Observations in Leucocytosis in Normal Children, and also in Whooping Cough and Lobar pneumonia in Children.

Thesis for the Degree of M.D.

by

W. P. MURRAY, M.B., Ch.B.

NORMAL LEUCOCYTOSIS IN CHILDHOOD.

The various writers on this subject have paid great attention to the leucocytosis of the new born. Da Costa gives the following:-

Birth	21,000	p.c.m.
1st. day ...	24,000	"
2nd. day ...	30,000	"
4th. day ...	20,000	"
7th. day ...	15,000	"
10th day ...	10,000 - 14,000	p.c.m.
12th - 18th.	12,000	p.c.m.
1st. year ..	10,000	"
6th. year and upwards.	7,500	"

He also gives the following differential count in infants.

Polymorphonuclear Leucocytes	28 - 40%
Large Lymphocytes	6 - 14%
Small Lymphocytes	50 - 70%
Eosinophils	.5 - 10%

Sahli dismisses the subject with the following, "The white count is two or three times the normal the first day of life. It them diminishes to normal and increases again after the first week, remaining at/

at about 50% above the normal. Rieder found in this leucocytosis a preponderance of mononuclears. He also found that the blood of the new born contained a high percentage of eosinophils and normoblasts and exhibited a moderate leucocytosis
The normal number of lymphocytes is 22 - 25% of the total leucocytes i.e. 1500 to 1700 per c.m. up to 70% in children."

Hutchison finds the total number of white cells in the blood at birth to be about 15,000 per c.m.; by the end of the first year it has sunk to about 14,000, by the second to 12,000, by the third to 10,000. After that the decline goes on steadily till the usual adult figure of 7,500 is reached.

He also gives the following differential count:

	Poly.	Large L.	Small Lymp.	Eosinoph.
1st day	72	9	17	2
3rd "	67	11	18	4
6th "	42	17	35	6
9th "	36	18	42	4
12th "	37	16	44	3

Now, although it is extremely interesting to find such changes in the blood of new born children, it is very little use from a practical standpoint. What one wants to know is the usual total count and differential/

differential at different ages till the ordinary adult figure is reached. The variation in children's blood is so great that one might think one were dealing with something abnormal if one had not a good standard for the different years of childhood.

The following work was undertaken before the publication of "Blood" by Gulland and Goodall. This is the first book one has been able to find in which the necessary standard is given.

It is as follows:-

Birth	18,000	per c.m.
3rd day	30,000	" "
7th day	10,000	" "
8th month	15,000	" "
1 year	10,000	" "
6 years	9,000	" "
9 "	8,000	" "
12 "	Adult.	

From the tenth day till about the fourth year the lymphocytes are in excess of the polymorphs. About the tenth day they constitute 60% of the white cells, and they remain about this proportion till the third or fourth year, when they fall to 50%. A gradual fall continues, so that the adult proportions are reached about twelve years of age.

The following work was done on surgical patients at/

at the Paddington Green Children's Hospital. Only healthy children were examined with such congenital affections as phimosis, hernia, naevous, etc. The examinations were made in the case of Out Patients when they had been starved for an hour or two before operation for circumcision etc., and in the case of In Patients about three hours after the evening meal. Thus it was hoped to avoid any error from digestion leucocytosis.

In each case recorded in this paper in addition to the ordinary white count by means of Thoma-Zeiss Haemocytometer a differential of 400 cells was made. This is the reason why most of the counts although expressed as percentages add up to 99.9 or 99.8.

In order that a differnetial count may be of any use it must be taken in conjunction with the total white count. In any individual case one can get a very good idea from simply looking at the figures but when one comes to compare one case with another a percentage differential count is useless. The only satisfactory method for statistical work is to express the differential count in terms of totals per cubic millimetre. Until one becomes accustomed to it, this looks clumsy, but it is the only scientific basis on which to make comparisons.

The following are the results of the investigation of 81 cases:-

ge.	Whites.	Polymorphs.	Large Lymphocytes	Small Lym.	Eosinp.	Basop.
6 mts	12,520	3088	807	8074	380	41
- lyr	11,170	3420	680	6887	171	13
years	12,910	3753	878	7929	245	26
years	10,920	4290	784	5658	233	35
years	11,260	5626	716	4417	412	31
years	9,580	4521	592	4029	397	23
years	9,340	5249	672	3055	317	30

Figures represent totals per c. m.

For greater simplicity these figures have been put in graphic form on a chart.

