

THE STREPTOCOCCO-OPSONIC INDEX IN SCARLATINA,
ERYSIPELAS, AND PUERPERAL FEVER,

By

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THE STREPTOCOCCO-OPSONIC INDEX IN SCARLATINA,
ERYSIPELAS, and PUERPERAL FEVER.

The observations detailed in this paper were made between January, 1909, and March, 1910, involving 40 patients, 12 with scarlet fever, 13 with erysipelas, and 15 with puerperal fever. Those in connection with erysipelas were made at Ruchill Fever Hospital, Glasgow, between January and April, 1909; those on puerperal fever at Belvidere Fever Hospital, Glasgow, between May and August, 1909; and those on scarlet fever at Grove Fever Hospital, London, between September, 1909, and March, 1910. In all 820 opsonic estimations are recorded,

300 on erysipelas,
251 on puerperal fever,
and 269 on scarlet fever,

requiring altogether about 116 c.c. of blood.

TECHNIQUE

The Leishman-Wright (1) method of opsonic estimation was employed throughout with slight modifications.

Serum.

- (a) Patient's: obtained by pricking the finger, and allowing the blood to flow into a straight capillary tube about one decimetre in length and one millimetre internal diameter. The end of the tube which had not come in contact with blood was closed in a spirit flame, leaving an

air space between the closed end and the blood of from two to three centimetres.

(b) Control: my own serum was always used as the control, and was obtained in a similar way. I have not had an attack of scarlet fever, nor of erysipelas.

The blood in each capillary tube was allowed to clot, and the clot drawn out before centrifuging.

This method gave an ample supply of serum, which was easily transferable to the mixing pipette by breaking off the closed end and aspirating.

Leucocytes.

My own leucocytes were ^{used} ~~made~~, being the most convenient, and the associated red cells not being susceptible of isoagglutination. (2)

A small test tube, about six centimetres long and one and a half c.c. capacity, was filled to a 1.25 c.c. mark with .85% sodium chloride and 1.5% sodium citrate solution. The finger was pricked and several drops of blood - about .2 c.c. - added. The tube was then shaken gently to ensure thorough mixing, and centrifuged, and the clear upper fluid then pipetted off, without disturbing the white layer of leucocytes: no washing was considered necessary.

Bacterial Emulsion.

The streptococcus used throughout the whole series was obtained from a case of otitis media, and was apparently a typical streptococcus pyogenes, growing well on agar at 37° C. and on gelatine at 20° C. It did not

clot milk, nor did it reduce neutral-red, nor produce acid in raffinose, inulin, or mannite, but did so in cane sugar, lactose, and salicin. In broth and in gelatin at 37° C. the growth did not affect the transparency of the media, but collected in flocculent masses at the bottom of the tubes. (3) (4)

To prepare the emulsion two small specks on a platinum loop ^{were raked} from a 12-to-14 hours' growth on agar, ~~raked~~ and transferred to a watch-glass containing about .2 c.c. normal saline solution. Each loop-raking was well broken up by rubbing the platinum wire against the watch-glass, and by tilting the latter so that the rubbing was done in a thin film of saline, thereby preventing particles from floating away before thorough trituration. By this means an opalescent emulsion was quickly obtained, which, after transferring to a small test-tube, such as has already been mentioned for the leucocytes, was allowed to stand for two hours. At the end of that time the upper two thirds of the emulsion was free from clumps, and very uncommonly contained chains of more than eight cocci. An enumeration of ten such emulsions showed that they held in suspension in their upper two-thirds, on an average about 350,000,000 cocci per c.c.

Mixing.

Having thus obtained the three essentials for the test, two units of leucocytes were aspirated into a capillary pipette, followed by one unit of emulsion and one unit of serum, with an air-bubble between. The three constituents were then mixed on a watch-glass by

several times aspirating and expelling from the pipette, after which the mixture was allowed to flow up a capillary tube, - ^{one} ~~over~~ such as has already been described for collecting serum. The tube was then tilted so that the mixture came to occupy the centre, whereupon the two ends were sealed, and incubation continued for fifteen minutes at 37° C. Films were then made in the usual way, and stained by Leishman's stain, and the cocci in fifty neutrophile leucocytes counted.

With regard to the opsonic technique in general, it is perhaps worth while quoting the words of J.C. Da Costa, (5) who warningly remarks, "It is obvious to any one who has worked with the opsonin test that satisfactory results demand considerable patience, a certain manual dexterity, and an absolutely faultless technique on the part of the examiner, for the lack of which one's theoretical conception of the subject, however thorough, and the laboratory equipment at one's command, however elaborate, can never compensate. On paper the test is a simple procedure; but in the laboratory it necessitates most rigid adherence to each technical detail, from the collection of the blood sample until the stained specimens are placed on the stage of the microscope. One false step may be sufficient to negative the result of an hour or two of continuous work."

Observations on the phagocytic process.

The process of engulfment of the cocci can easily be followed under the microscope by means of an improvised warm-stage, made of a piece of sheet-copper, on the even surface of which a mechanical stage may be

adjusted to move with smoothness and precision.

The cocci while outside the leucocyte are affected with Brownian movement. The leucocyte protrudes its ectosare in various directions, and the granules move to and from the pseudopodium in a streaming fashion, like the rush of pebbles on a steep gravelly shore with the flow and ebb of the waves. If a chain of cocci is at hand one end is attacked by the pseudopodium, and gradually the whole is sucked into the interior, the continuity of the chain being undisturbed, and the cocci always lying in the cytoplasm without the nucleus. Vacuoles appear, and in these the chains range themselves very characteristically round the periphery; much less often do they lie diametrically. Two vacuoles in one leucocyte are not uncommonly met with, and occasionally three. [See Photo-micrographs]

In the films some points of interest were noted.

1. Eosinophiles were occasionally found with engulfed cocci, but much more often without, and a fractured eosinophile with cocci amongst its scattered granules was now and again met with. J.D. Da Costa (5) has suggested that the juxtaposition of ruptured eosinophiles with bacteria has some significance. Macgregor, (6) on the other hand, found that eosinophiles in cerebro-spinal fever did not phagocytose meningococci at all.
2. Clusters of blood-platelets were more often associated with unengulfed cocci than without.
3. Large mononuclears on rare occasions were phagocytic to cocci.

4. Erythrophagocytosis associated with erythroagglutination was present in one case of erysipelas, Case XXII, appearing during the first three days of a recurrence, when the opsonic index was .61, .46, and .41. With the rise of the index the phenomenon passed away, but reappeared nine days later, and persisted for fourteen days, at the end of which time the patient left hospital. During the latter period the average daily index was .59. Macgregor (6) has recorded four cases of such associated phenomena in cerebrospinal fever, and Hektoen (2) two cases of erysipelas exhibiting autoagglutination and autophagocytosis of red cells. The former author likewise found that the opsonic index for the meningococcus fell with the appearance of the erythrophagocytosis, and increased when the latter disappeared.

See Chart ←

SCARLATINA

Of the twelve cases investigated five were uncomplicated and ran an ordinary course, four had kidney complication, and three died. The opsonic index was taken daily in all cases, and at about the same time each day.

A. Uncomplicated Cases:

x Case I. - Girl, aged 15 years, admitted with well-marked rash, fauces red and swollen, submaxillary lymph glands enlarged, temperature 99.2° F.

x A chart accompanies each case.

<u>Index,</u>	<u>Day of disease.</u>	<u>Index</u>	<u>Day of Disease</u>
.62	5th	1.30	17th
1.46	6th	.95	18th
1.20	7th	1.00	19th
1.07	8th	1.01	20th
1.10	9th	1.45	21st
1.00	10th	2.07	22nd
1.44	11th	.89	23rd
1.18	12th	.95	24th
.70	13th	1.42	25th
1.10	14th	1.12	26th
1.60	15th		
1.24	16th		

Case II.- Girl, aged 15 years, admitted with a bright punctate erythema, with exudation on the tonsils, and with enlarged submaxillary lymph glands, temperature 101° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of disease</u>
.72	3rd	.90	14th
.80	4th	1.07	15th
1.00	5th	.84	16th
1.10	6th	1.03	17th
.80	7th	1.57	18th
.88	8th	1.46	19th
.95	9th	1.73	20th
1.00	10th	1.21	21st
.96	11th	1.35	22nd
1.24	12th	.92	23rd
1.11	13th		

Case III. - Woman, aged 28 years, admitted with a bright rash, and with exudation on the tonsils, temperature 100.4° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.72	4th	1.40	14th
.82	5th	1.16	15th
.71	6th	.70	16th
.89	7th	.87	17th
1.00	8th	1.64	18th
1.15	9th	1.50	19th
1.20	10th	1.63	20th
1.44	11th	1.44	21st
1.12	12th	1.18	22nd
1.26	13th		

On the 5th, 6th and 7th days had pain in the knees, ankles and elbows.

Case IV. - Boy, aged 10 years, admitted with a brilliant rash, faucial oedema, and superficial ulceration of the right tonsil, temperature 103° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.74	3rd	1.02	13th
.85	4th	1.00	14th
.90	5th	.77	15th
1.12	6th	1.27	16th
1.04	7th	1.63	17th
1.04	8th	1.35	18th
1.15	9th	1.13	19th
1.34	10th	1.18	20th
1.24	11th	.88	21st
1.11	12th	1.17	22nd

Case V. - Boy, aged 13 years, admitted with bright rash, red and swollen fauces, and enlarged submaxillary lymph glands, temperature 98.2° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.75	3rd	1.10	14th
.86	4th	1.00	15th
1.20	5th	1.01	16th
.93	6th	1.04	17th
1.02	7th	1.35	18th
1.10	8th	1.01	19th
1.44	9th	1.00	20th
1.14	10th	1.08	21st
.85	11th	1.00	22nd
1.10	12th	1.21	23rd.
.87	13th		

TABLE A.

Table of opsonic indices in Scarlatina during first three weeks, of five uncomplicated cases
+ two cases before complications set in.

Day of Disease	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st
Case I.	-	-	.62	1.46	1.20	1.07	1.10	1.00	1.44	1.18	.70	1.11	1.60	1.24	1.30	.95	1.00	1.01	1.45
" II.	.72	.80	1.00	1.10	.80	.88	.95	1.00	.85	1.10	.87	1.10	1.00	1.01	1.04	1.35	1.01	1.00	1.08
" III.	-	.72	.82	.71	.89	1.00	1.15	1.20	1.44	1.12	1.26	1.40	1.16	.70	.87	1.64	1.50	1.63	1.44
" IV.	.74	.85	.90	1.12	1.04	1.04	1.15	1.34	1.24	1.11	1.02	1.00	.77	1.27	1.63	1.35	1.13	1.18	.88
" V.	.75	.86	1.20	.93	1.02	1.10	1.44	1.14	.96	1.24	1.11	.90	1.07	.84	1.03	1.57	1.46	1.73	1.21
" VI.	.68	.75	.56	1.30	1.13	.93	1.00	.66	1.07	.80	.75	.84	.80	1.16	1.03	.90	-	-	-
" VII.	.72	.75	.90	1.17	1.14	1.27	.73	.70	1.29	1.31	1.61	1.62	1.30	1.10	.85	1.15	1.13	1.30	1.10
Total	3.61	4.73	6.00	7.79	7.22	7.29	7.52	7.04	8.29	7.86	7.32	7.97	7.70	7.32	7.75	8.91	7.23	7.85	7.16
Average	.72	.79	.86	1.11	1.03	1.04	1.07	1.00	1.18	1.12	1.04	1.14	1.10	1.04	1.10	1.27	1.20	1.31	1.19
Weekly average	.86					1.08							1.17						
Number of Estimations	32					49							46						

On referring to Table A. it is seen that the average index during the first week in scarlet fever is .86, during the second week 1.08, and during the third week 1.17, showing that there is a substantial relative increase of opsonin in the second week, which is during the third week further enhanced. Banks (7), on the other hand, records that during the second week a marked fall occurs, which is continued into the third week, and probably reaches its maximum in this week. It would seem, however, on clinical grounds, that immunity in scarlet fever during the early weeks is increased and not diminished, in as much as the percentage of true second attacks or real reinfections or relapses during that period is practically negligible.

Table A. shows, also, that the normal index is reached on the fifth or sixth day, and the figures for the following three days correspond generally with those of Tunnicliffe, (8) who found a rise of index above normal between the seventh and the ninth day.

It may be noted, probably as a curiosity, that the increment of opsonin on the fourth and fifth days may be represented by the fraction .07, as compared with the third and fourth days respectively, as if the increase were a very regular one. Moreover, if .07 be subtracted from the third day index, we get .65, which was the index observed on the second day in Case XII.

Thus .65 = second day index in Case XII

$$\begin{array}{r} .07 \\ \hline .72 \end{array} = \text{third day average index}$$

$$\begin{array}{r} .07 \\ \hline .79 \end{array} = \text{fourth day average index}$$

$$\begin{array}{r} .07 \\ \hline .86 \end{array} = \text{fifth day average index.}$$

Taking the temperature in relation to the index it was found that the average temperature of the severe cases on the fifth day was 100° F., and on the sixth day 99.1° F., corresponding to indices of .86 and 1.11 respectively. It would appear, therefore, that as the temperature falls the index rises, and it may be added that the elevation of the index corresponds clinically with the decline in severity of symptoms. Accordingly, it may be concluded that the course of the index in the initial stages of scarlatina is analogous to that observed in pneumonia, as recorded by Macdonald (9) and by Wolf (10), and to that observed in erysipelas as recorded by Tunnicliffe. (11)

B. Four cases complicated with albuminuria or nephritis.

Case VI. - Boy, aged 8½ years, admitted with general punctate rash, faucial oedema, nasal discharge, and enlarged submaxillary lymph glands, temperature 101° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.68	3rd	.80	15th
.75	4th	1.16	16th
.56	5th	1.03	17th
1.30	6th	.90	18th
1.13	7th	.59	19th
.93	8th	.60	albumen 20th
1.00	9th	.61	" 21st
.66	10th	.75	" 22nd
1.07	11th	.80	" 23rd
.80	12th	.83	" 24th
.75	13th	.58	" 25th
.84	14th	.57	" 26th

A cloud of albumen appeared in the urine on the twentieth day of the disease, the index on the day previous having fallen to .59, and continuing at a low figure till the 26th day, when the observations were unavoidably discontinued.

Case VII. - Girl, aged 4 years, admitted with a bright erythema, faucial oedema, exudate on the tonsils, and nasal discharge, temperature 101.8° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.72	3rd	1.66	24th
.75	4th	1.50	25th
.90	5th	1.63	26th
1.17	6th	1.56	27th
1.14	7th	.80	28th
1.27	8th	.88	29th
.73	9th	.93	30th
.70	10th	.78	albumen 31st
1.29	11th	.83	" 32nd
1.31	12th	1.09	" 33rd
1.61	13th	1.14	" 34th
1.62	14th	.81	35th
1.30	15th	1.16	36th
1.10	16th	1.13	37th
.85	17th	1.07	37th
1.15	18th	1.28	39th
1.13	19th	1.68	40th
1.30	20th	1.53	41st
1.10	21st	.97	42nd
1.15	22nd	1.04	43rd.
1.22	23rd		

Albuminuria appeared on the 31st day of the disease, a decided relative lowering of the index having been present for the three preceding days, The amount of albumen was slight, and persisted for four days only.

Case VIII. - Boy, aged 14 years, admitted with mild initial symptoms, developed albuminuria on the 20th day of disease, and haematuria on the 24th day, albuminuria persisting till the 60th day.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.62	20th	1.11	48th
.60	21st	2.00	49th
.65	22nd	1.39	50th
.71	23rd	.92	51st
.72	24th	.84	52nd
.83	25th	1.92	53rd
.89	26th	1.15	54th
.82	27th	1.43	55th
.73	28th	.92	56th
.82	29th	1.53	57th
.82	30th	1.33	58th
.80	31st	1.63	59th
.74	32nd	1.08	60th
1.00	33rd	1.20	albumen 61st
1.43	34th	1.61	absent 62nd
1.13	35th	1.25	63rd
1.26	36th	1.04	64th
.84	37th	.90	65th
1.30	38th	1.14	66th
1.00	39th	1.10	67th
.83	40th	1.25	68th
1.00	41st	1.38	69th
1.13	42nd	.84	70th
2.00	43rd	1.25	71st
1.67	44th	1.34	72nd
1.14	45th	1.34	73rd
2.20	46th	1.31	74th
.93	47th	1.16	75th.

Case IX. - Girl, aged 5 years, admitted with moderately severe initial symptoms developed albuminuria with haematuria on the 29th day of the disease: albuminuria persisted till the 62nd day.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.66	29th	1.07	39th
.77	30th	1.13	40th
.54	31st	1.86	41st
1.07	32nd	1.88	42nd
1.39	33rd	1.14	43rd
1.23	34th	.90	44th
.52	35th	.66	45th
.90	36th	.85	46th
.62	37th	.88	47th
.77	38th	1.00	48th

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
2.01	49th	1.10	57th
2.03	50th	1.69	58th
1.63	51st	1.12	59th
1.30	52nd	.98	60th
1.12	53rd	1.00	61st
.78	54th	1.04	62nd
1.18	55th	1.42	albumen 63rd
1.88	56th		absent

Table B. showing the indices in the first week of
albuminuria or nephritis.

Day of albumen	1st	2nd	3rd	4th	5th	6th	7th
Case VI.	.60	.61	.75	.80	.83	.58	.57
Case VII.	.78	.83	1.09	1.14			
Case VIII.	.62	.60	.65	.71	.72	.72	.83
Case IX.	.66	.77	.54	1.07	1.39	1.23	.52
<u>Total</u>	<u>2.66</u>	<u>2.81</u>	<u>3.03</u>	<u>3.72</u>	<u>2.94</u>	<u>2.53</u>	<u>1.92</u>
<u>Average</u>	<u>.66</u>	<u>.70</u>	<u>.76</u>	<u>.93</u>	<u>.98</u>	<u>.84</u>	<u>.64</u>

On referring to Table B. it is seen that the index shows a decided fall at the onset of albuminuria, the average for the first three days being .71. A rise to normal takes place about the fourth or fifth day. It may be noted, also, that in Cases VI and VII, which were examined in a routine way from the beginning of the disease, the indices showed a well-marked relative fall for the two or three days immediately preceding the appearance of albuminuria. These results correspond very closely with those of Banks (7) who found the average index during the early stages of nephritis to be .72. Case VIII presented the most severe symptoms of the four, and retained its relatively low index for thirteen days. In the later stages of nephritis high

indices were often recorded, as compared with the indices in ordinary convalescence.

