day of illness, acetonuria may have been present previous to that date.

One can therefore conclude that patients of the age of sixteen years, and under, suffering from typhus fever, usually, if, not always, develop acetonuria. This condition is considered to be due to abnormal or faulty fat metabolism, which in its turn is dependent on carbohydrate starvation. Yet in three typhus patients aged respectively twenty-four, twenty-five and twenty-eight years, acetonuria did not occur, and this in spite of the fact that the diet for from eleven to fourteen days consisted solely of fluids, so that a condition of carbohydrate starvation was established as far as any external supply was concerned.

The non-appearance of acetonuria in these cases might possibly be accounted for by the fact that adults

adults have, stored in the liver, a quantity of glycogen upon which they can draw in times of need. If this be the correct explanation one would expect to find a similar absence of acetonuria in adults suffering from typhoid fever, at least during the early stages. For the purpose of investigating this matter the urines from eight typical cases of typhoid fever, aet.from nineteen to thirty-nine, were examined daily. In four no acetone was found, while in two of the remaining four it was present in very large quantities and in the other two in small quantities. The occurrence of acetonuria in these cases cannot be explained by a long-continued drain on the glycosuric store, because in one case it was detected on the sixth, and in the other on the ninth day of illness. It may be that some persons have a smaller store of glycogen than others and that the acetone therefore makes its appearance at a correspondingly earlier time, but it is much more probable that other unknown factors are responsible.

There is no doubt that a non-carbohydrate or restricted carbohydrate diet is one cause of acetonuria in children. The urines of eighteen children suffering from

from diphtheria, faucial and laryngeal, all gave a positive reaction to Legal's test. The cases, in which the ages varied from two to nine years were not selected in any way but were admitted in ordinary course to two diphtheria wards. They were kept on a fluid diet, viz. milk, lemon drinks, imperial drink, for varying lengths of time after admission. When the diet was increased, bread, milk puddings, tea with sugar, being allowed, the acetone disappeared very quickly.

Of 18	cases	in	5	acetonuria	absent	on 1st.day after increase of diet	
"	"		9	"	"	2nd. "	"
"	"		3	"	"	3rd. "	"
"	"		1	"	"	4th. "	"

The greater the quantity of acetone on the day on which the diet was increased, the longer did it take to disappear, and the sooner the increase was permitted, the sooner did the acetone disappear, i.e. if a child were given farinaceous diet on his third day in hospital there would probably be no acetonuria on his fifth day, while if the fluid diet were continued, the acetonuria would remain till the eighth or tenth day at least. The latter period (tenth day) was obtained in two

two cases, one of diphtheria and one of scarlet fever: it was impossible to restrict the patients (children) to fluid diet after their tenth day of residence.

There can be no doubt that in these cases the carbohydrate starvation was the cause of the acetonuria, but, on the other hand, it is sometimes found that the acetone disappears without any increase of diet. Of cases 1 to 7, in three the acetonuria cleared up as soon as farinaceous food was given, while in the remaining four without any increase in the diet.

Again,acetonuria occurs in cases of gastric carcinoma and of cyclical vomiting. These fews facts indicate that the exact etiology of acetonuria, involving diet, metabolism &c., is very obscure.

Indicanuria. Jaffe's test was carried out as described.-

10 cc. each of urine and of strong hydrochloric acid were mixed in a test-tube, and to the mixture there was added drop by drop a saturated solution of chlorinated lime, the while the development of a blue colour was looked for. The maximum depth of colour was usually obtained by adding 2 to 5 drops of the lime solution. Thereafter

Thereafter 2 to 3 cc. of chloroform were added and the whole shaken up and then allowed to stand. There upon the chloroform sank to the bottom coloured blue or lilac.

In seven out of nine cases examined from time of admission, there was a definite increase in the amount of indican during the first few days.

Ehrlich's Diazo-reaction.

Two solutions necessary:-

(a) Saturated solution of sulphanilic acid to which 5 per cent. of hydrochloric acid is added.

(b) ½ per cent. solution of sodium nitrite.

To 10 cc. of urine in test-tube, 2 cc. of (a) and 2 drops of (b) were added, and the mixture shaken vigorously to produce a froth. 2 drops of Liq.Ammon. Fort. were then allowed to descend gradually down the side of the test-tube on to the froth, and thereafter a little more of the Liq.Ammon.Fort. was added.

By this gradual addition of the ammonia solution one can more readily appreciate the typical salmon-pink colour which appears as soon as the ammonia reaches the froth i.e. if the diazo reaction is present.

This

This test has been chiefly applied to typhoid urines and in its application thereto very varied results have been obtained by different observers. In the urines from the present series of typhus patients no reaction was classified as positive unless it was very definitely positive, the froth being salmon-pink in colour, and the fluid deep scarlet. In a number of the urines the fluid was deep scarlet but the froth had a "gingery-orange tint": these were considered to be negative.

Of sixteen cases of typhus only three gave a definitely positive reaction. Case 5 was markedly positive during the second, third and fourth days of illness. Cases 8, 9 and 25 were members of the same family, and were admitted to hospital on the tenth day of illness. Case 8 gave a typical reaction on the tenth, eleventh and twelfth days of illness and case 25 on the tenth and eleventh days only: case 9 was negative during the whole course of the illness.

The cases are not sufficiently numerous to justify any conclusions, but it would appear that a positive diazo reaction is obtained less frequently in typhus than in typhoid fever, in the latter of which it is

is almost always found between the fifth and twelfth days of illness.

Curschmann[2] states that some recent observers have obtained a positive diazo-reaction in typhus with a fair degree of regularity.

The test is therefore of no value for the purpose of differential diagnosis between typhus and typhoid fevers.

The results of the urinary examination were therefore:

(1) Albuminuria present in 92.3 per cent. of the cases.

(2) Sugar not found in any of the cases.

(3) Chlorides reduced in 75 per cent of the cases.

(4) Output of urea increased during first week - variable during second week.

(5) Acetonuria present in 100 per cent. of cases - under seventeen years of age.

Aceto-acetic acid found when acetonuria was marked.

(6) Indican increased in 77.7 per cent. of the cases during the first few days.

(7) Diazo-reaction present in 18.7 per cent.of the cases.

Treatment

Treatment. The patients were isolated in two wards of equal size. The first consideration was to provide sufficient cubic space per patient. Each ward had a total floor space of 1765.6 sq.ft., and a total cubic space of 33,544 cub.ft., the maximum number of patients in any one ward was fourteen, so that 126.1 sq. ft. and 2,396 cub.ft. were allowed per patient.

At the same time steps were taken to ensure frequent change of air in the wards. The windows were kept wide open, day and night, and as they were situated opposite each other very efficient cross-ventilation was obtained.

The doors of the wards likewise stood open day and night.

Posture of Patients. During the seven or ten days subsequent to the fall of temperature the patients were kept in the horizontal position; after this, they were permitted to sit up for meals and then for a gradual ly increasing length of time day by day. When they had been "sitting up in bed" for a week, they were allowed "up in blankets", and the following day "in clothes". By this gradual progression into the erect posture one endeavoured

endeavoured to exclude all possibility of cardiac failure in the post-critical stage.

Diet. While the pyrexia persisted this consisted of milk, water, lemon drinks, imperial drink, chicken-tea. An endeavour was made to get the patients to drink large quantities of fluids with the object of reducing the degree of toxaemia. After the temperature had settled the diet was gradually increased in the usual way.

The toilet of the mouth was carefully attended to, the tongue being swabbed frequently with glycerine and borax, and the fauces with chlorine water or carbolic lotion (1 in 60).

Cold baths, used much in past epidemics and still advised by some authorities, were not employed, frequent tepid sponging being carried out instead.

Hypnotics were ordered frequently for insomnia, delirium &c., antipyretics were not prescribed.

Stimulants. It is considered by many that typhus fever is the fever above all others in which to administer alcohol, but in the above cases it was not given as a matter of routine, being prescribed for six cases

cases only out of twenty-five. It was given in the form of whisky and only when there were indications of cardiac failure.

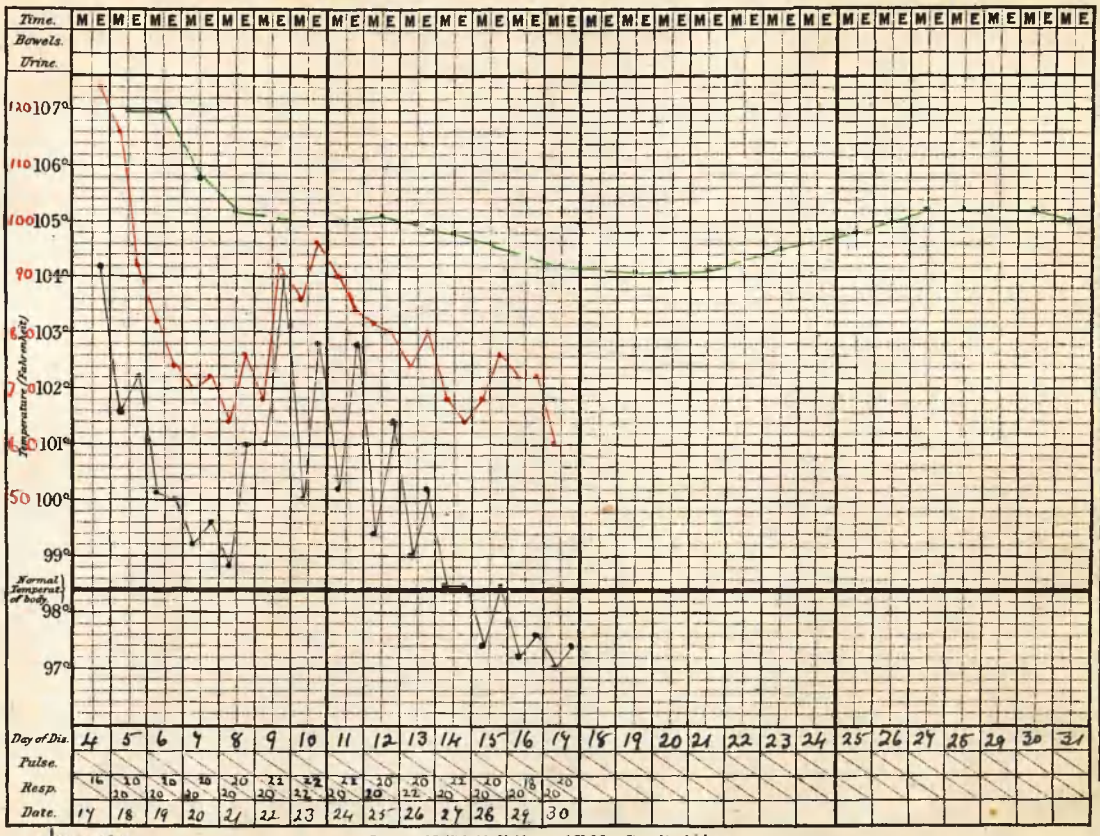
The treatment otherwise was the same as is adopted in any acute febrile condition.

BIBLIOGRAPHY.

1. Murchison on Continued Fevers. Edited by Cayley.
2. Typhoid and Typhus Fevers. Nothnagel's Encyclopedia of Practical Medicine.
3. The Principles & Practice of Medicine, Osler.
4. Acute Contagious Diseases, Welch & Schamberg.
5. Infectious Diseases, G.H.Roger.
6. Infectious Diseases, C.B.Ker.
7. Researches on the Daily Excretion of Urea in Typhus Fever. Keith Anderson, Edin. Med.Journal, Feb. 1866.

Case.

Name Case 1 Age 24yrs. Disease Result



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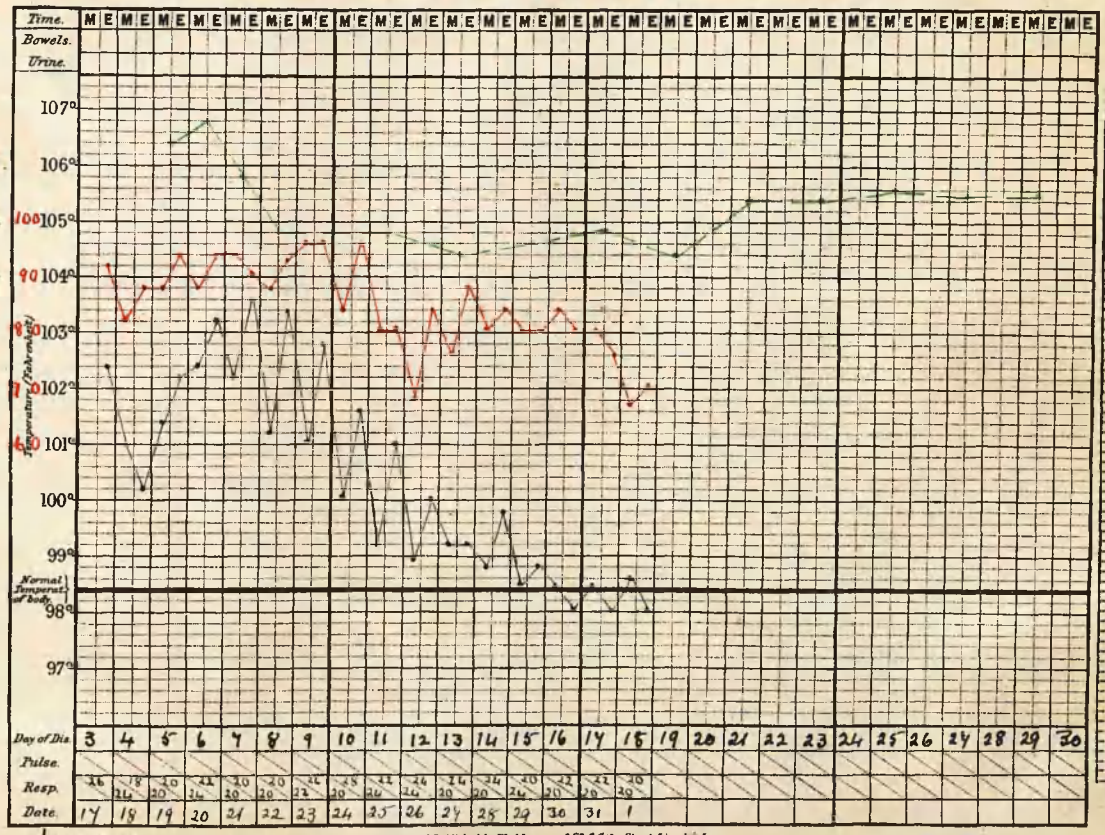
Case.