C. Three fatal cases

Case X. - Girl, aged 2 years, admitted on the second day of disease with a bright erythema, much faucial oedema, but no ulceration, temperature 103.2 F., pulse rate 172 per minute, apparently very ill. The rash remained bright till the seventh day, when the patient died. The fauces did not ulcerate, and the general condition was one of acute toxæmia.

<u>Index</u>	<u>Day of Disease.</u>	<u>Index</u>	<u>Day of Disease</u>
.70	3rd	.83	6th
.64	4th	.30	Died 7th
.52	5th		

Case XI. - Girl, aged 8 years, admitted on the third day of disease with a history of delirium during the two previous days: punctate erythema confined to the pubes and inner sides of the thighs: deposit on both tonsils: fauces injected: temperature 103.4° F.: pulse uncountable: on the following day developed a "septic" rash of a papulo-macular type, and died, never having been quite conscious while in hospital.

The index on the fourth day of disease, being the day of death, was .46.

Case XII. - Boy, aged 3 years, admitted with a bright rash on the first day of disease: on the third day the rash had become "septic" in character, of a papular type, and the tonsils had ulcerated: temperature 104° F.: on the fifth day there was much nasal discharge

and the fauces were markedly oedematous: he died on the ninth day.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.65	2nd	.78	6th
.76	3rd	.83	7th
.66	4th	.44	8th
.72	5th		

Table C.

showing the indices in three fatal cases.

Day of Disease	2nd	3rd	4th	5th	6th	7th	8th	Total	Average
Case X		.70	.64	.52	.83	.30		2.99	.60
" XI			.46					.46	.46
" XII	.65	.76	.66	.72	.78	.83	.44	4.84	.69

The three fatal cases present a well-marked lowering of the opsonic index, and are in the main comparable to the three fatal cases observed by Banks (7), in one of which he found the index to be .55 on the day preceding death. The cases recorded here were of a very virulent type, dying on the seventh, fourth, and ninth days, whereas two of the above author's cases died at dates considerably later. The index during the last 24 hours of life was .30, .46, and .44 respectively, and the average index during the last five days in Case X. was .60, and during the last seven days in Case XII was .69. The pneumococco-opsonic index in acute lobar pneumonia has been investigated by Rosenow (10) and by Wolf (11), and they likewise have found a markedly subnormal index in fatal cases.

ERYSIPELAS

Thirteen cases were investigated. Of these, eight may be described as ordinary and uncomplicated, one was of the migratory type, and five had recurrences.

D. Uncomplicated Cases.

Case XIII. - Woman, aged 48 years, with moderately severe attack involving both sides of the face, and with much oedema of the eyelids, temperature 102.8° F. on admission, cloud of albumen in urine. Temperature fell to normal on the seventh day of disease.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
1.20	5th	1.07	15th
.59	6th	1.00	16th
.92	7th	1.34	17th
.55	8th	1.16	18th
.88	9th	.96	19th
1.04	10th	1.34	20th
1.20	11th	2.01	21st
1.57	12th	1.60	22nd
.82	13th	1.06	23rd.
.96	14th		

On the fifth day the temperature was falling, and the clinical symptoms indicated that the disease had passed its maximum. A well marked negative phase followed, and after that till the 25th day the index was normal or above normal, the highest record being 2.01.

Case XIV. - Woman, aged 44 years, admitted with a facial attack when the redness and swelling had receded to the region of the auricles, albuminuria, temperature 96.8° F., being the sixth day of the disease.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.91	6th	.54	12th
1.06	7th	1.76	13th
1.22	8th	.80	14th
.80	9th	.62	15th
.96	10th	1.54	16th
1.33	11th	1.32	17th

On the 12th and 15th days the patient suffered from excessive diarrhoea, and the index was apparently lowered by its presence. There was no evident cause to account for the diarrhoea.

Case XV. - Man, aged 43 years, admitted with a slight facial attack and with a history of two previous attacks about a year ago: redness of the face disappeared quickly, and was entirely gone on the fifth day of disease: trace of albumen in urine.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.74	3rd	1.00	9th
1.60	4th	.98	10th
.53	5th	1.21	11th
.85	6th	.77	12th
.81	7th	.70	13th
1.42	8th	.84	14th

The rise of opsonic index to 1.60 corresponded with the fading of the redness of the face and general clinical improvement. A short negative phase followed. The generally low index of this patient during convalescence probably points to a low immunity, corresponding with his susceptibility - this being the third attack.

Case XVI. - Man, aged 52 years, admitted with an ordinary facial attack, temperature 102° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.72	3rd	.92	12th
1.00	4th	.66	13th
1.03	5th	.95	14th
.83	6th	1.05	15th
.82	7th	.82	16th
.53	8th	.93	17th
.80	9th	.72	18th
.90	10th	.90	19th
.77	11th	1.04	20th

The average index in this case after the normal is first reached is only .86.

Case XVII. - Man, aged 29 years, admitted with a sharp attack, temperature 104° F., face very red and swollen, temperature normal on the twelfth day.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.58	3rd	1.02	13th
.64	4th	1.08	14th
.55	5th	.95	15th
.76	6th	1.08	16th
.98	7th	.55	17th
1.00	8th	.77	18th
.45	9th	.93	19th
.81	10th	.70	20th
1.17	11th	.92	21st
1.08	12th		

On the seventh day the index rose to normal, and next day redness had faded entirely from the auricles to which it had gradually receded. A deep negative curve followed with the temperature still elevated, but with the fall of temperature the index rose to 1.17 on the eleventh day.

Case XVIII. - Woman, aged 27 years, admitted with a sharp facial attack, temperature 103.4, reaching normal on the tenth day.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.76	4th	1.65	14th
.63	5th	1.52	15th
.78	6th	.68	16th
.64	7th	.80	17th
.88	8th	1.00	18th
.92	9th	1.75	19th
1.50	10th	1.20	20th
.60	11th	.76	21st
.73	12th	.80	22nd
.74	13th	1.08	23rd

The subnormal index during the height of the disease and the rise during the defervescence of the fever, are well marked, and the regularity of the negative phases is noticeable, occurring at intervals of about four days.

Case XIX. - Woman, aged 31 years, admitted with slight attack of facial erysipelas following a scalp wound, temperature 101.8° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.74	6th	1.00	14th
.51	7th	1.04	15th
.90	8th	1.34	16th
1.16	9th	1.17	17th
1.41	10th	1.24	18th
1.20	11th	.83	19th
.93	12th	.72	20th
.61	13th	.91	21st

As the temperature fell, and the symptoms declined the index rose. A pure streptococcal culture was obtained from the scalp wound.

Case XX. - Girl, aged 15 years, admitted with an ordinary facial attack, temperature 102.6° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.79	6th	1.41	13th
1.21	7th	1.15	14th
.72	8th	1.10	15th
.82	9th	1.23	16th
.67	10th	.70	17th
.83	11th	.90	18th
1.00	12th	1.09	19th

The temperature fell to normal on the eighth day, and the index on the day previous was 1.21. A well marked negative phase followed.

... and the subsidence ... XVII, XVIII, XIX ... correspondingly ... time to reach the ... however, concluded that there was no ... between severity and low index, but ... again, in an examination of eight cases ... decidedly low ... from .2 to .7. In the series given in ... between .51 and .75.

... cases exhibiting recurrences.

TABLE D.

Table of opsonic indices in Erysipelas during first three weeks of eight uncomplicated cases

Day of Disease	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st	
Case XIII.			1.20	.59	.92	.55	.88	1.04	1.20	1.57	.82	.96	1.07	1.00	1.34	1.16	.96	1.34	2.01	
" XIV.				.91	1.06	1.22	.80	.96	1.33	.54	1.76	.80	.62	1.54	1.32					
" XV.	.74	1.60	.53	.85	.81	1.42	1.00	.98	1.21	.77	.70	.84								
" XVI.	.72	1.00	1.03	.83	.82	.53	.80	.90	.77	.92	.66	.95	1.05	.82	.93	.72	.90	1.04		
" XVII.	.58	.64	.55	.76	.98	1.00	.45	.81	1.17	1.08	1.02	1.08	.95	1.08	.55	.77	.93	.70	.92	
" XVIII.		.75	.63	.78	.64	.88	.92	1.50	.60	.73	.74	1.65	1.52	.68	.80	1.00	1.75	1.20	.76	
" XIX.				.74	.51	.90	1.16	1.41	1.20	.93	.61	1.00	1.04	1.34	1.17	1.24	.83	.72	.91	
" XX.				.79	1.21	.72	.82	.67	.83	1.00	1.41	1.15	1.10	1.23	.70	.90	1.09			
Total	2.04	4.00	3.94	6.25	6.95	7.22	6.83	8.27	8.31	7.54	7.72	8.43	7.35	7.69	6.81	5.79	6.46	5.00	4.60	
Average	.68	1.00	.79	.78	.87	.90	.85	1.03	1.04	.94	.96	1.05	1.05	1.10	.97	.96	1.08	1.00	1.15	
Weekly average						.82					.97					1.04				
Number of Estimations						28					49					42				

On referring to Table D., it is seen that the average index during the first week in erysipelas is .82, during the second week .97, and during the third week 1.04, - figures which are comparable to those obtained for scarlet fever, though indicating a less decided increase of opsonin during the second and third weeks, thus -

	First week	Second week	Third week
(Scarlatina	.86	1.08	1.17
(Erysipelas	.82	.97	1.04

Shorer (12), on the other hand, found a gradual fall in the index from the third day onwards, but it appears that the number of estimations made was small.

Table D. shows, also, that the normal index is reached between the fourth and eighth days, corresponding with the time of fall of temperature and the subsidence of acute symptoms. Of the eight cases XVII, XVIII, XIX, XX were the most acute, and presented correspondingly low indices, which took the longest time to reach the normal. Shorer, however, concluded that there was no correspondence between severity and low index, but Tunnicliff (11) again, in an examination of eight cases during the early febrile period found a decidedly low index, varying from .2 to .7. In the series given in Table D. the variation lay between .51 and .78.

E. Five cases exhibiting recurrences.

Case XXI. - Man, aged 46 years, admitted on the first of February, 1909, with facial erysipelas, which gradually extended down the back to the buttocks, where it was lingering in a few patches on the 16th February,

when a severe facial recurrence, accompanied by delirium, appeared, which again migrated down the back.

<u>Index</u>	<u>Day of recurrence</u>	<u>Index</u>	<u>Day of recurrence</u>
.68	8th	.73	20th
.50	9th	.73	21st
.40	10th	1.41	22nd
.45	11th	1.55	23rd
.90	12th	1.21	24th
1.17	13th	1.20	25th
.70	14th	1.26	26th
1.80	15th	1.34	27th
1.07	16th	1.07	28th
1.44	17th	1.00	29th
.91	18th	.96	30th
1.10	19th	.94	31st

The index remained subnormal till the eleventh day, when a few small patches of redness remained at the lower part of the back. The temperature was normal on the thirteenth day, when the index had risen to 1.17.

On 28th March, a second severe facial recurrence appeared, also ~~was~~ accompanied by delirium, and the redness also migrating gradually down the back to the buttocks.

Case XXI. Indices during second recurrence.

<u>Index</u>	<u>Day of Recurrence</u>	<u>Index</u>	<u>Day of Recurrence</u>
.64	1st	.81	17th
.89	2nd	.68	18th
1.47	3rd	1.03	19th
1.61	4th	.70	20th
1.05	5th	.70	21st
.85	6th	.52	22nd
1.16	7th	.76	23rd
1.55	8th	.78	24th
1.42	9th	1.34	25th
1.11	10th	1.06	26th
.97	11th	1.11	27th
.88	12th	1.20	28th
.59	13th	.73	29th
.78	14th	.70	30th
.89	15th	1.02	31st
.57	16th		

Case XXII. - Woman, aged 40 years, admitted with well marked facial erysipelas, temperature 102.2°F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.50	2nd	.55	18th
.52	3rd	.77	19th
.42	4th	.51	20th
.52	5th	.57	21st
.65	6th	.62	22nd
.41	7th	.65	23rd
.87	8th	.73	24th
1.06	9th	.51	25th
.61 Vomited	10th (Recurrence)	.50	26th
.46	11th	.54	27th
.41	12th	.83	28th
.80	13th	.50	29th
1.00	14th	.46	30th
1.50	15th	.40	31st
.64	16th	.48	32nd
1.39	17th	1.00	33rd.

As the redness of the face disappeared and the temperature fell the opsonic index rose on the eighth and ninth days. On the eleventh day the face again became very red and swollen, and next day the temperature was 104.2° F., and the index had fallen to .41. It was at the beginning of this recurrence that the phenomena of erthrophagocytosis and erythroagglutination were first observed, as has already been mentioned on page 6.

Case XXIII. - Man, aged 47 years, admitted on the second day of disease with severe facial erysipelas. Temperature 102.6°F. On the sixth day the index was .74, and remained subnormal till the eleventh day. Next day the temperature was normal. On the sixteenth day about two drachms of pus were evacuated from the right side of the scalp, the pus containing both streptococci and staphylococci.

<u>Index.</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.74	6th	.45	Recurrence 27th
.68	7th	.73	28th
.68	8th	.60	29th
.77	9th	1.17	30th
.77	10th	1.02	31st
.54	11th	.92	32nd
.87	12th	.87	33rd
1.00	13th	.95	34th
1.16	14th	.86	35th
1.38	15th	.63	36th
1.04	Incision 16th	.83	37th
1.24	17th	1.00	38th
1.30	18th	1.07	39th
1.12	19th	1.17	40th
.72	20th	1.00	41st
.95	21st	.74	42nd
1.18	22nd	.79	43rd
1.12	23rd	.91	44th
.82	24th	.95	45th
.90	25th	.60	46th
1.03	26th	.61	47th

On the twenty-seventh day both sides of the face became very red and swollen, and the index fell to .45, and remained subnormal for three days. With the fall of temperature and the fading of the redness the index rose.

Case XXIV. - Woman, aged 20 years, admitted on the first of January, 1909, with facial erysipelas, and dismissed well on the 25th January. She had several areas of lupus on the nose, hands, feet, and left leg. On the 28th January she was readmitted with a recurrence on the face of moderate intensity. On the 11th February a second facial recurrence appeared of diminished severity, temperature 99.2° F.

<u>Index</u>	<u>Day of Second Recurrence</u>	<u>Index</u>	<u>Day of Second Recurrence</u>
.40	1st	.83	13th
.59	2nd	.65	14th
.51	3rd	.58	15th
.51	4th	.90	16th
1.50	5th	.54	17th
.65	6th	1.43	18th
.98	7th	.73	19th
.54	8th	.90	20th
.65	9th	.73	21st
.55	10th	1.00	22nd
.98	11th	.73	23rd.
.92	12th		

The rise of index on the fifth day corresponded with the disappearance of the redness of the face. The average index, however, from that day onwards is only .84, which would appear to indicate a lessened degree of immunity corresponding to the susceptibility to recurrences.

Case XXV. - Woman, aged 40 years, admitted in an apparently moribund condition with cyanosis and sub-normal temperature. The right side of the face was red and swollen. She had had erysipelas one month previously. There was a heavy cloud of albumen in the urine, and there was mitral and tricuspid incompetence with much oedema of the feet and legs.

<u>Index</u>	<u>Day of Recurrence</u>	<u>Index</u>	<u>Day of Recurrence</u>
.25	4th	.61	31st
.20	5th	.69	32nd
.20	6th	.70	33rd
.21	7th		
.25	8th	.94	40th
.20	9th		
.20	10th	.81	54th
.20	11th	1.36	55th
.20	12th		

This patient's serum was greenish in colour in the first nine observations, of a light green in the next three, and clear in the last three.

Table E, showing the indices in the first week of recurrences in erysipelas.

Day of recurrence	1st	2nd	3rd	4th	5th	6th	7th
Case XXI	.64	.89	1.47	1.61	1.05	.85	1.16
XXII	.46	.41	.80	1.00	1.50	.64	1.39
XXIII	.45	.73	.60	1.17	1.02	.92	.87
XXIV	.40	.59	.51	.51	1.50	.65	.98
Total	1.95	2.62	3.38	4.29	5.07	3.06	4.40
Average	.49	.65	.84	1.07	1.27	.76	1.10

On referring to Table E. it is seen that in recurrences the normal index is reached somewhat earlier than in primary attacks, namely, from the second to the fourth days, as compared with the fourth to the eighth of the primary attack. This shortened period corresponds to the diminished duration of acute symptoms associated with recurrences. These correlated facts may point to a lessened virulence of the invading organism, or to an increased rapidity of formation of effective antibodies, or to a combination of these factors.

Case XXV is not included in Table E., being a case apart and anomalous. She was admitted in extremis, and continued so for two weeks, with ^{water} ~~inter~~logged tissues and marked cyanosis. The index during the recurrence remained extremely subnormal till at least the twelfth day, the daily reading varying from .20 to .25. On the thirty-first day the index had risen to .50, and on the fortieth day to .94. The clinical symptoms of erysipelas were slight, and lasted only a few days, and did not lead one to expect these low readings over an extended period. The general metabolism, however, was evidently quite

abnormal, and may not unlikely have had some relation to the extreme deficiency of opsonins in the blood.

PUERPERAL FEVER

Thirteen cases were investigated, all of which were of a severe type except one, eight terminating fatally. Streptococci were obtained from the uterus either in pure culture, or associated with one or more organisms in all the cases except one. The following table shows the distribution of the several organisms, and the mortality in each group.