Name Case 2 Age 27yrs. Disease Result



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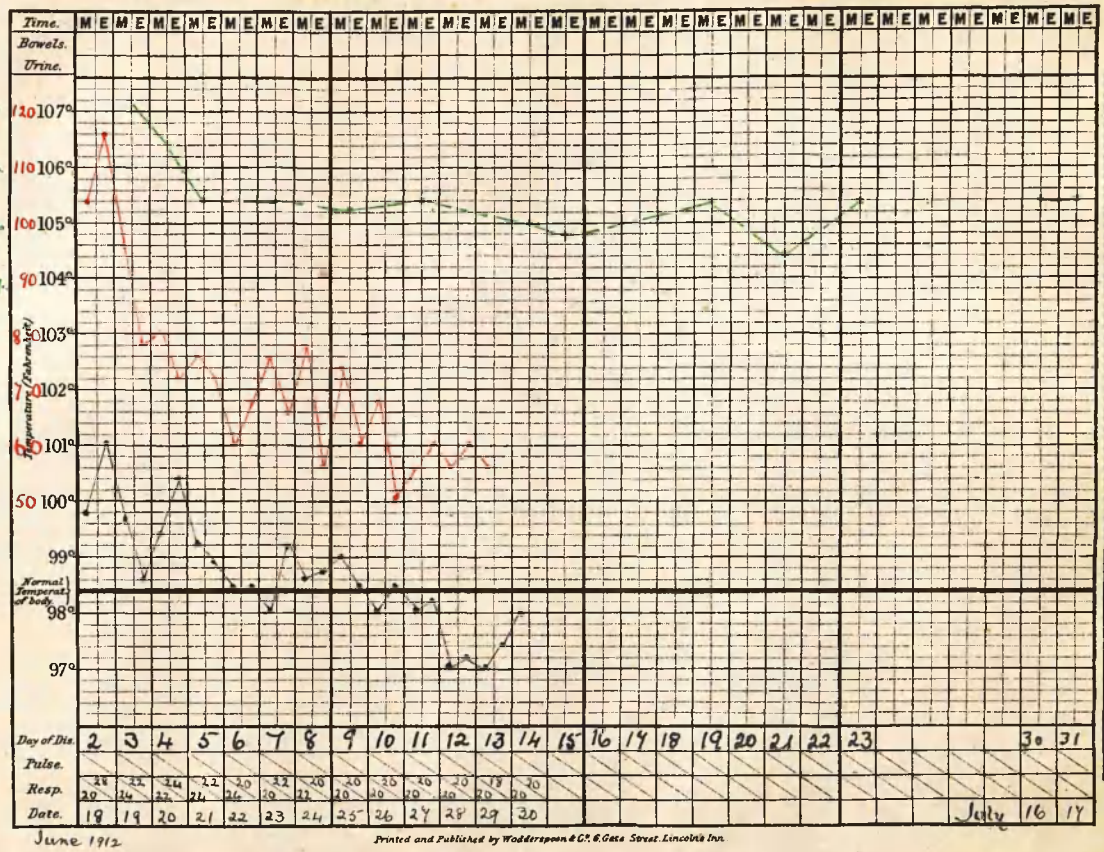
Case.

Name Case 3 Age 12 yrs. Disease Result



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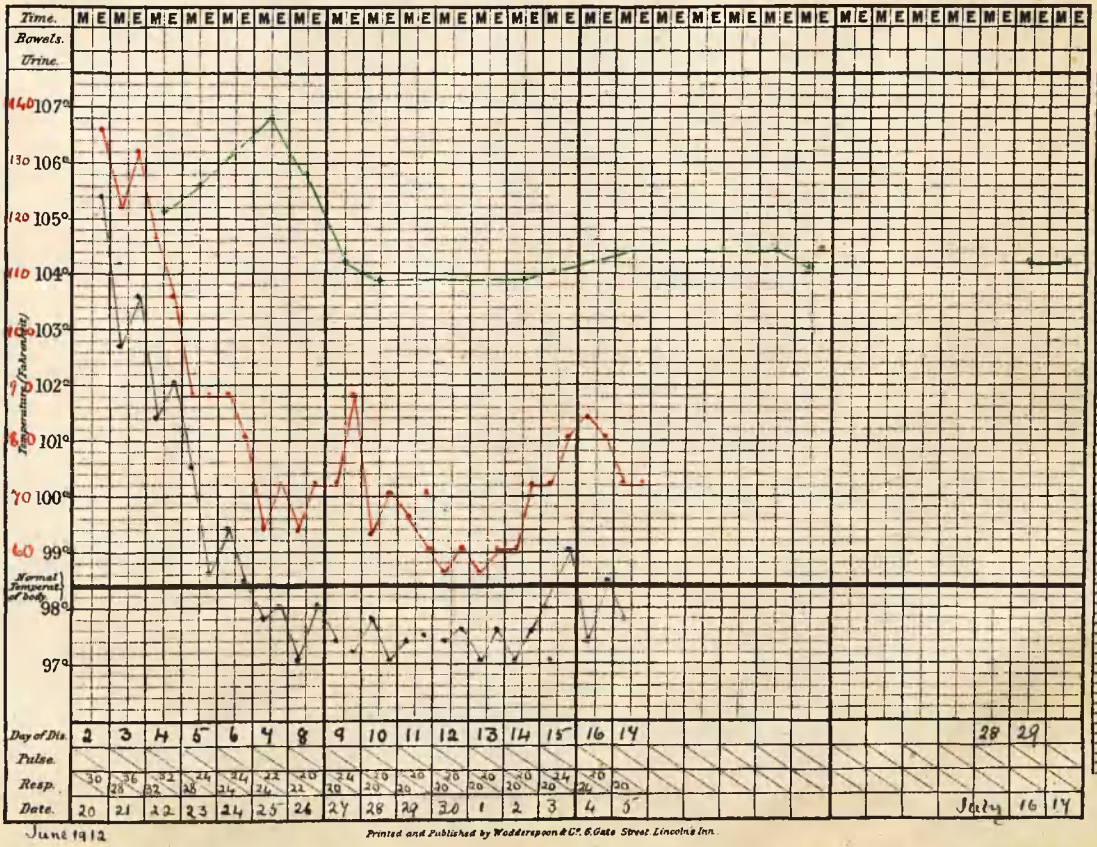
Case.

Name Case 4. Age 13½ yrs. Disease Result



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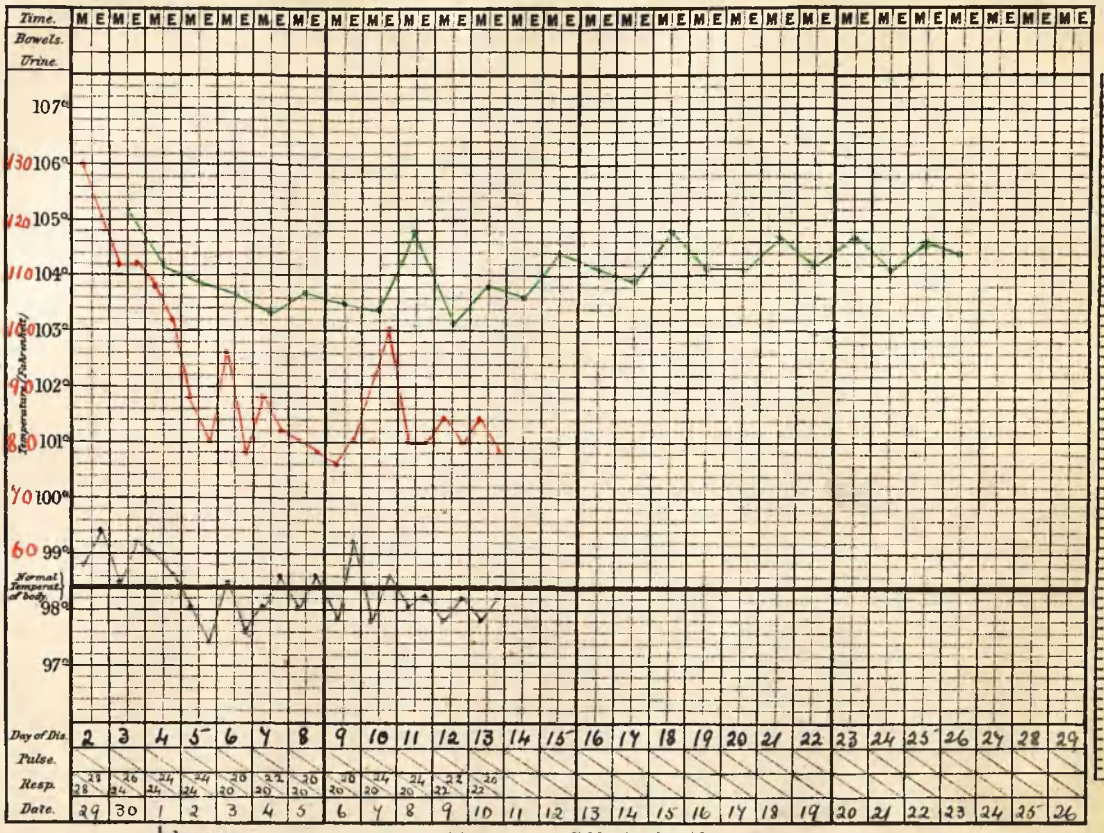
Case.

Name Case 5 Age 4 yrs. Disease Result



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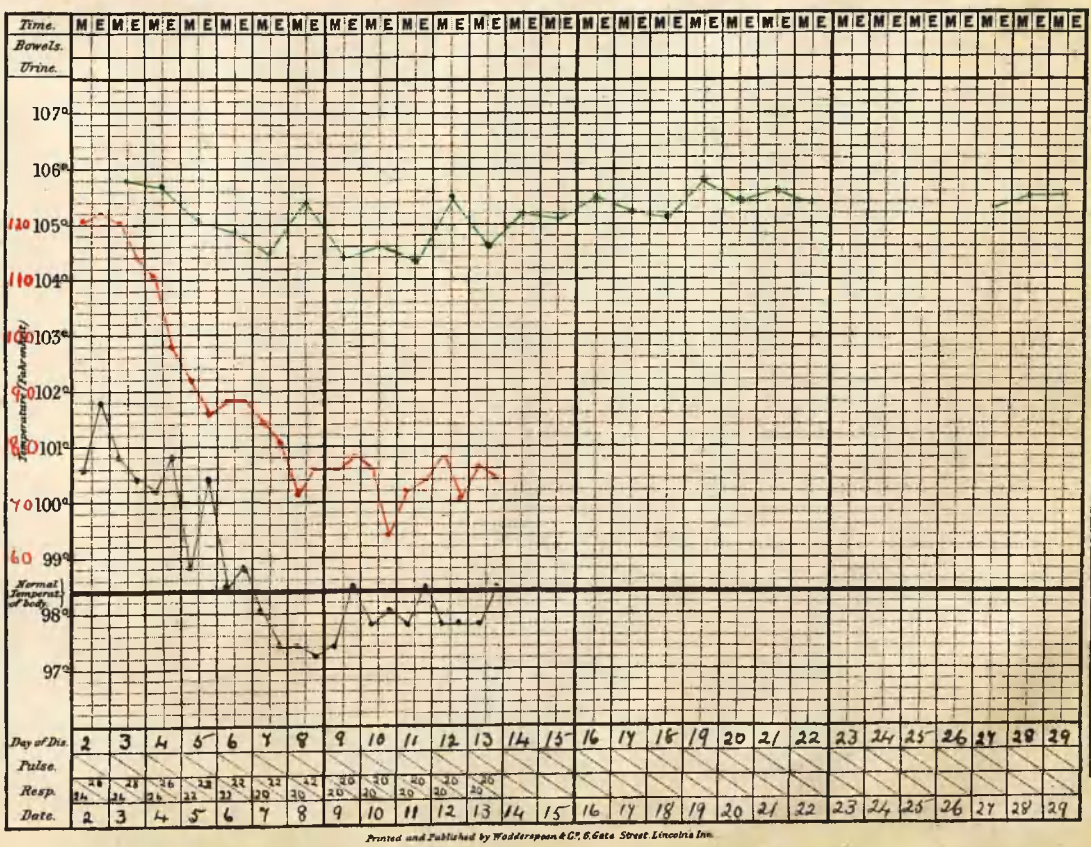
Case.

Name Case 6 Age 14 yrs. Disease Result



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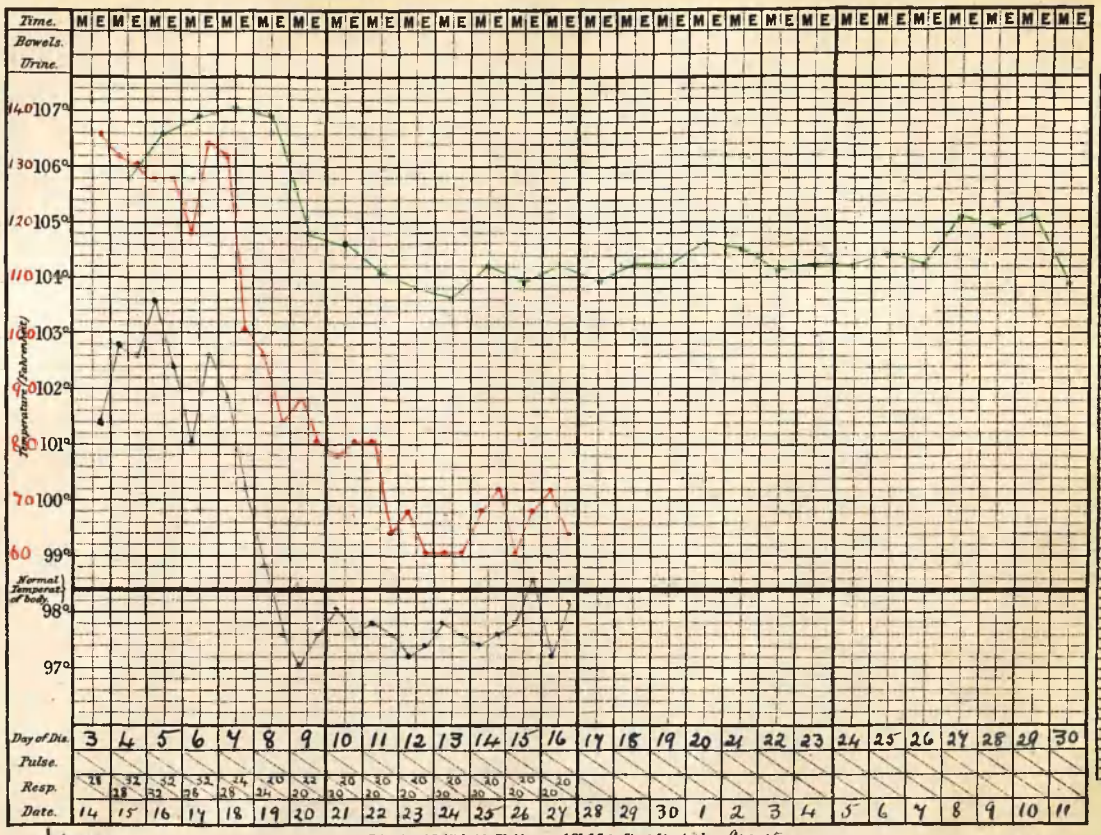
Case.