Group	Organisms found in the uterus	Cases	Deaths
1.	Pure culture of streptococcus	3	1
2.	Streptococcus + staphylococcus pyo- genes albus	7	4
3.	" + bacillus coli	2	1
4.	" + " " + staph. albus	1	1
5.	" + a diplococcus	1	1
6.	Bacillus coli alone	1	0

The relative frequency of the several organisms agrees generally with that found by Foulerton (14), whose words with regard to the mortality of the several infections may be quoted: "If we simply place side by side the results of the bacteriological examination and the clinical facts we can say that cases, in which there is a mixed infection of the uterus by streptococci and ^astaphylococcus pyogenes albus, are usually of greater severity than cases in which there is a pure infection

by streptococci, and that cases, in which there is a mixed infection by streptococcus and bacillus coli communis, are usually of greater severity than either of the others." In the series of cases in Table F., Group I with pure cultures represents a mortality rate of 14 in 42, Group II of 24 in 42, and Group III and IV together of 28 in 42, or percentage rates of 33, 57, and 66 respectively. Such a method of interpreting a small number of facts is of course inaccurate, but the result is at least a significant coincidence.

F. Three cases with pure cultures of streptococcus from the uterus.

Case XXVI. - Admitted on the fourth day of fever, having been confined eleven days previously, temperature 102.5° F., pulse rate 104 per minute; had a rigor on the first day of fever, discharge from the uterus copious but not foul-smelling, died on the fourteenth day of fever, temperature 107.5° F.

<u>Index.</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
1.06	5th	.50	10th
1.15	6th	.84	11th
.93	7th	.56	12th
1.30	8th	.55	13th
1.20	9th		

Case XXVII. - Admitted on the fourth day of fever, and the seventh day after confinement, temperature 104° F. pulse rate 130 per minute, discharge from the uterus copious but not foul smelling.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.75	5th	.79	21st
1.10	6th	.80	22nd
1.44	7th	.66	23rd
1.40	8th	1.17	24th
.77	9th	.64	25th
.98	10th	.73	26th
1.10	11th	.60	27th
1.04	12th	1.48	28th
1.07	13th	1.87	29th
1.36	14th	.68	30th
.84	15th	1.01	31st
.96	16th	1.11	32nd
1.36	17th	.76	33rd
.74	18th	.92	34th
.51	19th	.80	35
.62	20th		

Case XXVIII. Admitted on the seventh day after confinement at which the placenta had been removed in fragments, foul discharge and fever since the birth, temperature 103° F., pulse rate 118 per minute, uterus large and soft.

<u>Index.</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.58	7th	1.50	30th
.82	8th	.85	31st
.88	9th	1.23	32nd
1.01	10th	1.11	33rd
1.04	11th	.76	34th
.58	12th	.84	35th
.81	13th	.83	36th
1.21	14th	.67	37th
1.25	15th	.88	38th
1.16	16th	.70	39th
.95	17th	.65	40th
.80	18th	.92	41st
1.17	19th	.96	42nd
1.05	20th	1.10	43rd
.70	21st	1.08	44th
.70	22nd	1.02	45th
.73	23rd	.95	46th
.81	24th	.60	47th
.88	25th	.59	48th
.80	26th	.66	49th
1.06	27th	.76	50th
1.00	28th	.85	51st
1.33	29th		

G. Seven cases with streptococcus + staphylococcus pyogenes albus from the uterus.

Case XXIX. - Admitted in a moribund condition, uterus large and soft and containing sloughing material, temperature 102.4° F., pulse rate 128 per minute, died on the day after admission, when the opsonic index was .53.

Case XXX. - Admitted in a delirious condition, vagina severely lacerated, and covered almost in its whole length with sloughs, uterus large and soft, temperature 102.4° F., pulse rate 128 per minute, died on the day after admission, when the opsonic index was .72.

Case XXXI. - Admitted on the seventh day of fever, instrumental birth twenty-four days before the onset of symptoms, temperature 104.8° F., pulse rate 136 per minute, slight cyanosis, crepitant rales at the right base, cervix lacerated on the right side, died at 5 a.m. on the tenth day. Index on the eighth day of fever was 1.43 and on the ninth .74.

Case XXXII. - Admitted on the fourth day of fever, with a history of having had several rigors, discharge from the uterus copious and foul smelling, temperature 103° F., pulse rate 124 per minute, suffered from chronic bronchitis, had rigors almost daily during the last fortnight.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.96	4th	.74	26th
1.00	5th	.88	27th
1.00	6th	1.30	28th
1.20	7th	.55	29th
1.54	8th	1.70	30th
.73	9th	.67	31st
.51	10th	1.28	32nd
.57	11th	.41	33rd
.60	12th	.63	34th
.80	13th	.80	35th
1.04	14th	.90	36th
.88	15th	.65	37th
.89	16th	1.10	38th
.81	17th	.68	39th
.75	18th	1.43	40th
.74	19th	.54	41st
.60	20th	.64	42nd
.76	21st	.77	43rd
.76	22nd	.80	44th
1.39	23rd	.62	45th
1.40	24th	.64	46th
1.15	25th	.52	47th
		Died	48th

Case XXXIII. - Admitted on the second day of fever, and the fifth day after confinement, temperature 101° F. pulse rate 130 per minute, discharge from the uterus copious and purulent.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.90	2nd	.86	14th
.70	3rd	1.86	15th
.94	4th	.96	16th
1.18	5th	.66	17th
1.25	6th	.78	18th
1.11	7th	1.00	19th
1.28	8th	1.32	20th
.73	9th	1.15	21st
1.17	10th	.88	22nd
1.00	11th	.71	23rd
1.07	12th	.88	24th
1.09	13th	1.41	25th

Case XXXIV. - Admitted on the third day of fever and the sixth day after confinement, temperature 103° F., pulse rate 120 per minute, discharge from the uterus scanty and foul.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.84	4th	1.77	15th
.63	5th	1.07	16th
.88	6th	1.66	17th
.91	7th	.81	18th
1.12	8th	.68	19th
.98	9th	.90	20th
1.47	10th	.90	21st
.88	11th	1.48	22nd
1.19	12th	1.01	23rd
.86	13th	1.04	24th
.66	14th		

Case XXXV. - Admitted on the ninth day of fever, and fourteenth day after confinement, temperature 102.2^oF., pulse rate 124 per minute, discharge from the uterus slight and not foul smelling.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.71	9th	.92	27th
1.40	10th	.56	28th
1.37	11th	.76	29th
.84	12th	1.01	30th
.78	13th	1.01	31st
.84	14th	1.02	32nd
1.37	15th	1.22	33rd
.91	16th	1.03	34th
1.40	17th	.53	35th
.74	18th	.75	36th
.56	19th	.88	37th
.60	20th	1.23	38th
.82	21st	1.10	39th
.84	22nd	.70	40th
1.00	23rd	.57	41st
.86	24th	1.14	42nd
.90	25th	.73	43rd
.87	26th		

H. Two cases with streptococcus and bacillus coli from the uterus.

Case XXXVI. - Admitted on the fifth day of fever in moribund condition, with bronchitic rales all over the chest, uterus large and contained several foul fragments, temperature 103.6^o F., pulse rate 142 per minute, next day became delirious and died.

Index on day of admission	.84
" " " " death	.70

Case XXXVII. - Admitted on the seventh day of fever, and the eleventh after confinement, temperature 102.2° F. pulse rate 124 per minute, discharge from the uterus slight and not offensive.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
1.88	7th	.94	16th
.46	8th		
.55	9th	.64	17th
.68	10th	.56	18th
1.43	11th	.51	19th
.95	12th	1.06	20th
.87	13th	.76	21st
1.70	14th	.94	22nd
.94	15th	.90	23rd
		.70	24th.

K. One case with streptococcus, staphylococcus pyogenes albus, and bacillus coli from the uterus.

Case XXXVIII. - Admitted three days after confinement, the placenta having been removed in fragments, temperature 101.6° F., pulse rate 132 per minute, discharge from the uterus copious and offensive; died on the sixth day of fever.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.90	2nd	.71	5th
.66	3rd	.67	6th
.78	4th		

M. One case with streptococcus, and an unknown diplococcus.

Case XXXIX.- Admitted on the eighth day of fever, having been confined three days before the onset of symptoms, temperature 105° F., pulse rate 132 per minute, uterus with copious and foul-smelling discharge, died on the sixteenth day of fever, when the temperature was 107° F.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
1.12	9th	1.45	13th
1.00	10th	1.48	14th
.52	11th	.32	15th
.69	12th		Died 16th

N. One case with bacillus *coli* alone in the uterus.

Case XL. - Admitted on the first day of fever, temperature 99.2° F., which rose on the third day to 103° F., with a pulse rate of 104 per minute, discharge from the uterus slight and not foul-smelling.

<u>Index</u>	<u>Day of Disease</u>	<u>Index</u>	<u>Day of Disease</u>
.90	2nd	1.04	6th
1.05	3rd	1.09	7th
1.20	4th	.98	8th
1.06	5th	1.00	9th

From a consideration of these cases it would appear that the streptococco-opsionic index in puerperal fever depends largely on the extent to which the streptococcus is responsible for the symptoms. If the infection is purely streptococcic, one may expect the index to vary as in scarlatina and erysipelas. If, on the other hand, the infection is not purely streptococcic, one might conceivably conclude, from an estimation of all the indices of the micro-organisms concerned, which micro-organism was chiefly responsible for the symptoms, but in estimating only the streptococcic index one must expect a want of parallelism with the symptoms.

The three purely streptococcic cases give charts which might equally well be those of scarlet or erysipelas patients.

Case XXVI was a severe case which died on the fourteenth day of fever, the temperature varying between 102° and 104° F. The indices were markedly subnormal

during the four days preceding death, and are comparable to those obtained in Cases X and XII of scarlet fever.

Case XXVII showed a fall of temperature from 104° F., on the fourth day of fever to normal on the ninth day, and a corresponding rise of index from .75 to 1.44. On the seventeenth day there was a recurrence of symptoms, and the temperature rose to 103° F. on the following day. The opsonic index at once fell, and on the disappearance of symptoms again rose, the opsonic curve following a course similar to that in a recurrence of erysipelas, or in the initial stages of an attack of scarlatinal nephritis.

Case XXVIII was initially a somewhat severe case, which was prolonged as parametritis with persistent elevation of temperature to about 100° F. The fall of the initial high temperature was accompanied by a rise of the index from .58 on the seventh day of fever to 1.04 on the eleventh day. During the fourth, sixth, and eighth weeks there were well-marked depressions of the index to .60, .65, and .59 respectively. This patient would probably have responded well to a streptococcic vaccine.

The seven cases with double infection of streptococcus and staphylococcus show the influence of the streptococcus by the decided depression or elevation of the index to that micro-organism, but these variations did not vary harmoniously with the temperature, symptoms, or general condition. Accordingly, one is led to believe that the want of correspondence may have been due to the

influence of the other causative agent - the staphylococcus.

The other four cases with infection of streptococcus and one or two accompanying micro-organisms show the same influence of the streptococcus in their indices, and also the same want of exact correspondence with the clinical symptoms.

Case XL gave a pure culture of bacillus coli, the index to the streptococcus varying between .90 and 1.20, i.e., it lay within the normal limits, as one should expect.

CONCLUSIONS.

1. In scarlet fever the opsonic index to streptococcus pyogenes is subnormal during the acute stage of the disease, rising to normal or above normal with the fall of temperature and the subsidence of symptoms, and remaining within normal limits during the second and third weeks.

2. At the onset of albuminuria or nephritis the index shows a decided fall.

3. In fatal toxæmic cases the index is markedly subnormal.

4. In erysipelas the opsonic index to streptococcus pyogenes varies in the same way as it does in scarlet fever.

5. During recurrences the index varies as in the primary attack, but reaches normal at an earlier date.

6. In puerperal fever, if the infection is due to streptococcus pyogenes alone, the streptococco-opsonic index varies as in scarlet fever and in erysipelas.

7. If the infection is due to streptococcus associated with one or more organisms the streptococco-opsonic index exhibits the influence of the streptococcus, but does not vary in accordance with the temperature, symptoms, and general condition.

8. If the infection is not a streptococcic one, the streptococco-opsonic index varies within normal limits.

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CHARTS TO THESIS

By

T. McCririck, M.A., M.B., B.Sc.

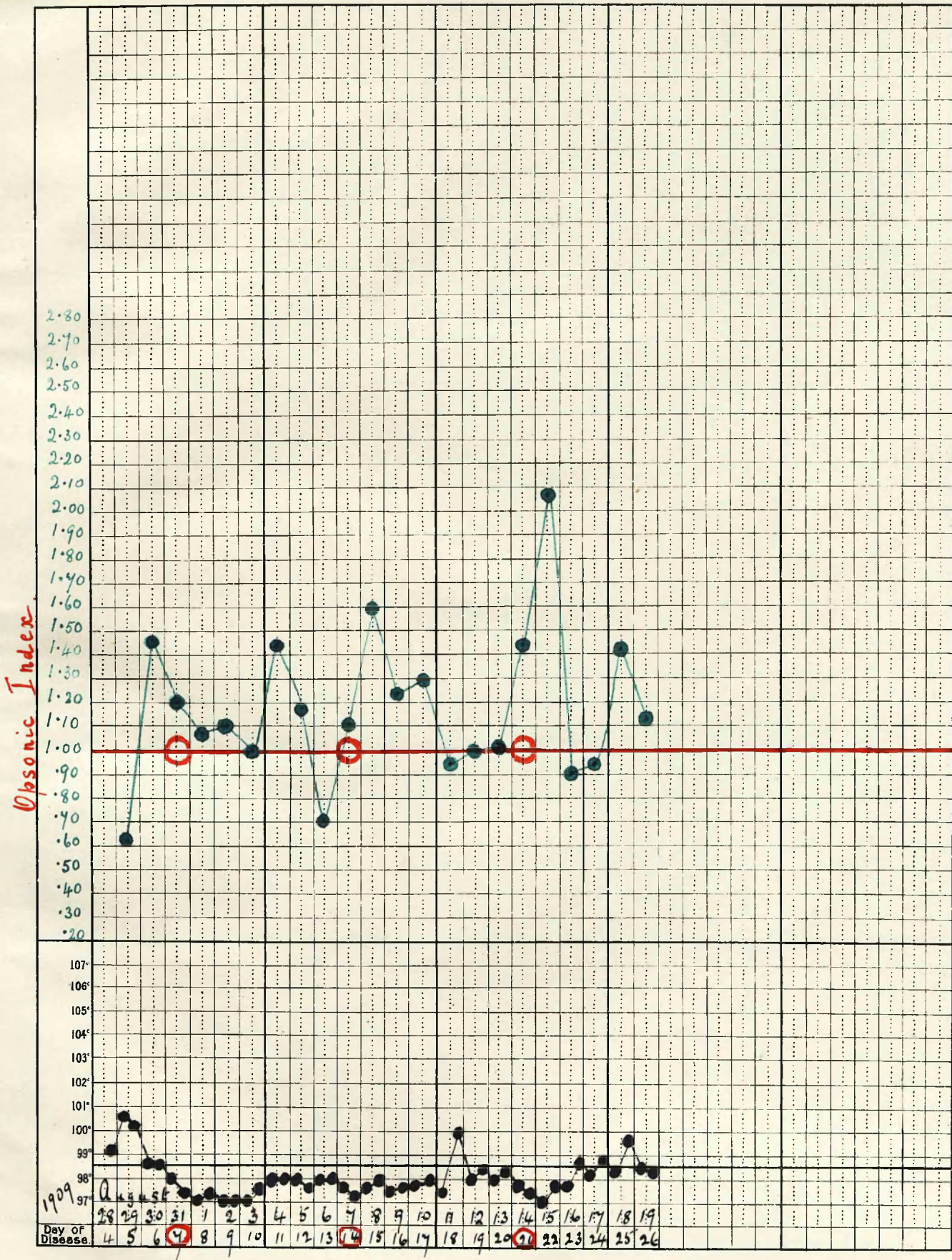
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"	VI.	"	6	"	XXVI.	"	21
"	VII.	"	7	"	XXVII.	"	22
"	VIII.	"	8	"	XXVIII.	"	23
"	IX.	"	9	"	XXIX.	"	24
"	X.	"	10	"	XXX.	"	24
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Photo-micrographs, Page 30.

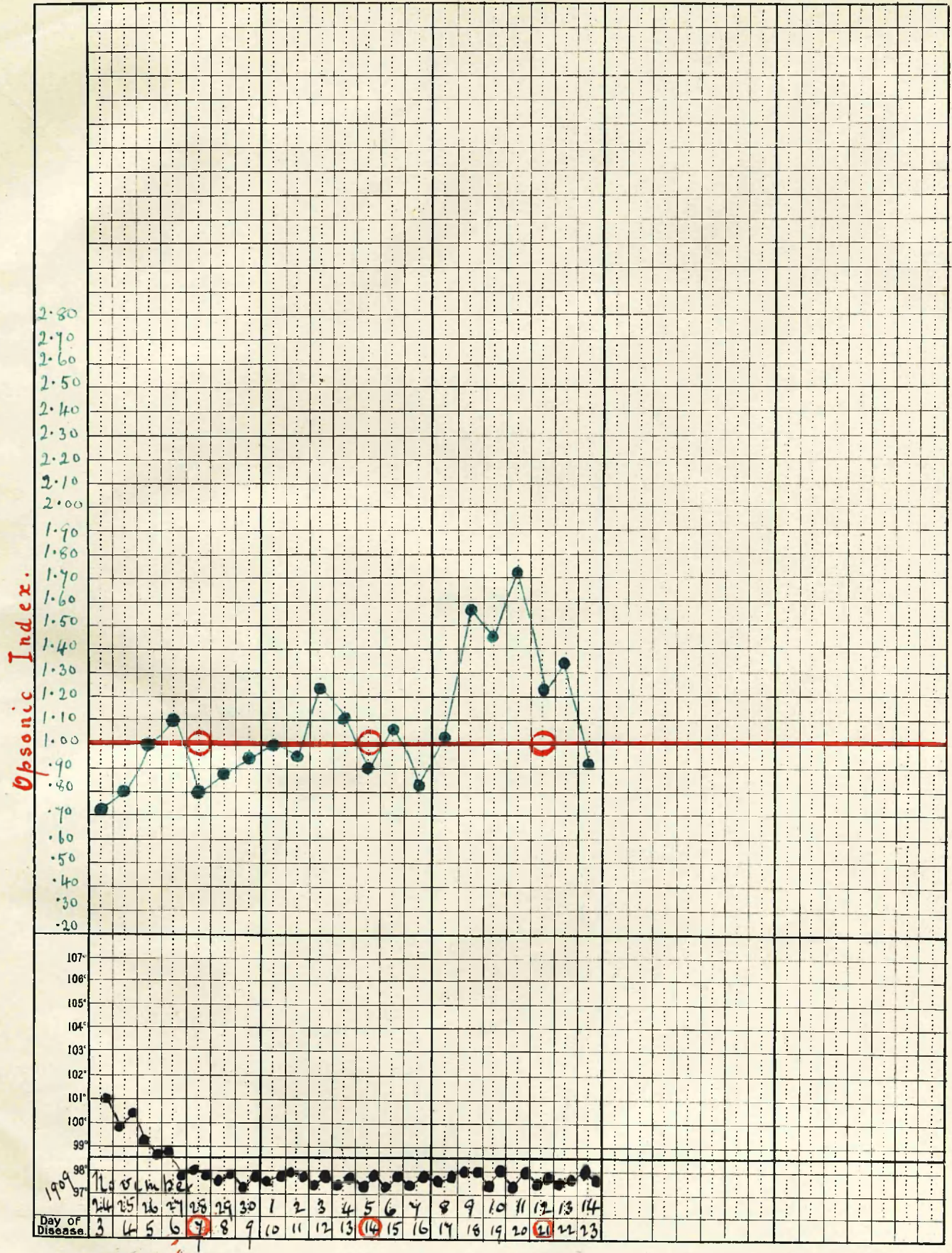
Case I.