Name Case 7 Age 13yrs. Disease Result



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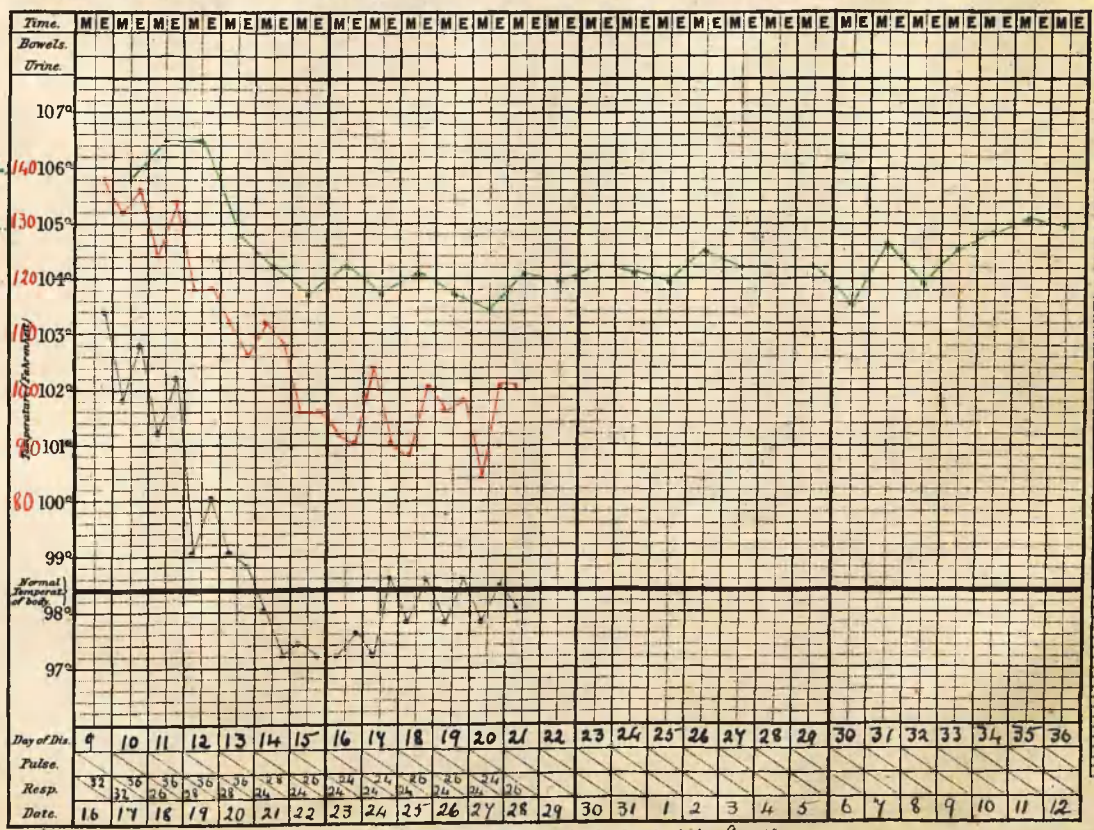
Case.

Name Case 8 Age 5yrs. Disease Result



July 1912

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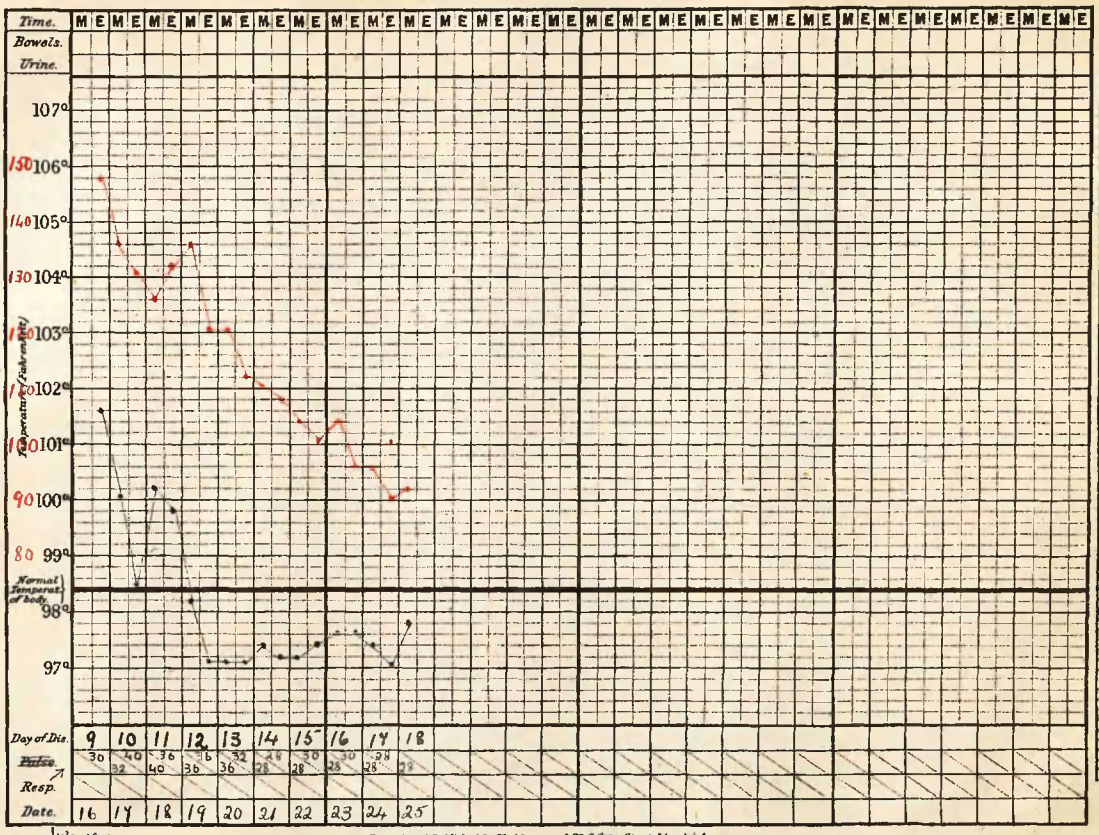
Case.

Name Case 9 Age 2 yrs. Disease Result



July 1912

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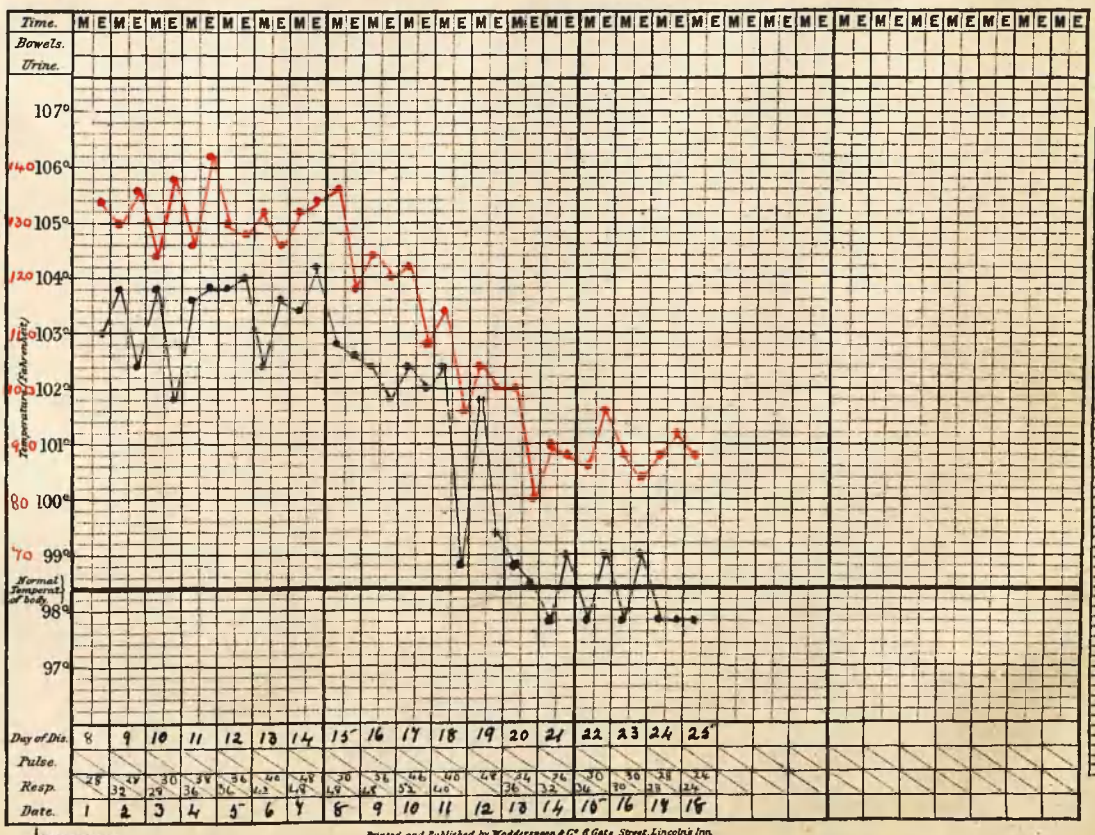
Case.