Florence Thorne.

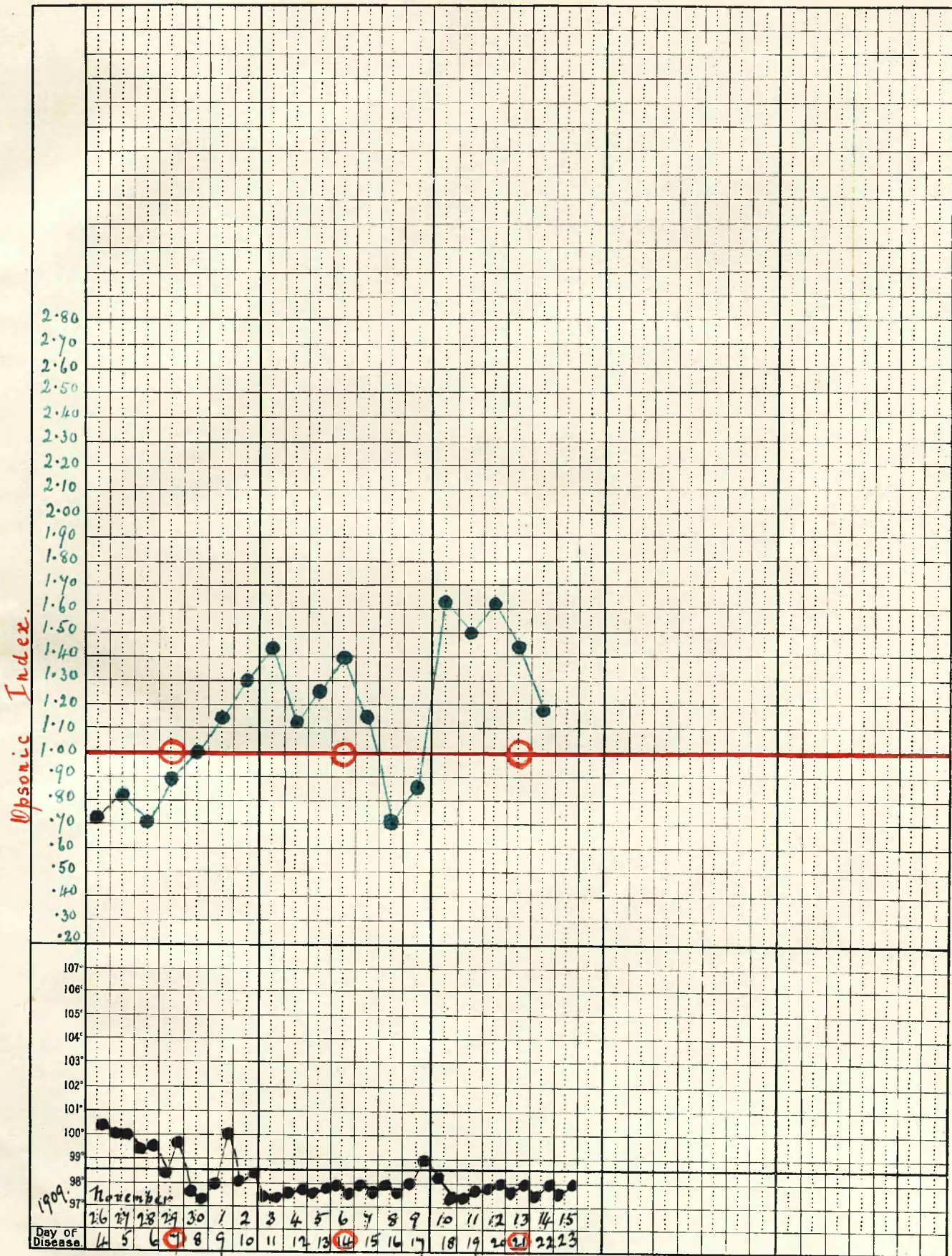


Case II.

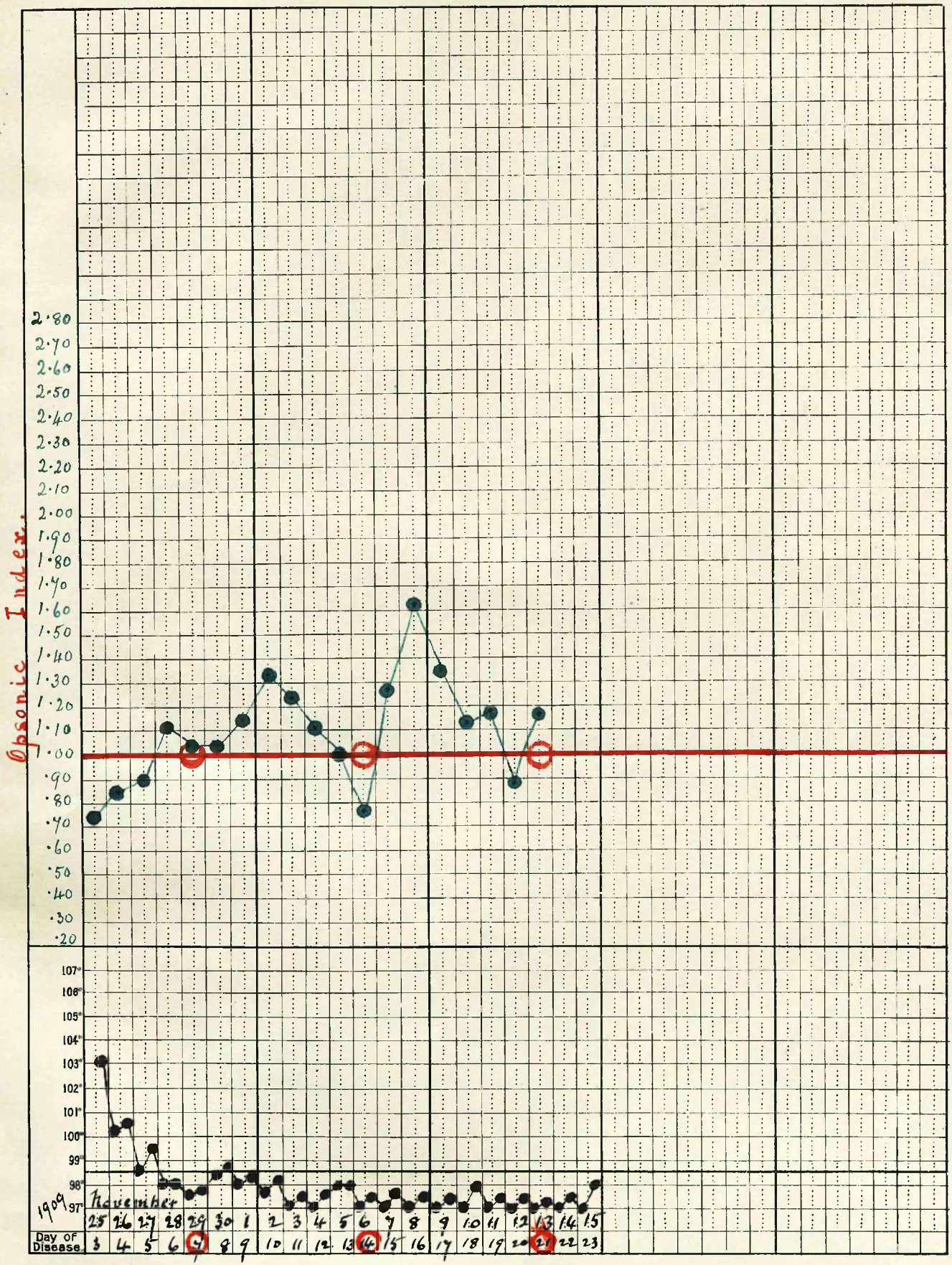
Bessie Bennett.



Rose Barker.

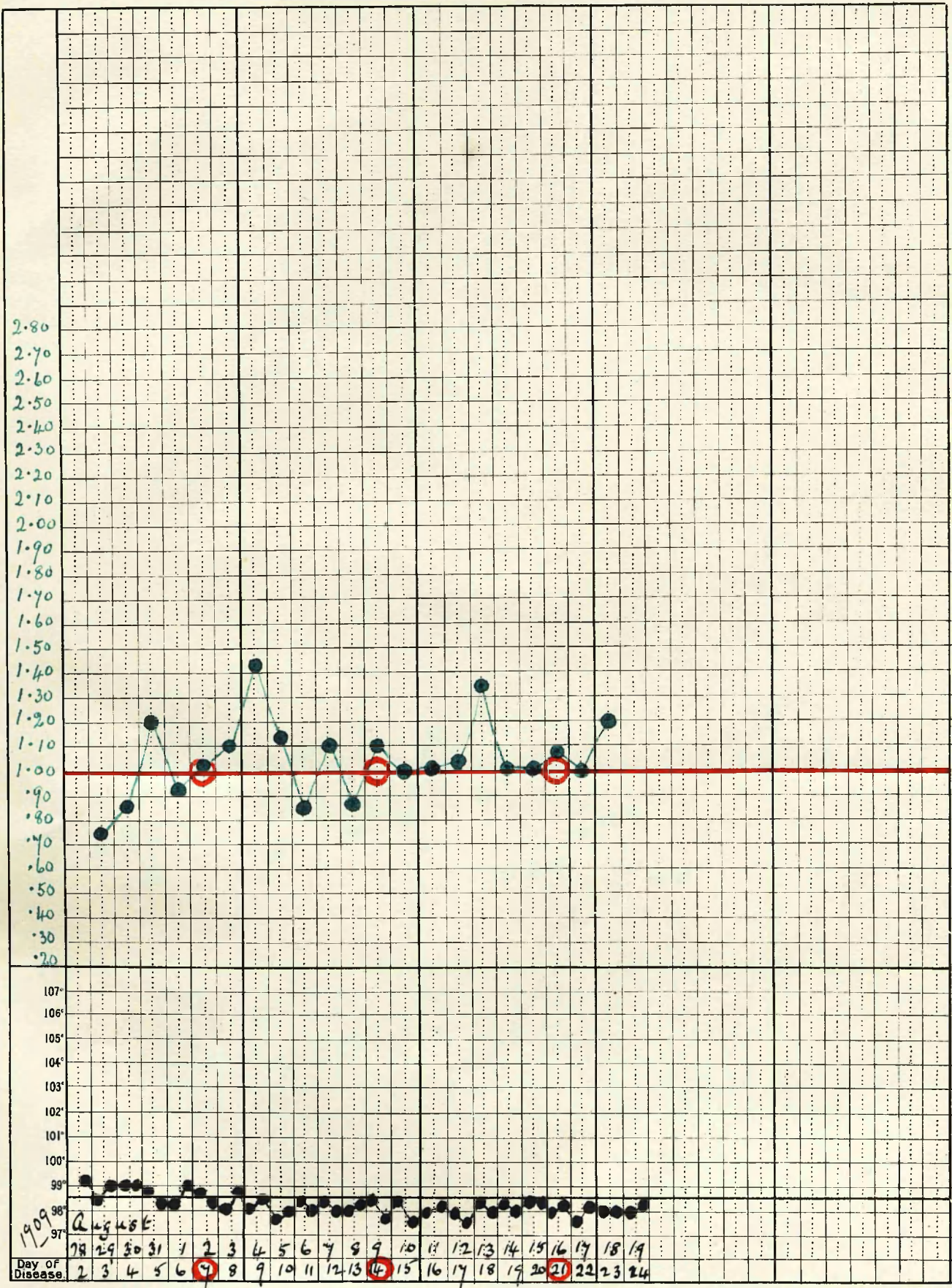


Frank Munnis.



Case V

Herman Heutschel.



1909

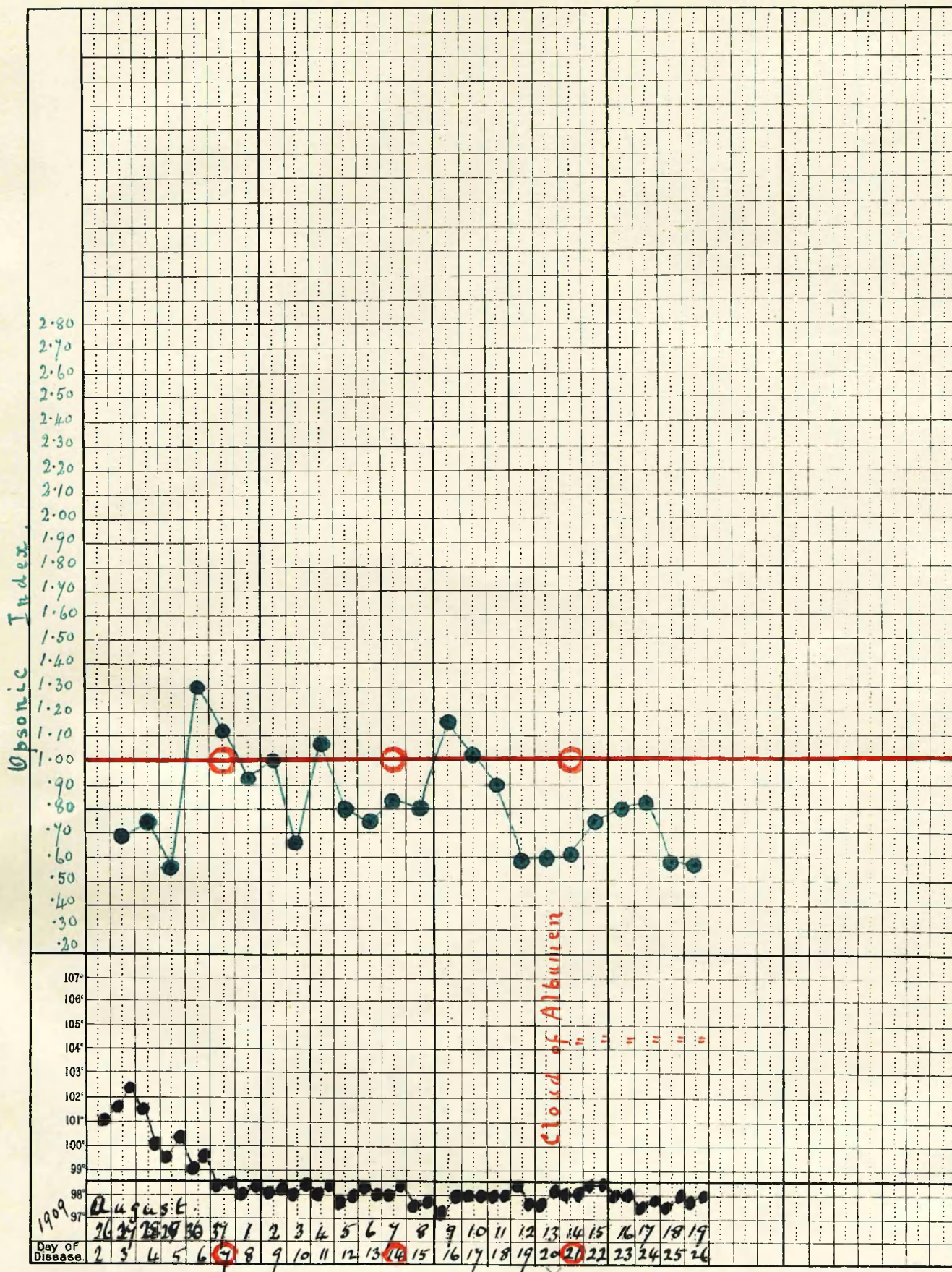
August

28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Day of Disease

Case VI.

William Payne.



Lilian Borgust.