Name Case 11. Age 13 yrs. Disease Result



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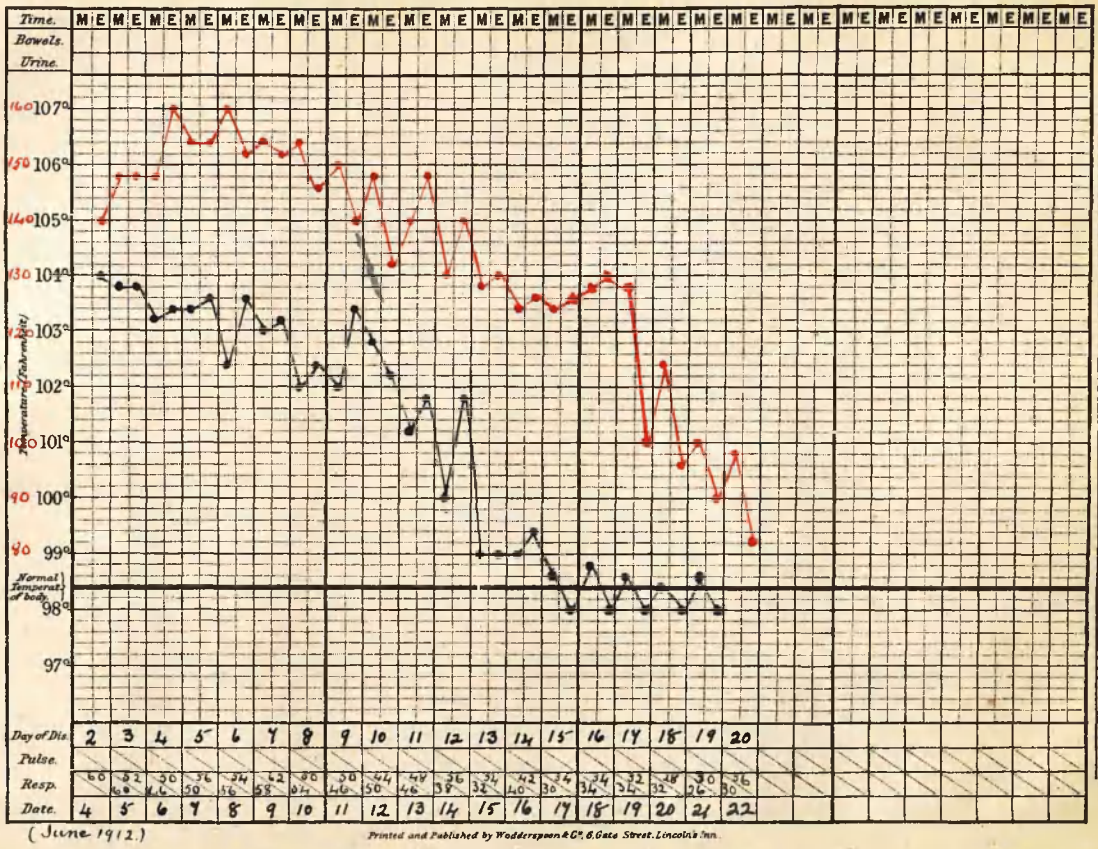
Case.

Name Case 12 Age 3yrs. Disease Result



(June 1912.)

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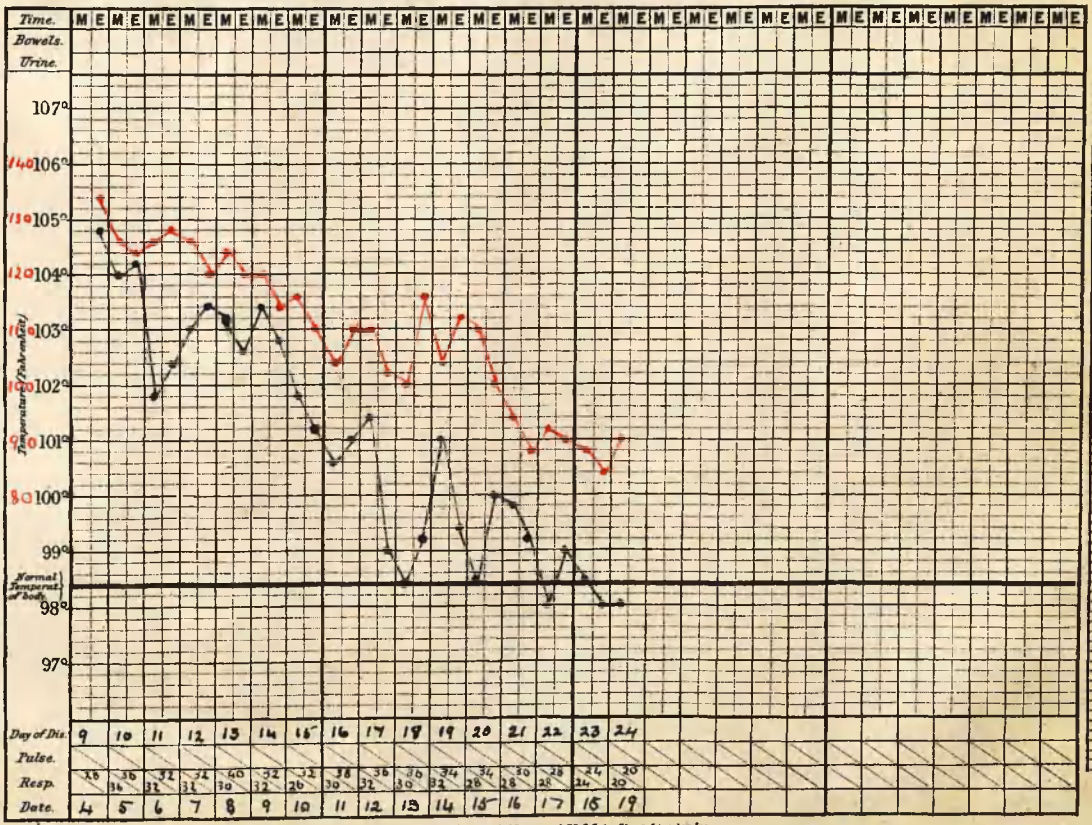
Case.

Name Case 13 Age 44yrs. Disease Result



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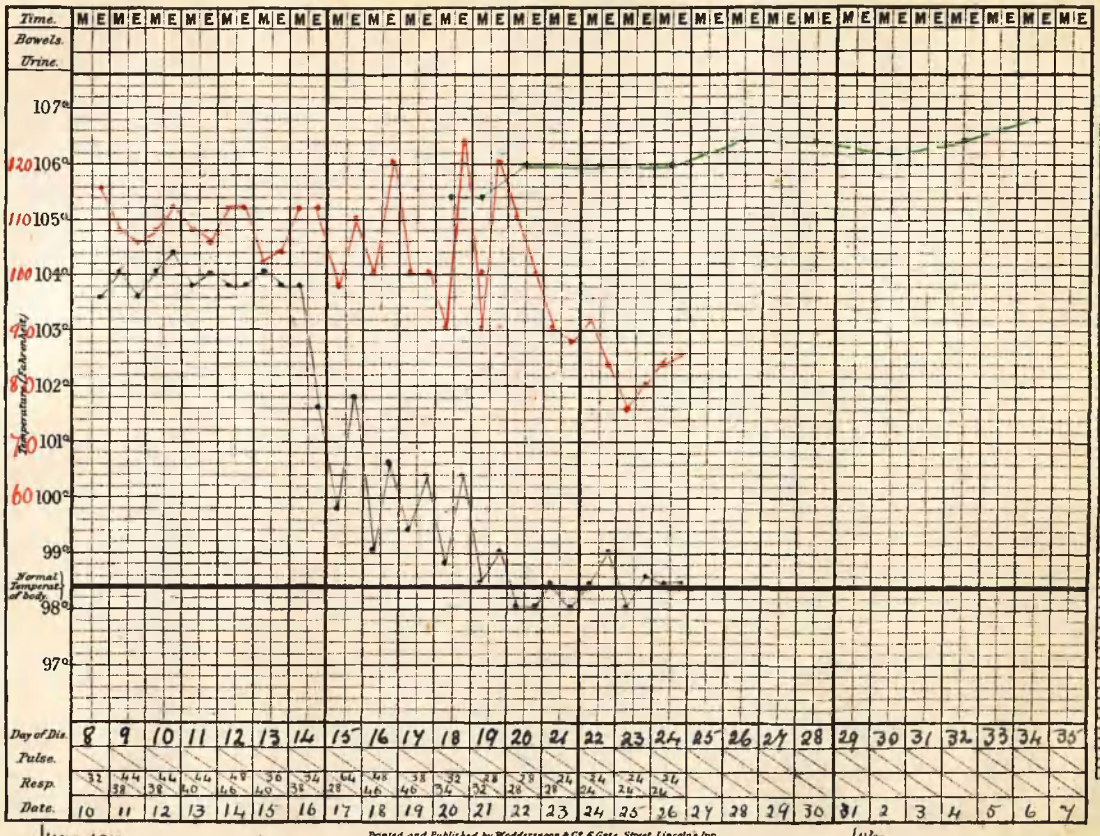
Case.

Name Case 15 Age 16 yrs. Disease Result



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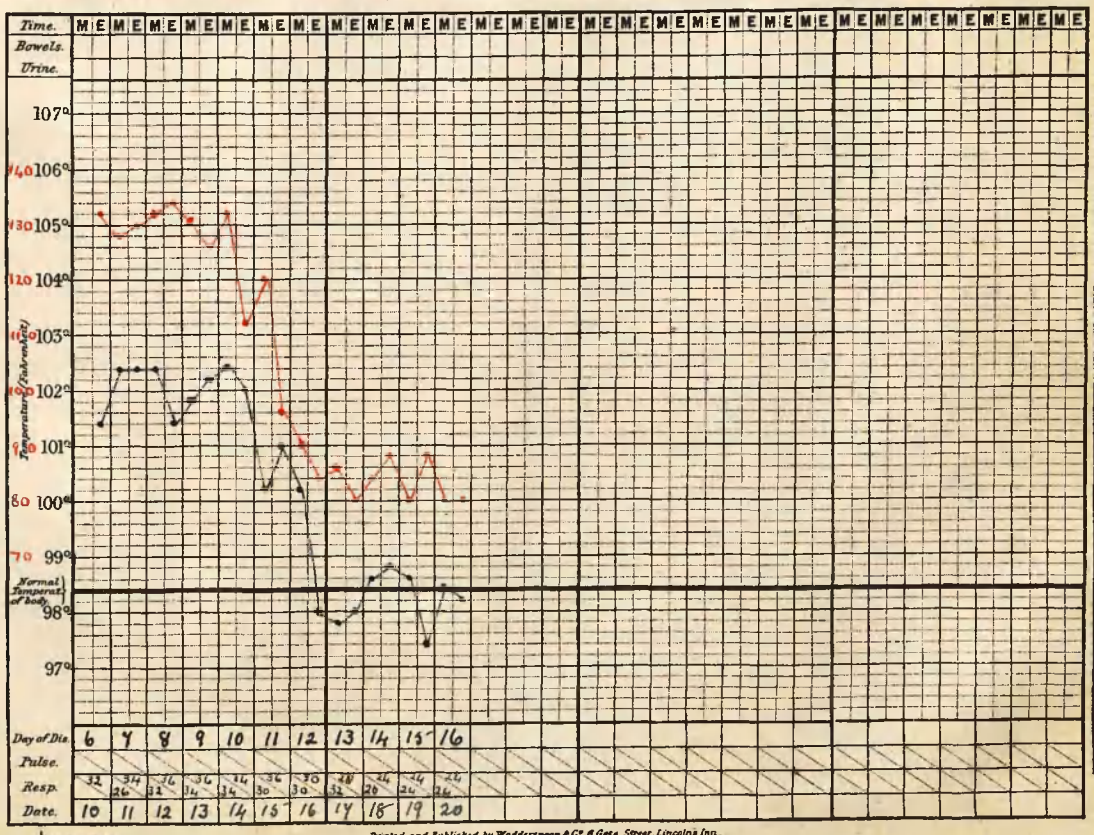
July

Case.

Name Case 16. Age 44 yrs. Disease Result



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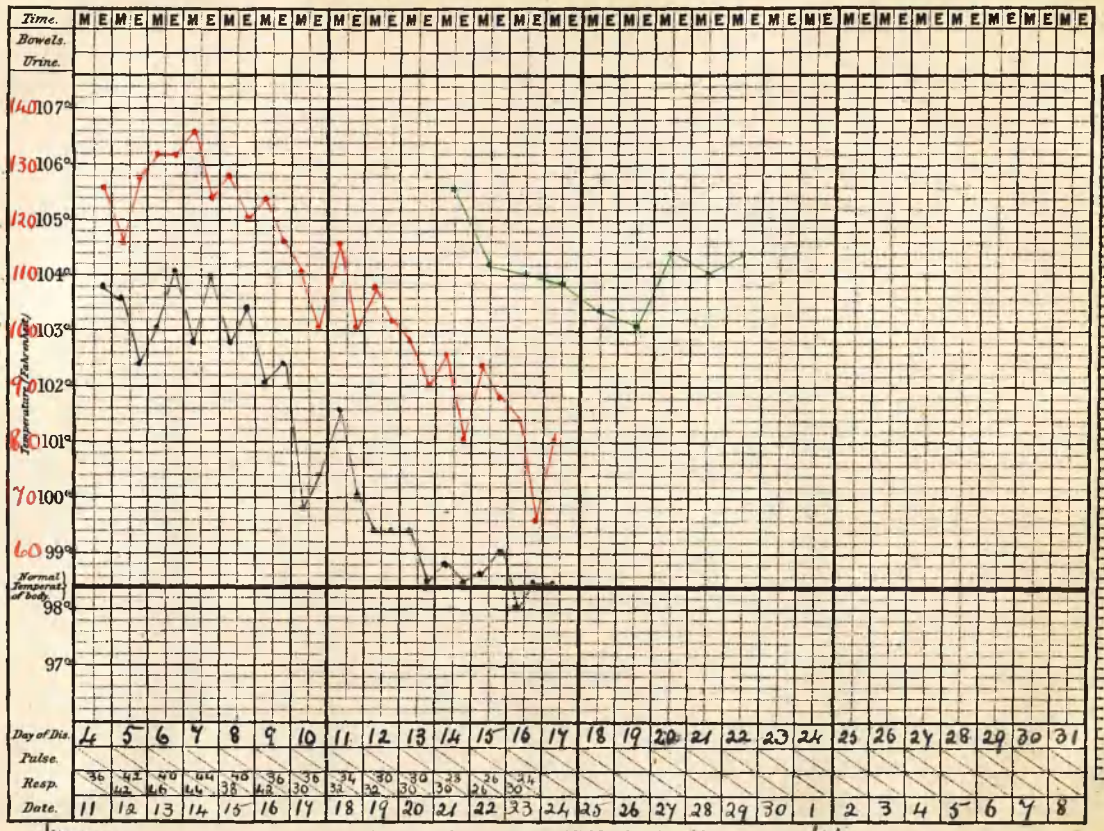
Name Case 17 Age 11 yrs. Disease Result