CASE VII

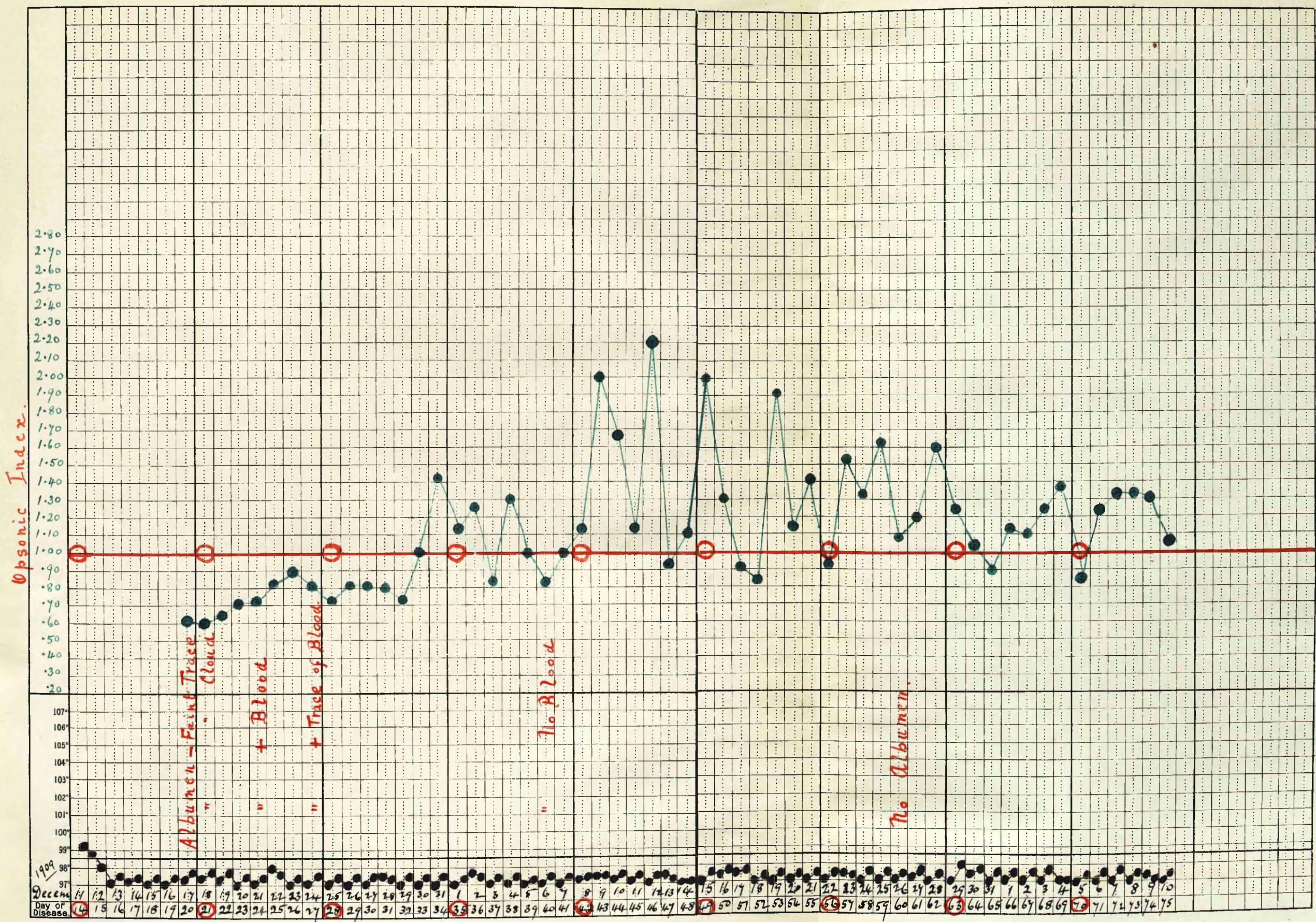
4.

Opsonic Index.

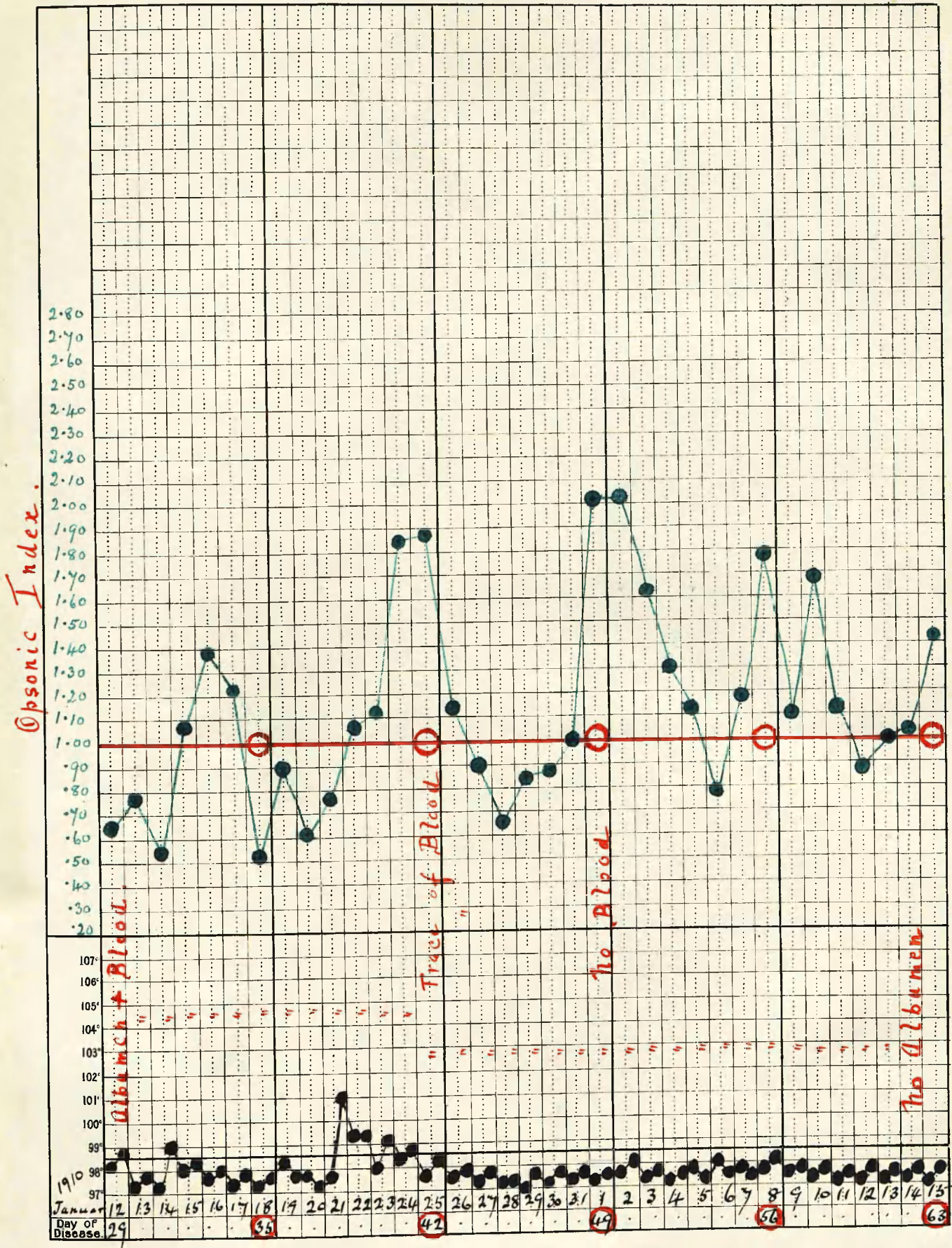


Trace of Albumen
Trace of Albumen
Trace of Albumen
No Albumen
No Albumen

Reginald Ware.

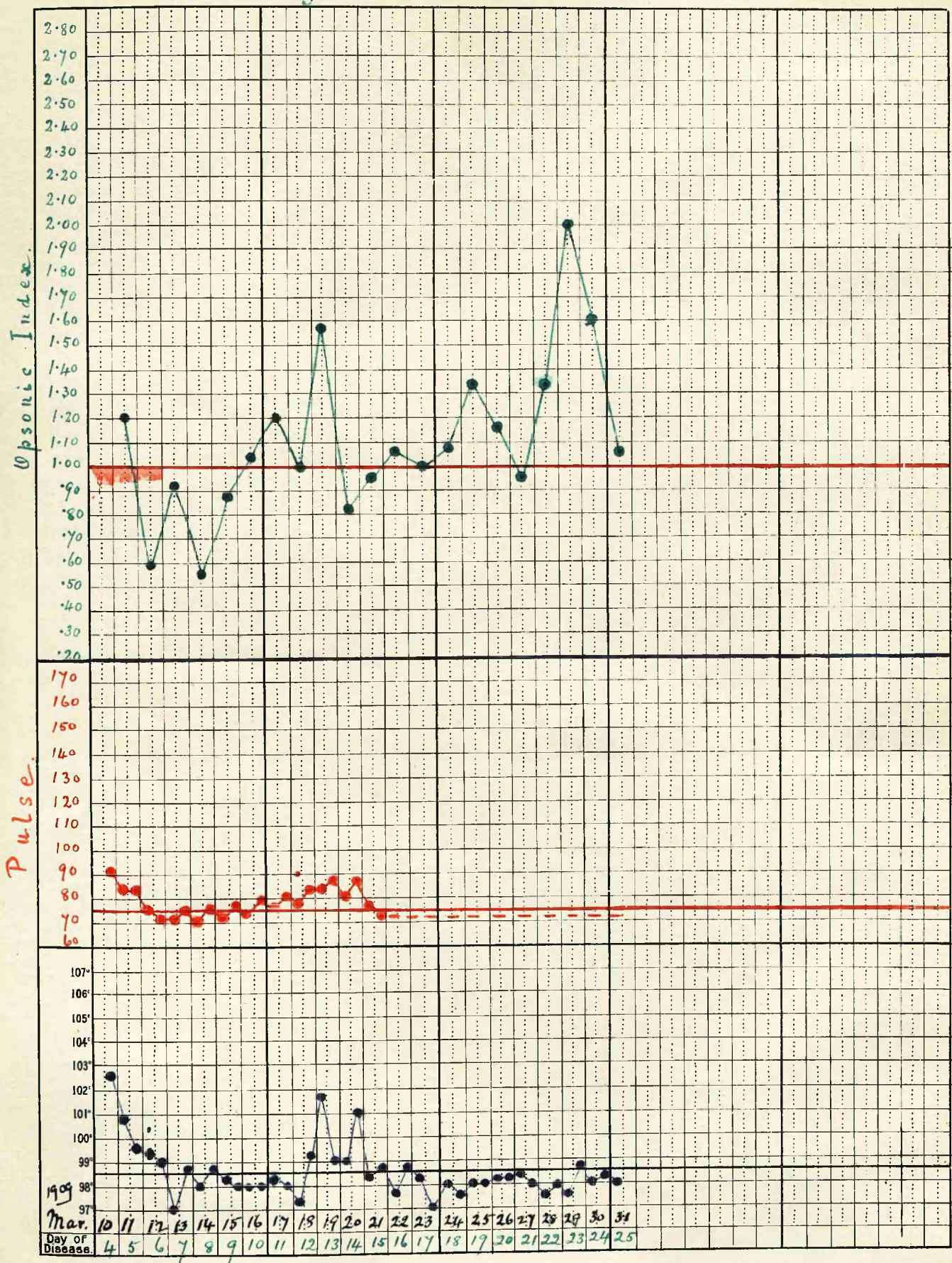


Violet Evison:



Case XIII

Mrs. McAreevey.

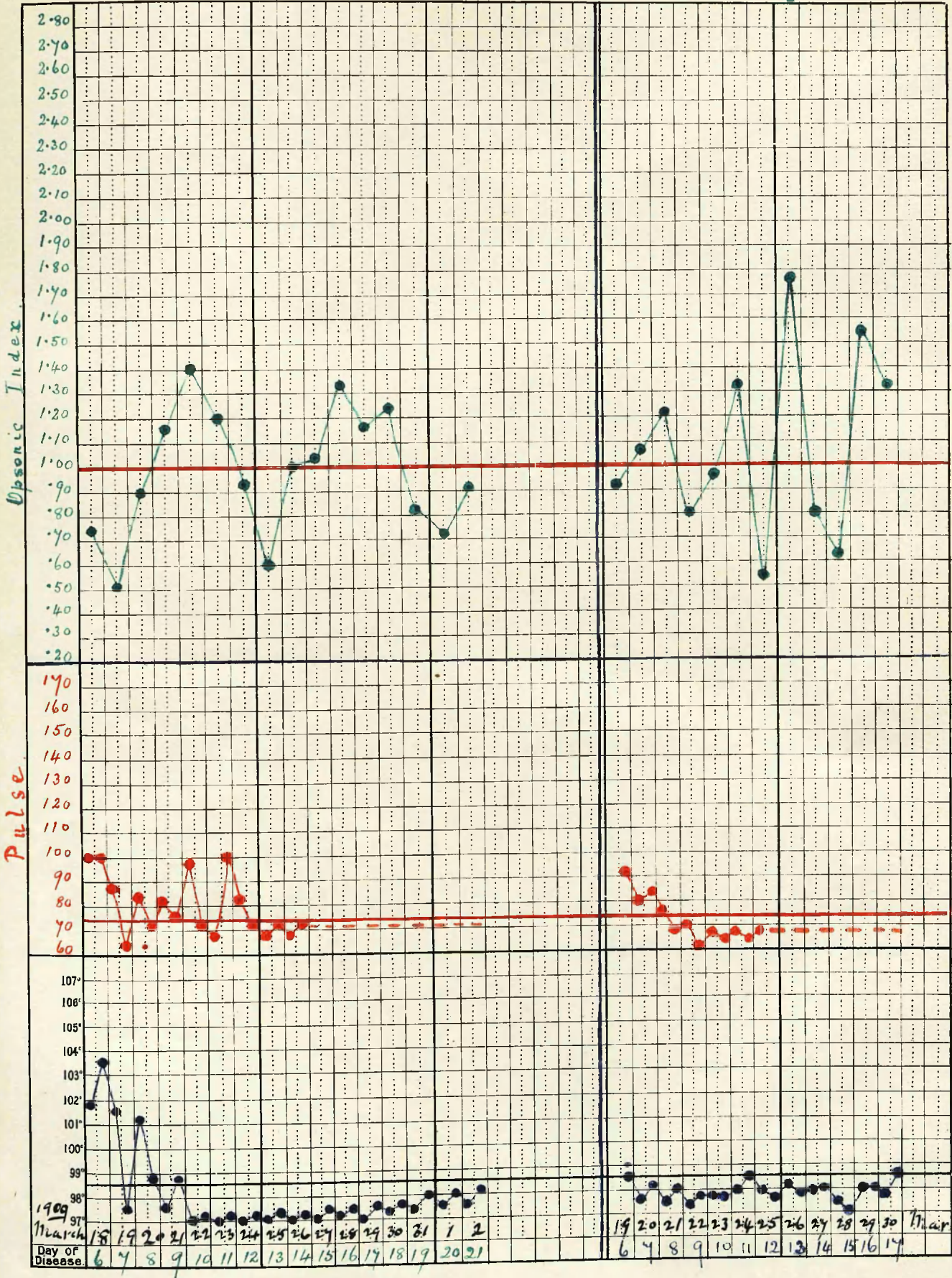


Case XIX

Case XIV

Mrs. Winter.

Mrs. Fleming.

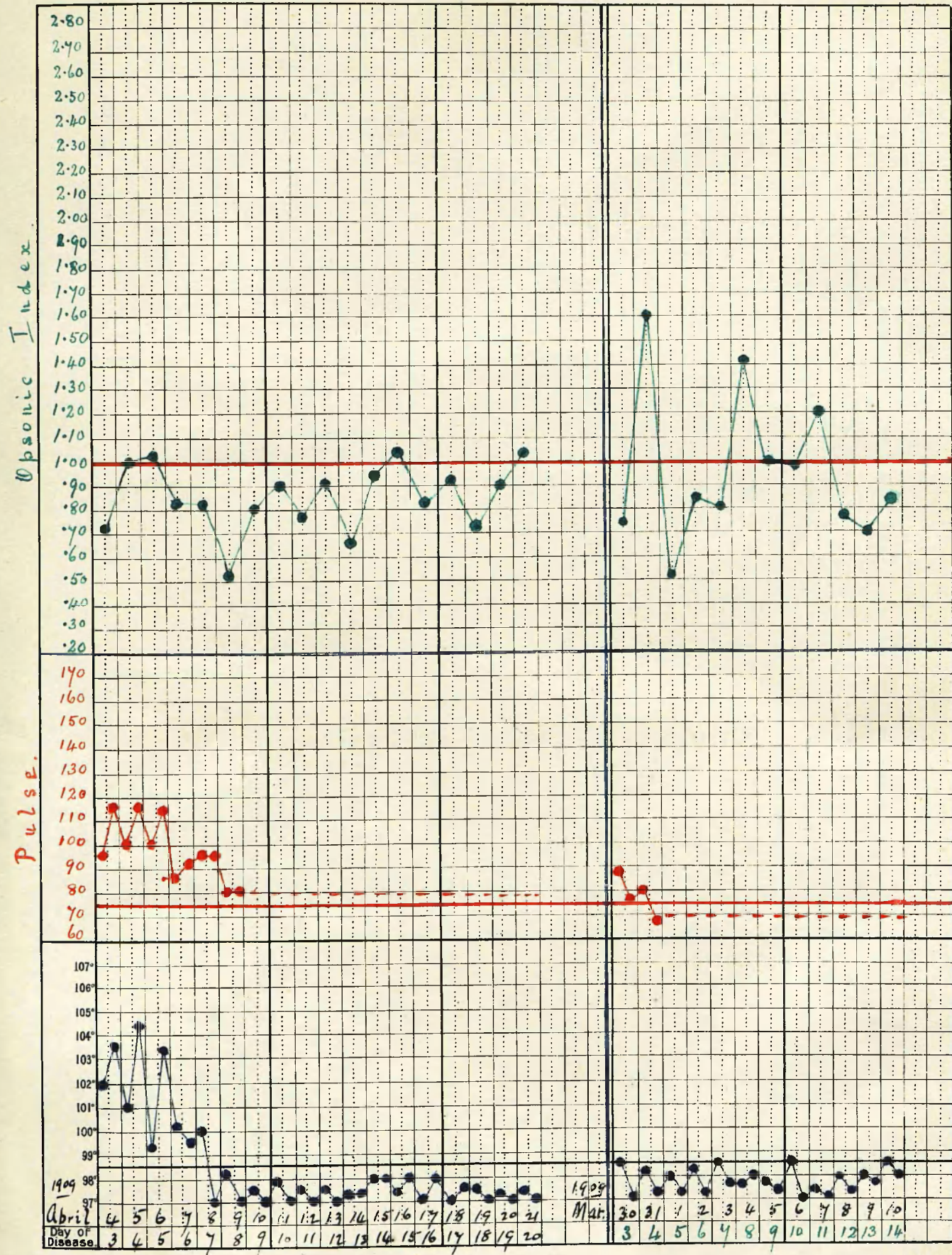


Case XVI

Peter Morrison.

Case XV

John Downie.



Case XVII

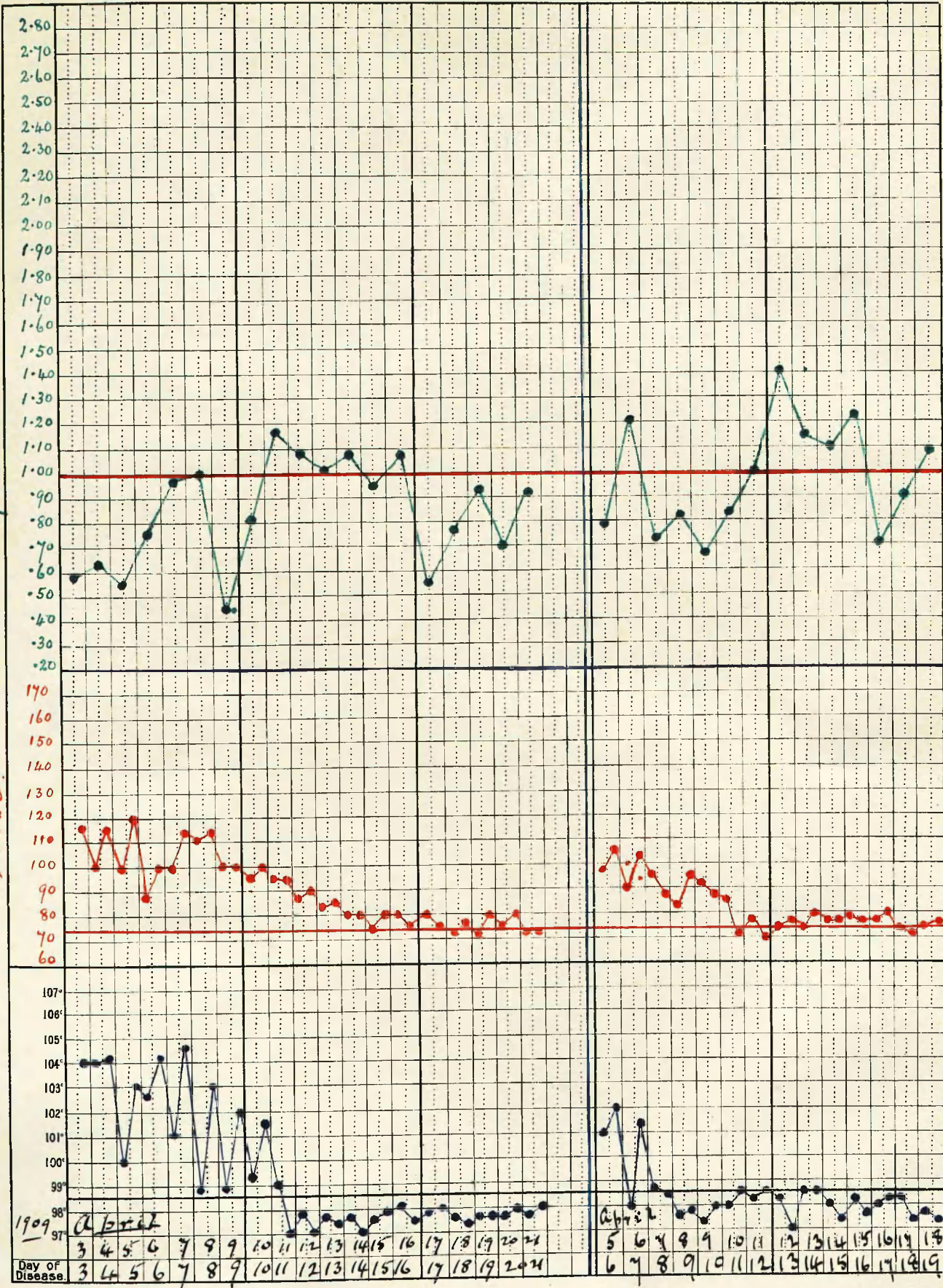
Case XX

Ralph Russell.

Catherine Sutherland.

Opsonic Index.

Pulse.



1909 April

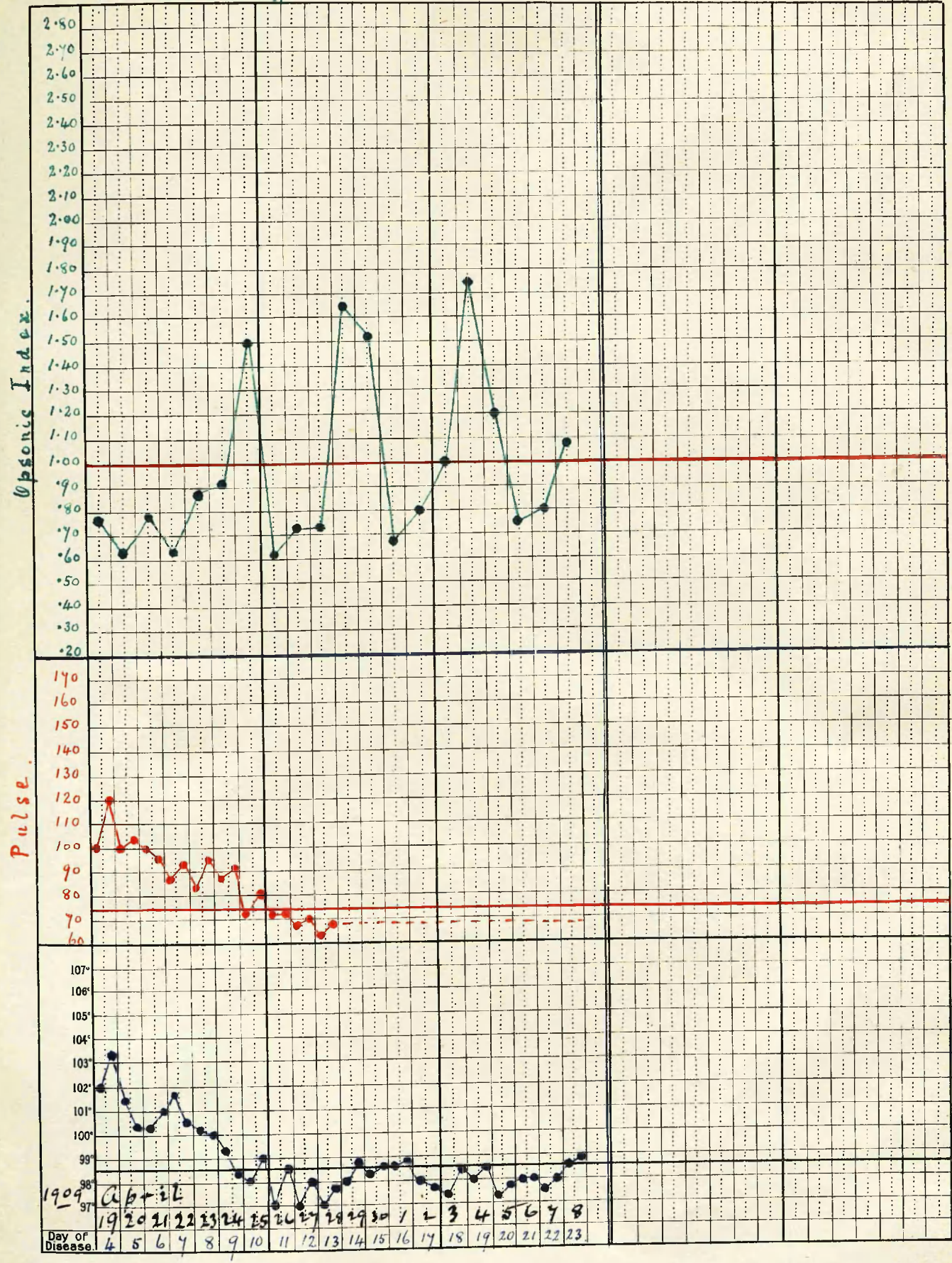
April

Day of Disease 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Day of Disease 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Case XVIII

Hannah Gray.



Case XXI

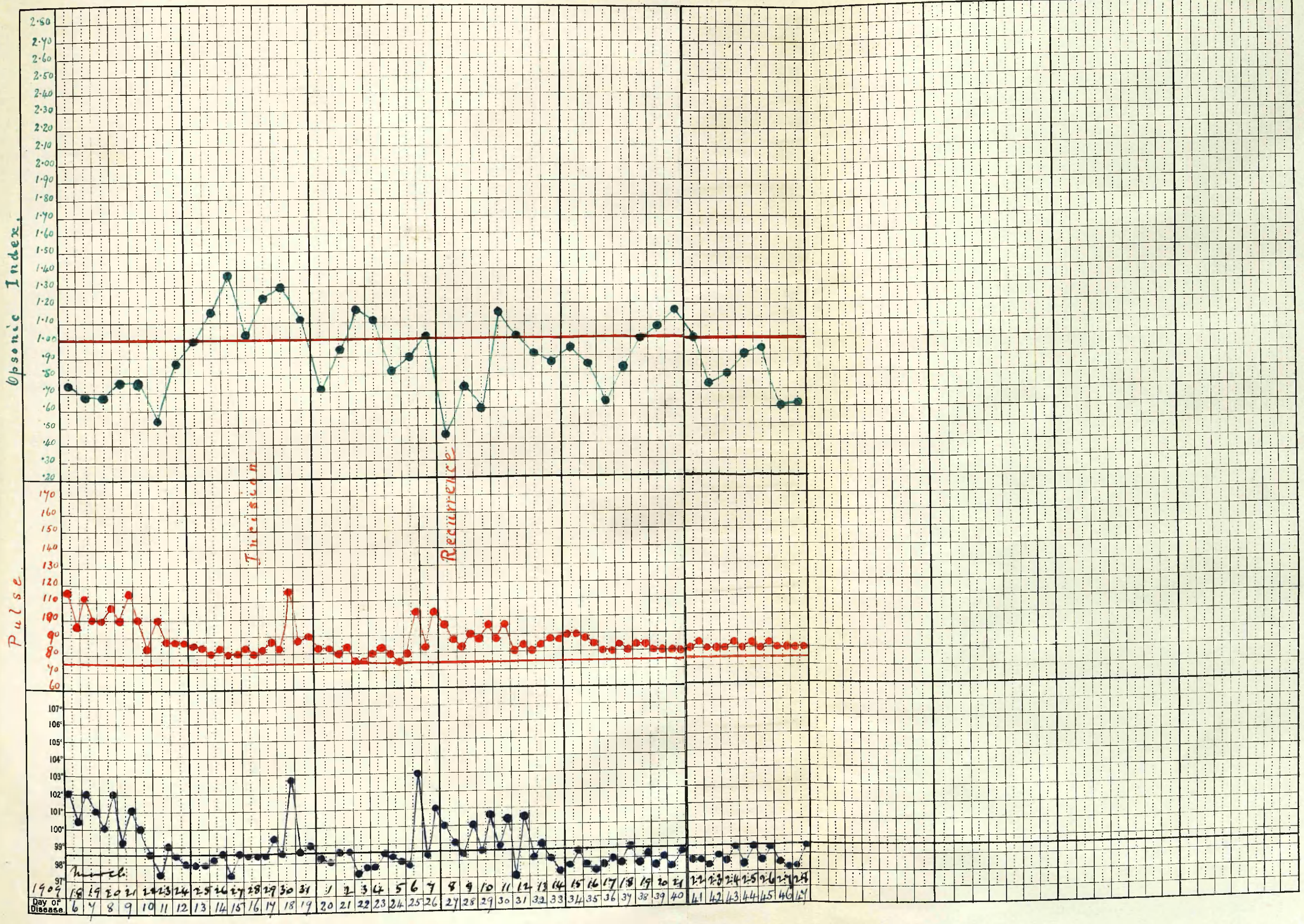
John Halliday.



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Day of Disease	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31															

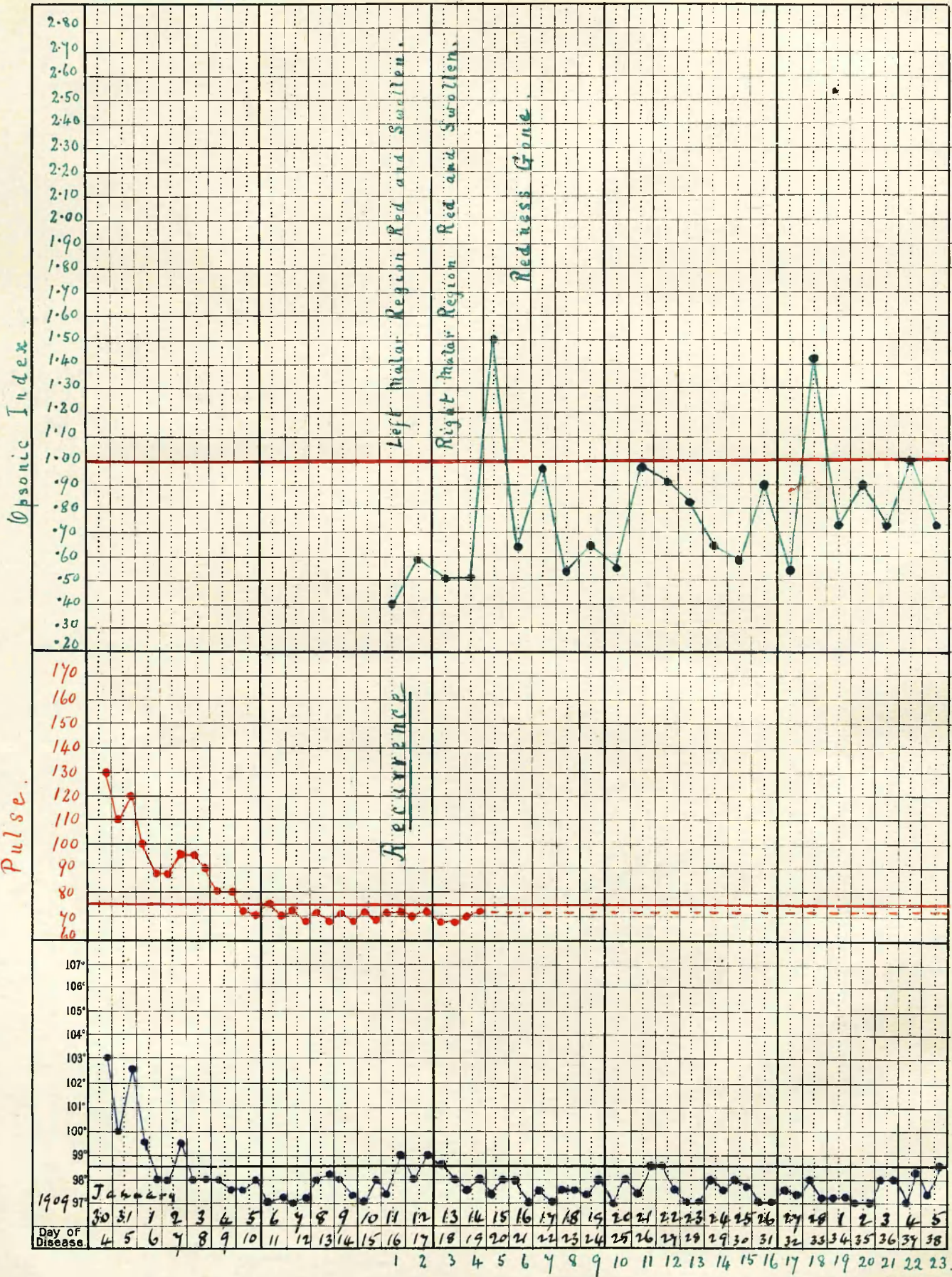
Case XXIII

Neil Meichan.



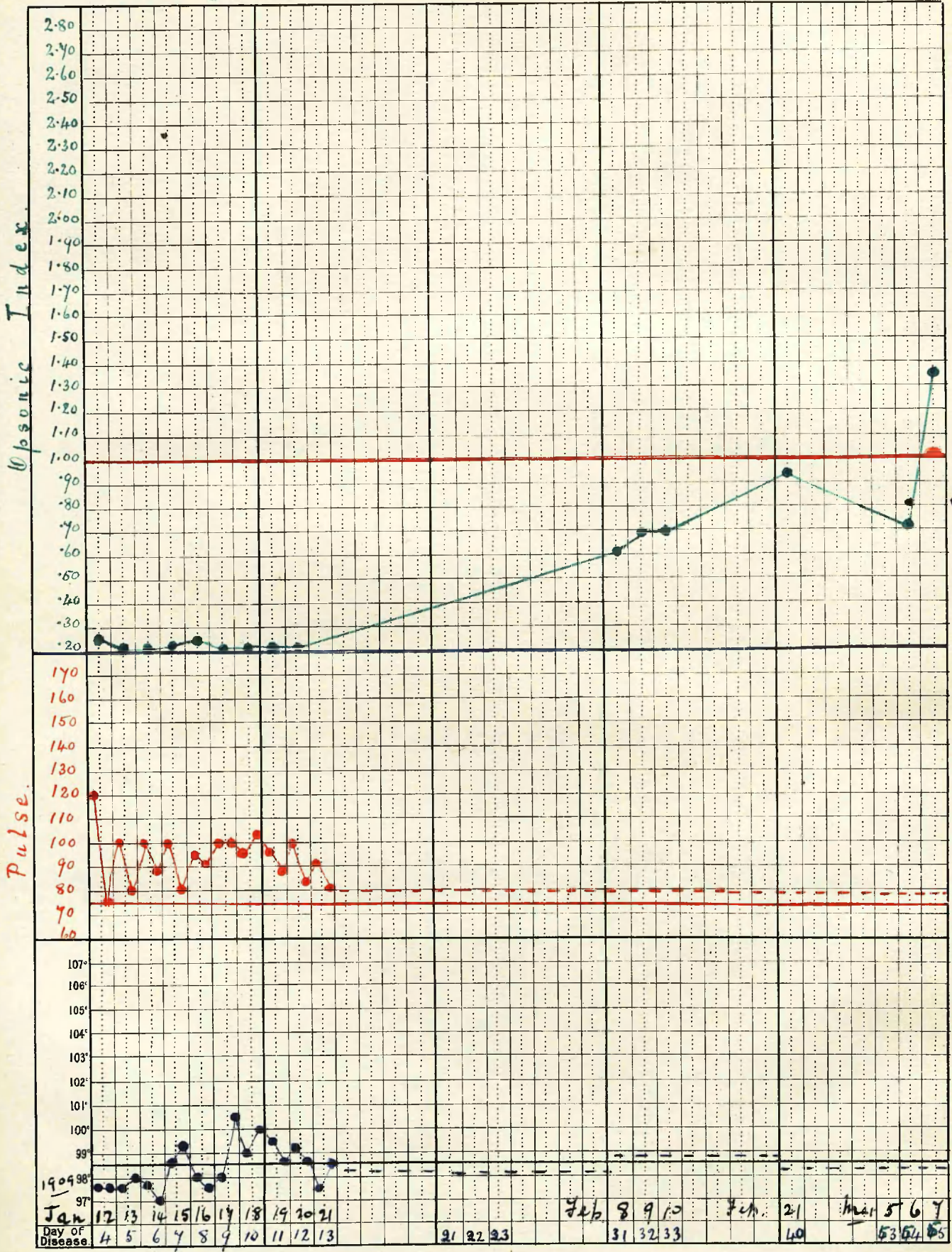
Case XXIV

Annie Lyle.