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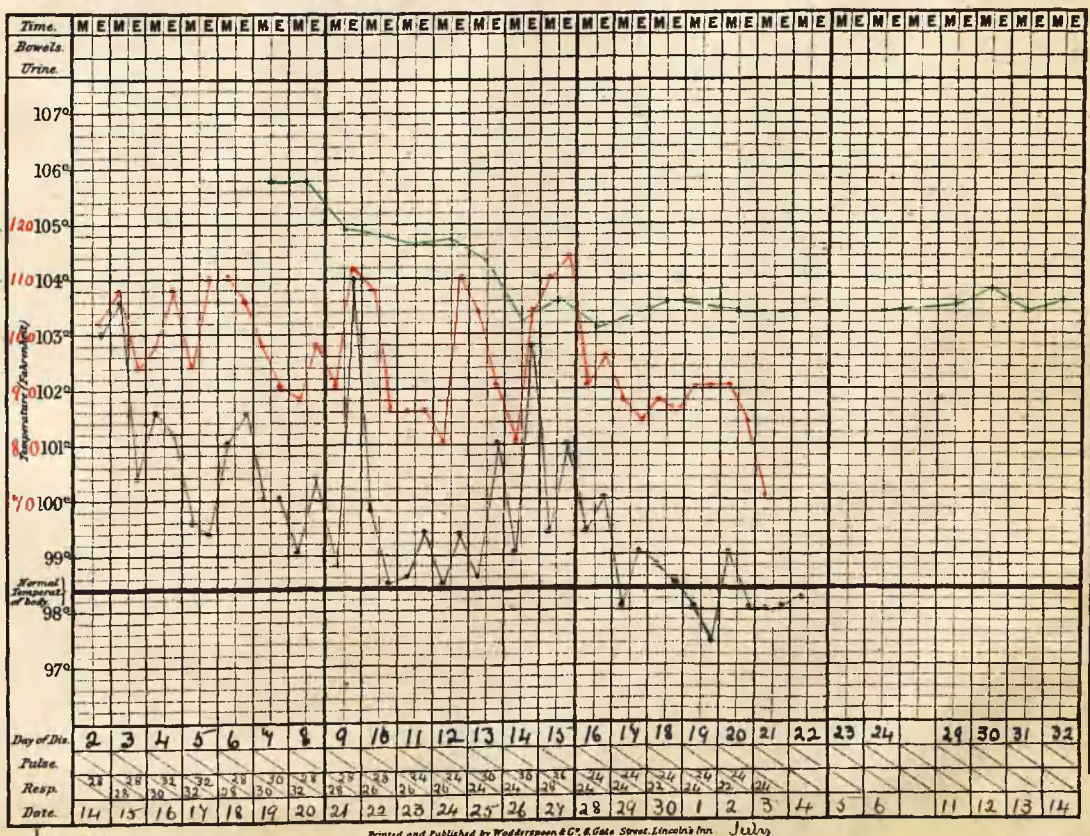
Name Case 20 Age 12 yrs. Disease Result



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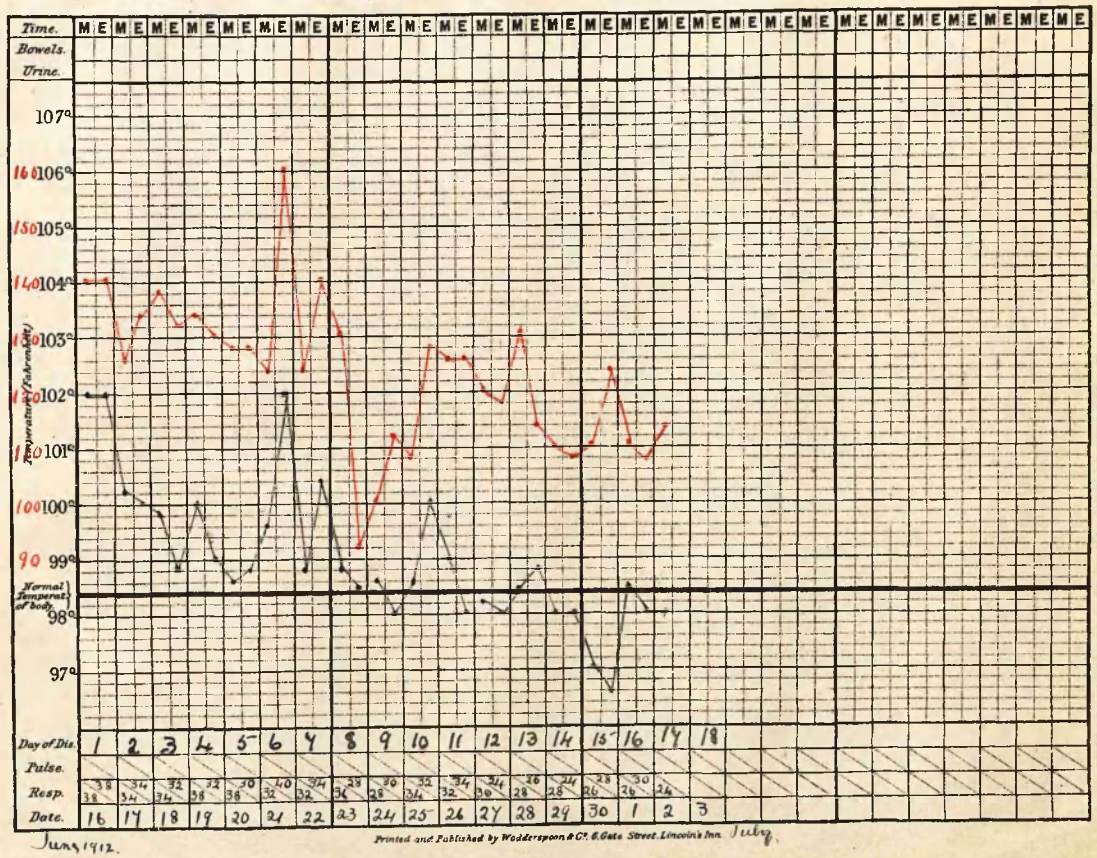
July

Case.

Name Case 23 Age 2 yrs. Disease Result



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