Case XXV.

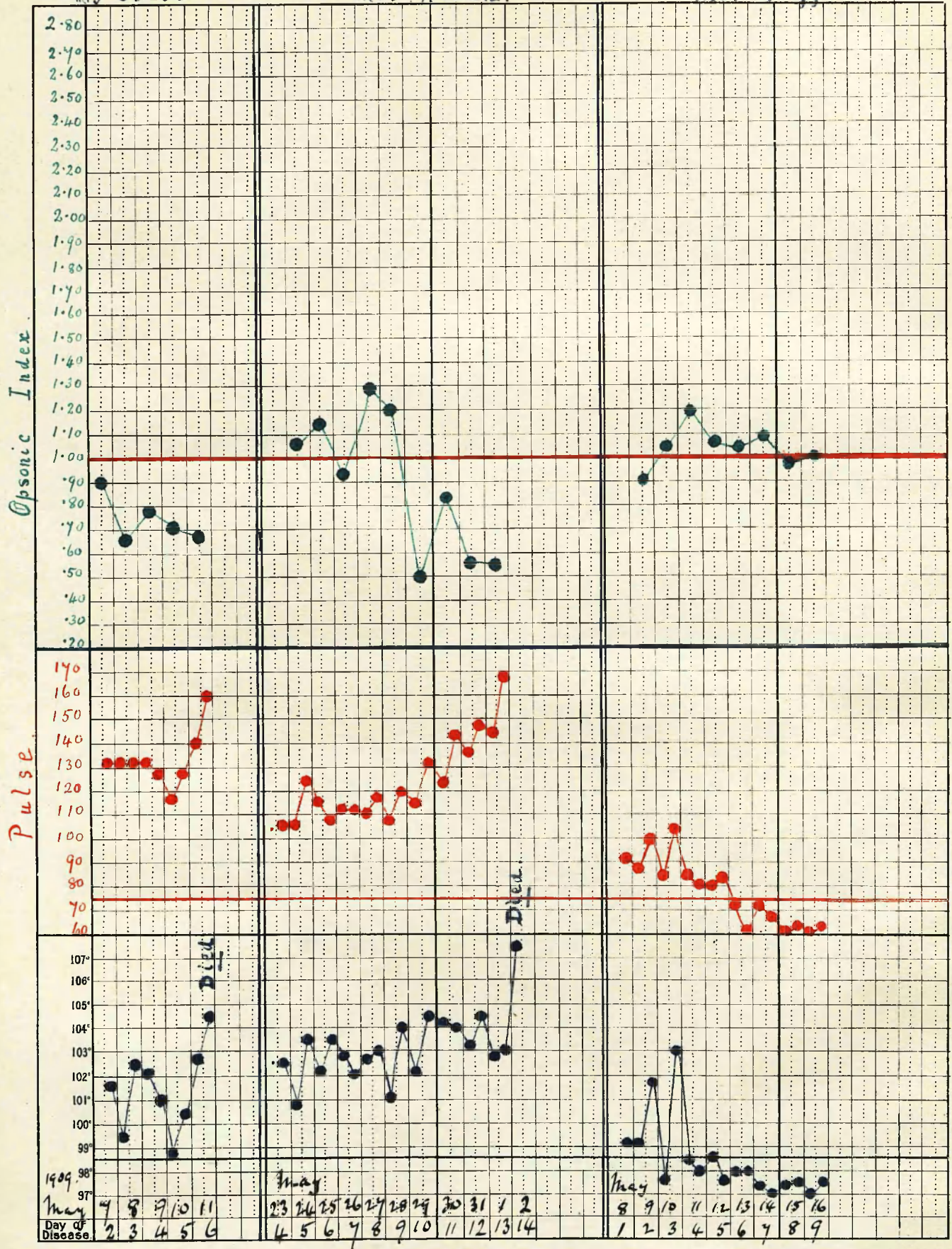
Mrs. Bryce.



← .81 Feb .71

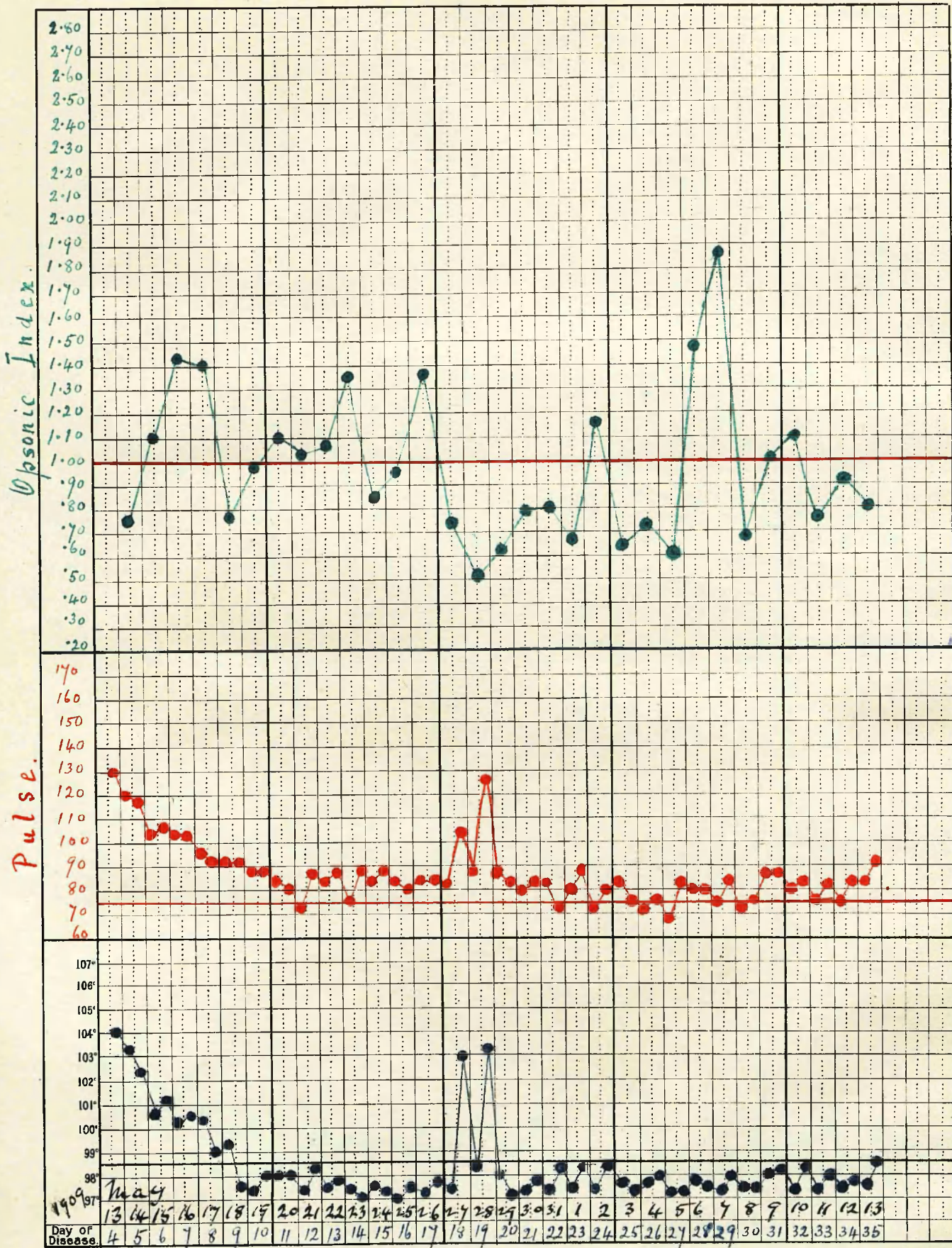
Case XXXVIII, Case XXVI, Case XL.

Mrs Steel Mrs Allan Mrs. Griffin.



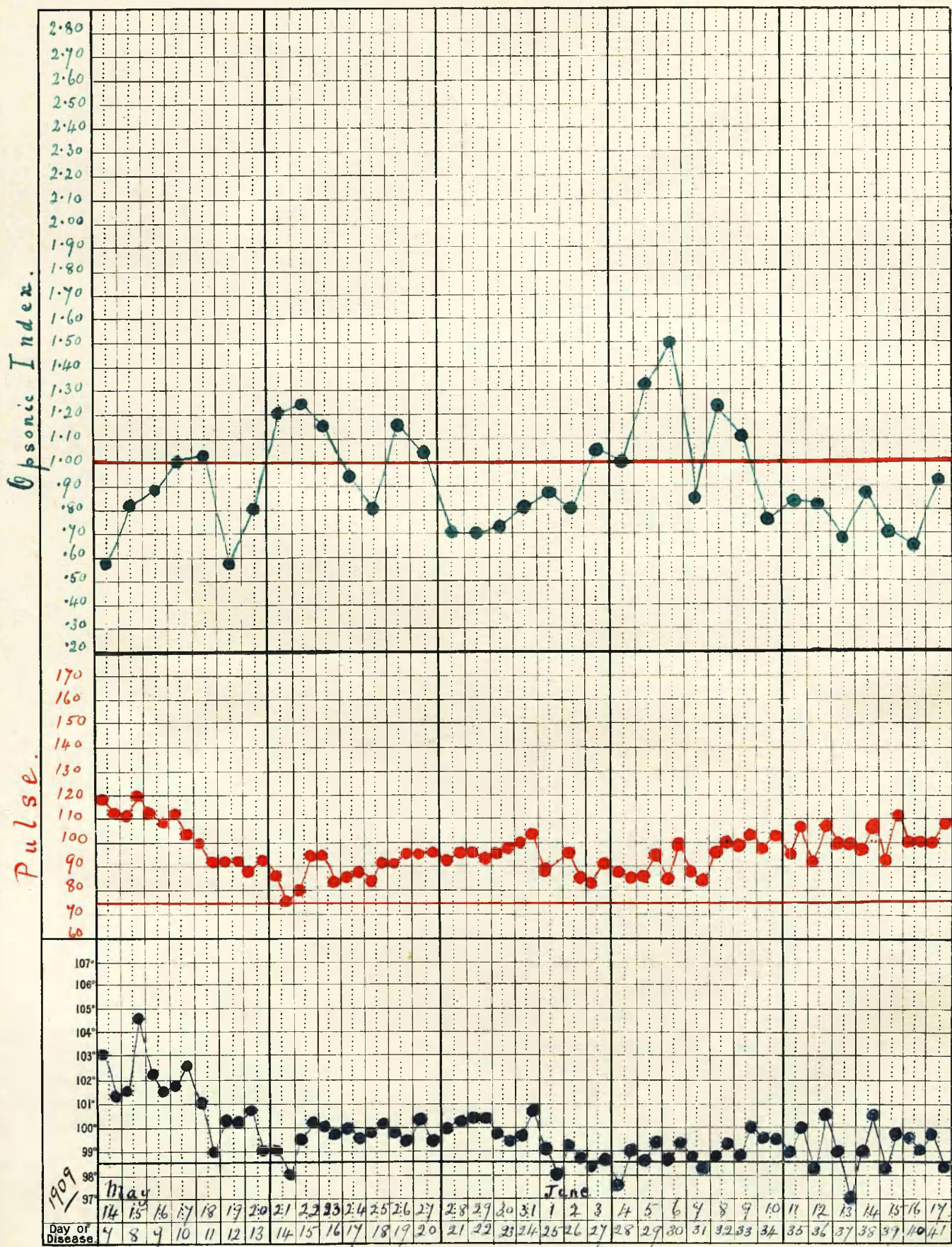
Case XXVII.

Mrs. Connelly.



Case XXVIII

Mrs. Douglas.



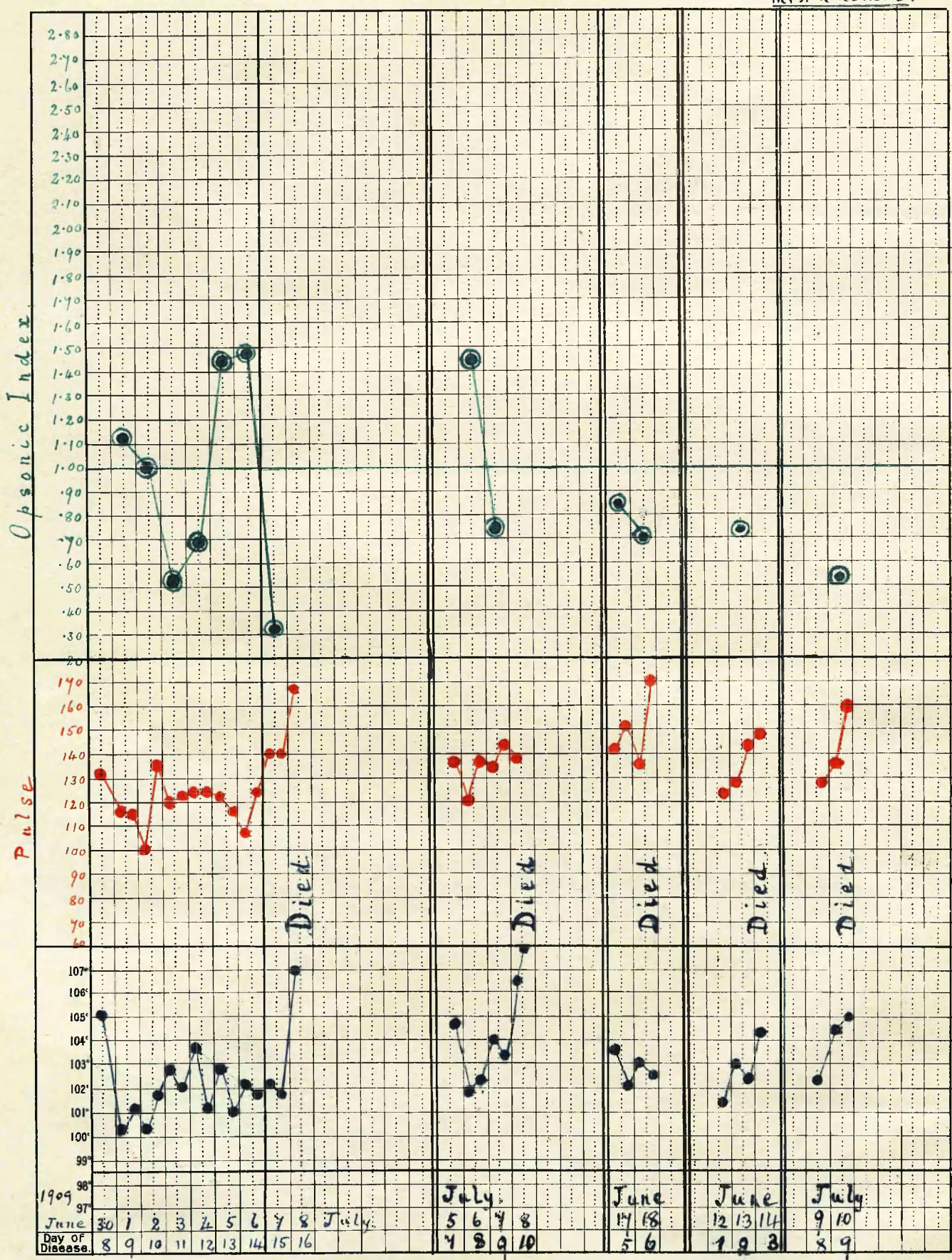
Case XXXIX
Mrs. M^cGuire.

Case XXXI
Mrs. M^cCaw.

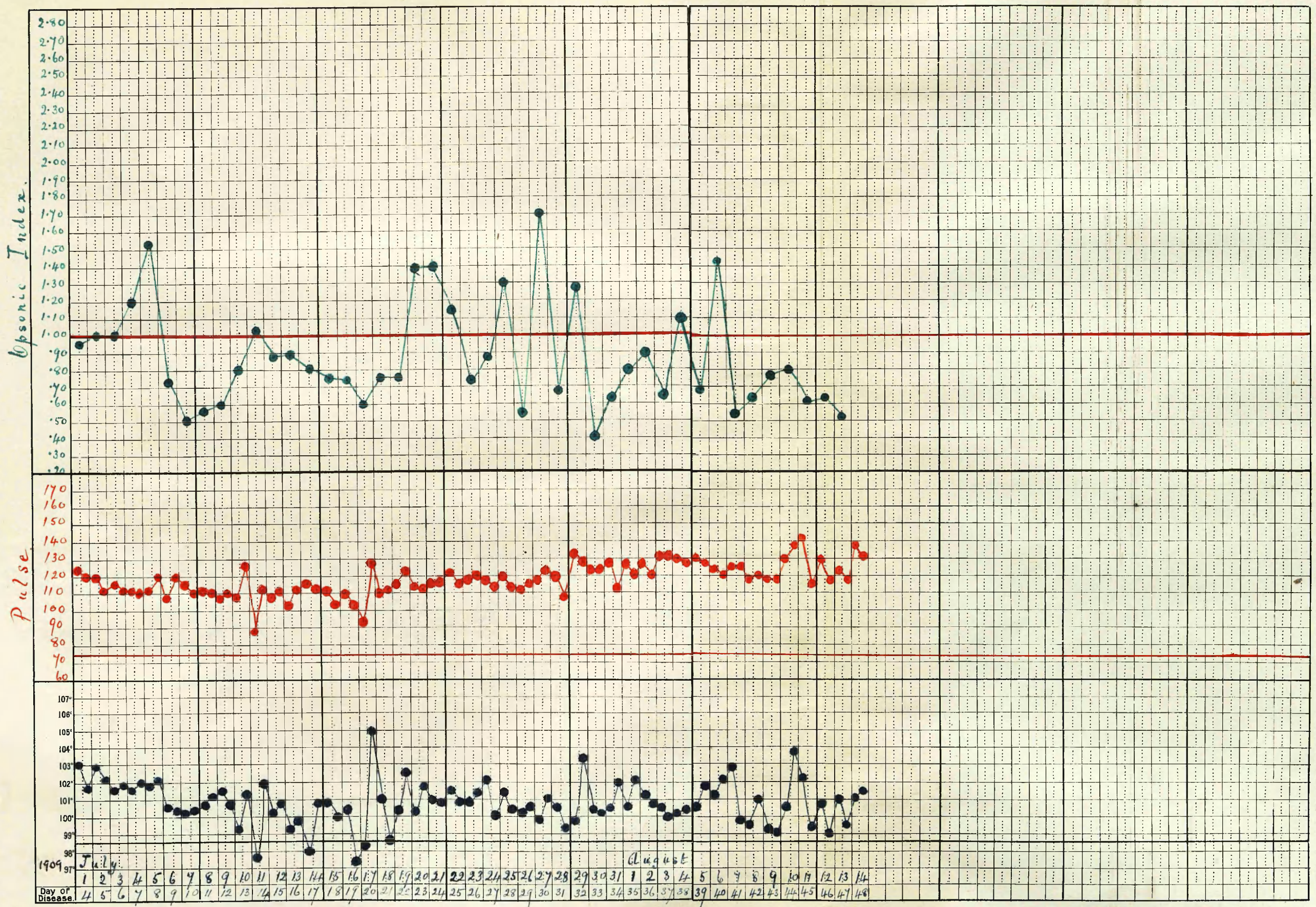
Case XXXVI
Mrs. Rooney.

Case XXX
Mrs. Stevenson.

Case XXIX
Mrs. McKinnon.

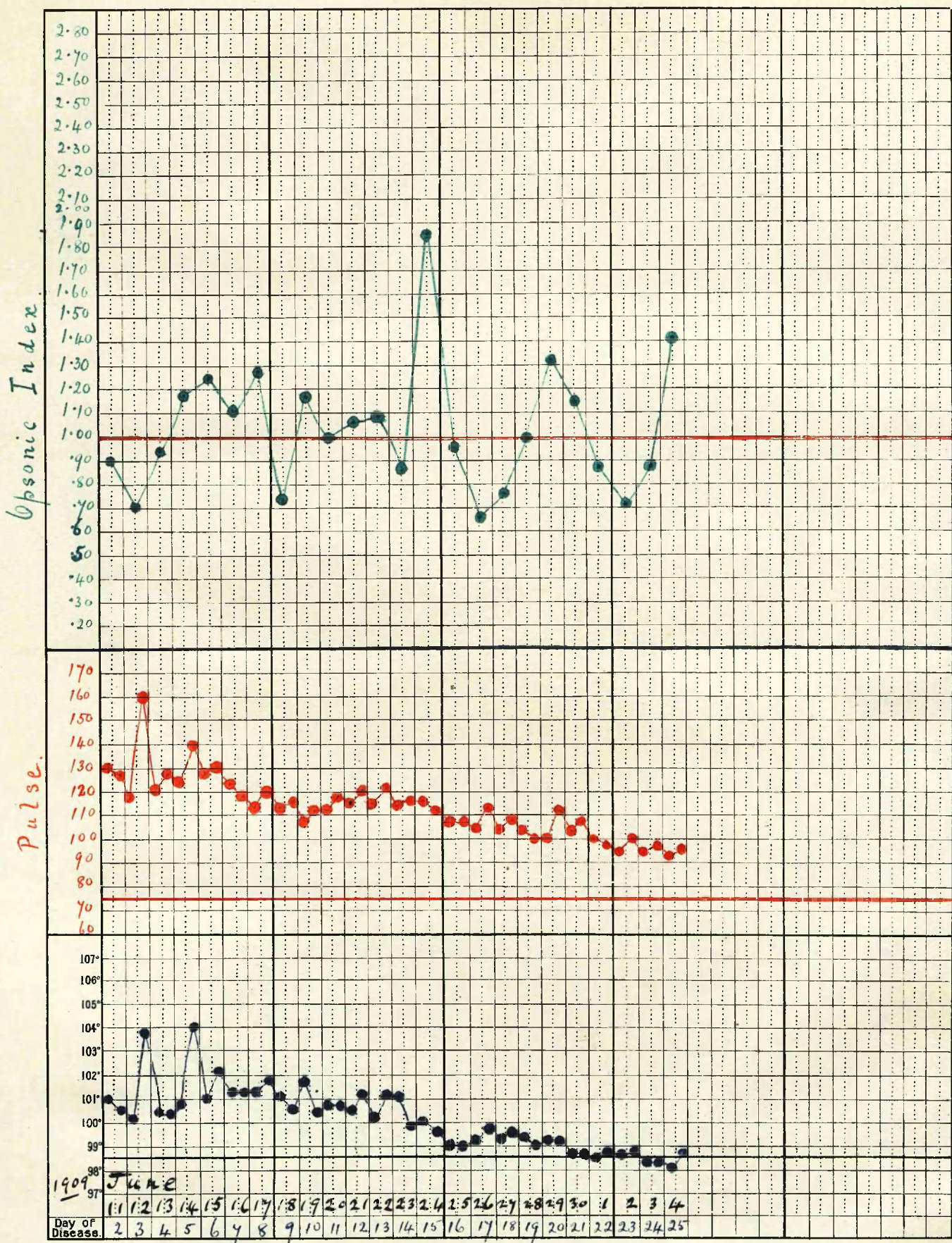


Mrs. McCafferty.



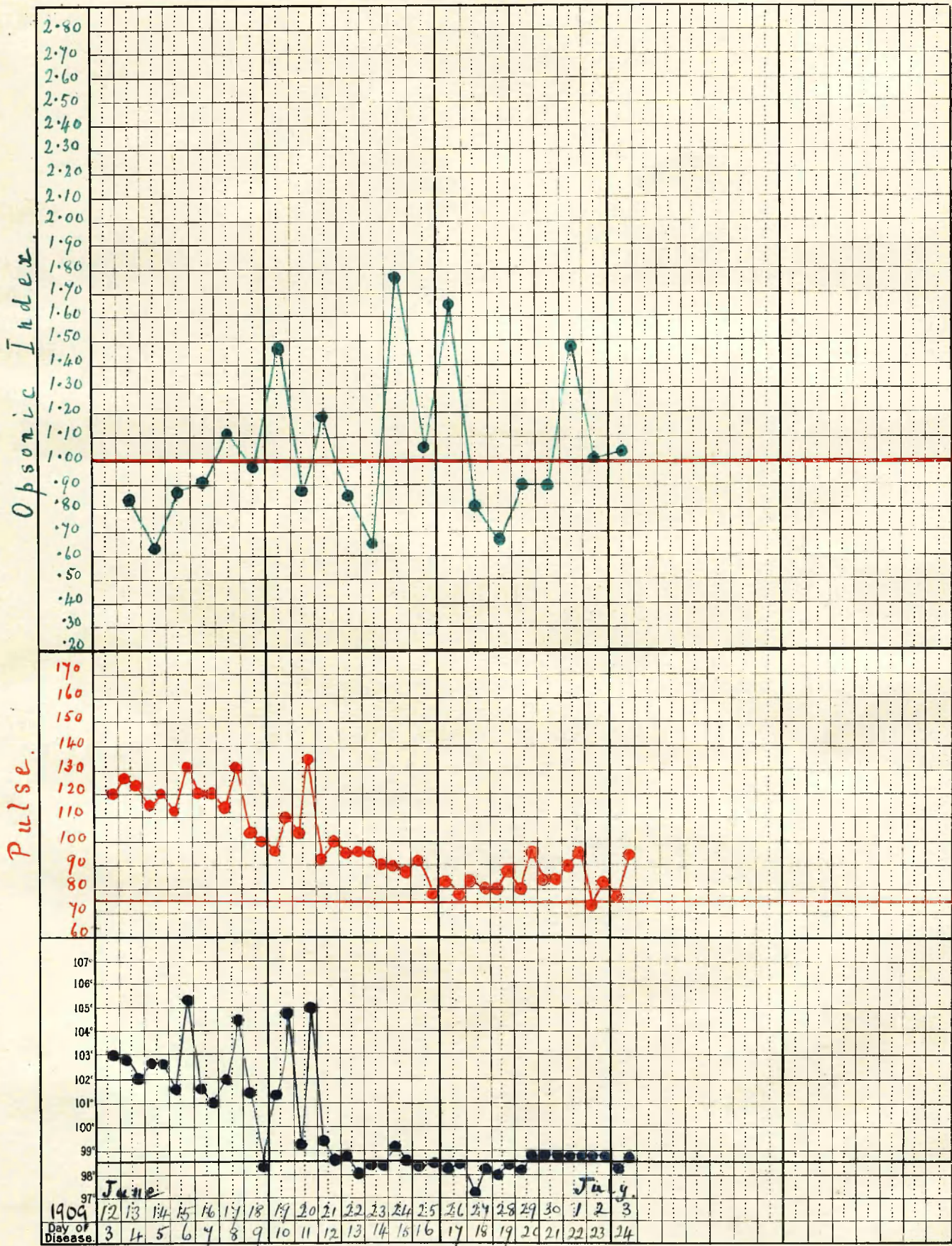
Case XXXIII

Mrs. Thomson



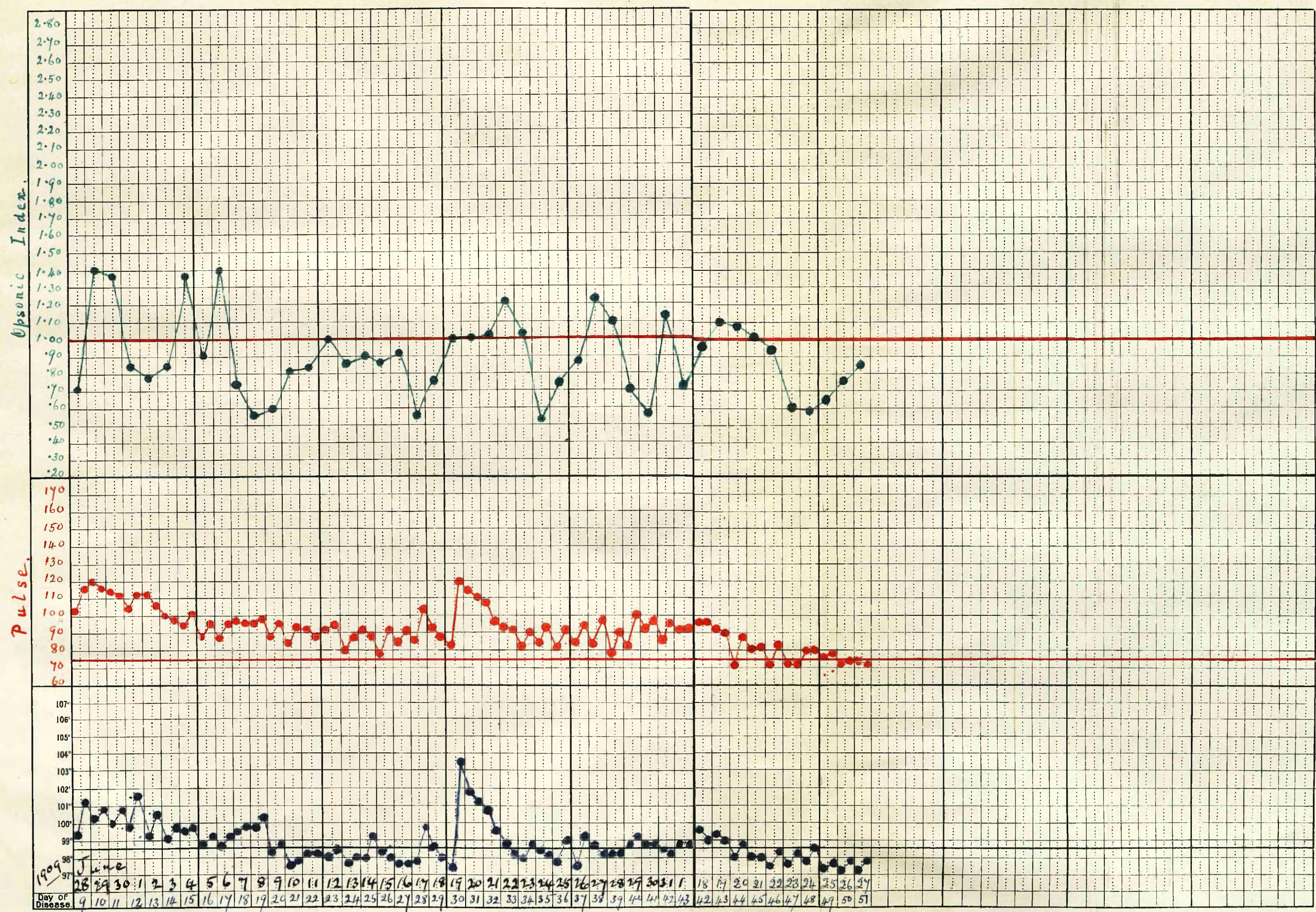
Case XXXIV

Mrs. Grant.



Case XXXV

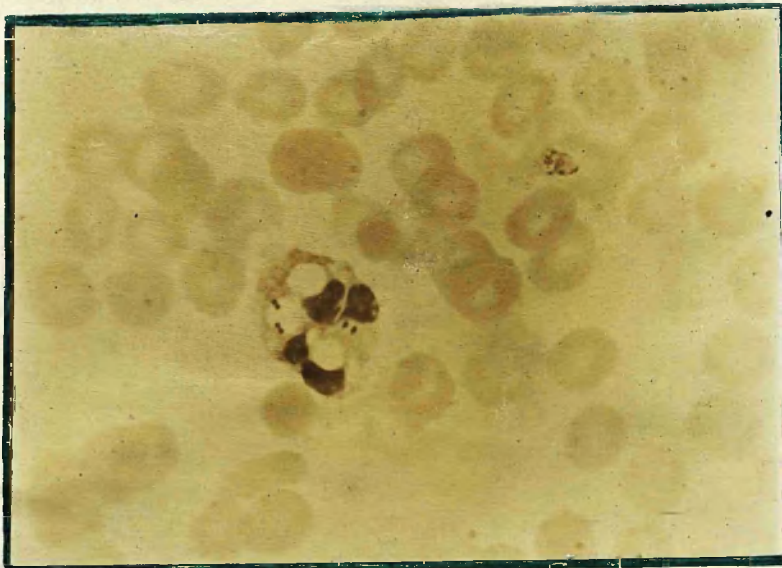
Mrs. Grainger.



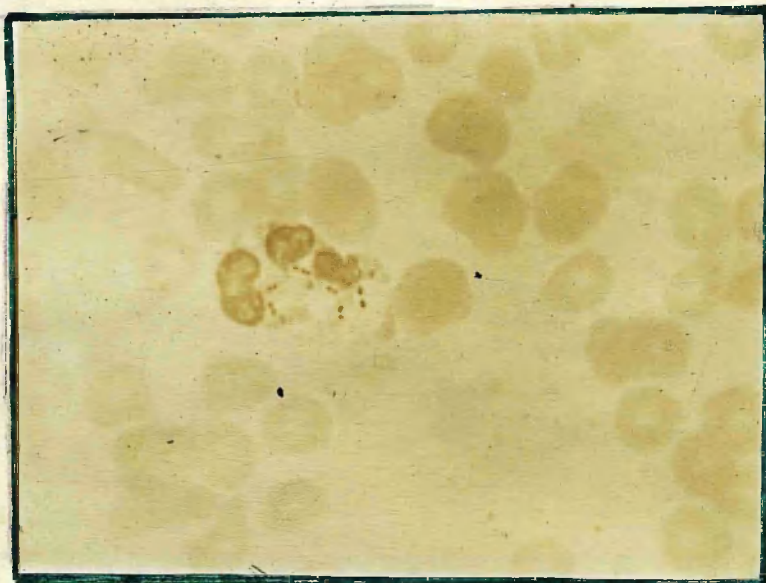
Case XXXVII

Mrs. M. Indoe

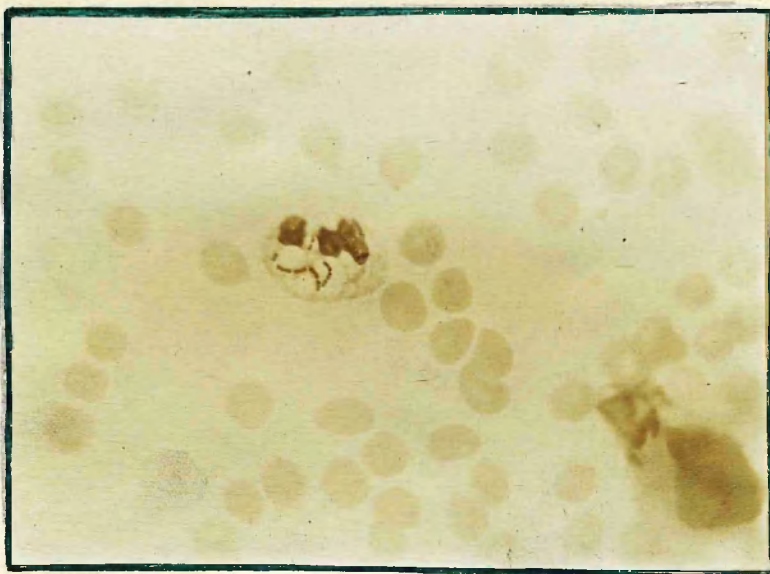




X 1500.



X 1500.



X 1000

Showing Ingested Streptococci and Vacuoles.