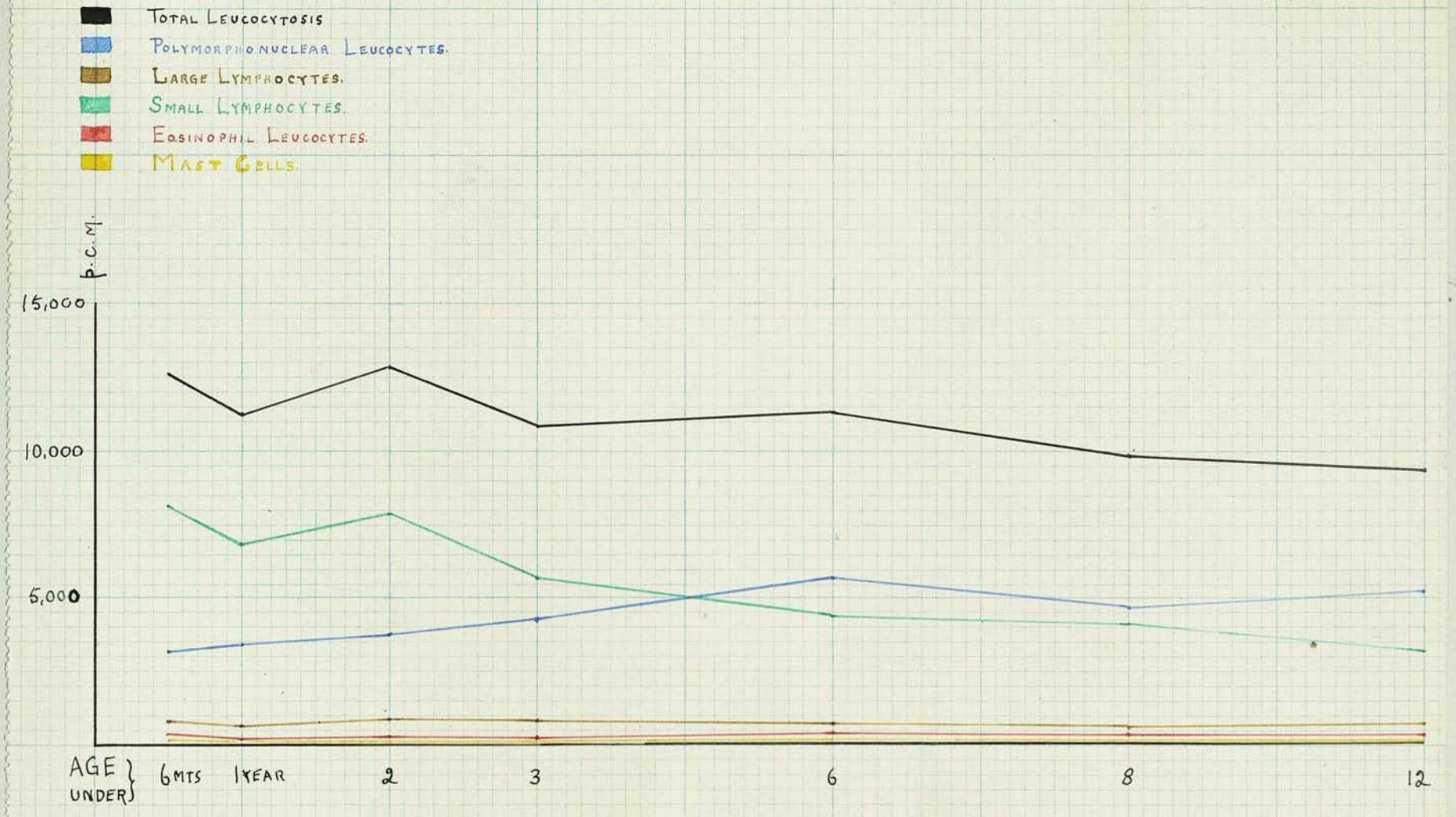
It will be seen that the totals under two years coincide fairly accurately with those given by Hutchison, and are a little in excess of Gulland and Goodall's. From two years onwards the totals are somewhat in excess of Gulland Goodall's partly because they are averages between ages charted under the higher figure. For example at "6 years" the counts include 8 children under five years of age. This is unfortunate but it is the only way to divide the limited number of examinations which were made.

The chief points of interest are the gradual decline of the number of small lymphocytes from 8074 p.c.m. at 6 months to 3055 p.c.m. at 12 years, and the rise of the polymorphs from 3088 at six months to 5626 p.c.m. at 6 years. The large lymphocytes are fairly regular throughout/

throughout, while the eosinophils show no great nor regular deviation.

Out of 81 counts i.e. 32,400 cells only two nucleated red cells were seen. These were both in babies one eleven weeks old and the other three months.

Chart to shew total leucocytosis and differential count in totals per cubic millimetres in normal children up to 12th year of life



Name	Age	Whites	Poly.	L.L.	S.L.	E.	B.	
H.S.	9/365	17,400	27.7	13	55	3.2	1	%
			4,819	2,262	9,570	556	174	p.c.m.
R.A.	3/52	9,800	28.7	4.2	65.2	1.7		%
			2,812	411	6,389	116		p. c. m.
J.F.	11/52	9,200	13.7	8.5	76.5	1.2		% One nucleated red per 400
			1202	782	7,038	110		p.c.m.
R.B.	3/12	10,200	14.6	6	76.3	3		% One nucleated red per 400
			1489	612	7,782	306		p.c.m.
A.L.	3/12	9,600	24.3	4.3	70	1.3		%
			2332	412	6720	124		p.c.m.
G.P.	3/12	9,800	37.2	4.2	58	.4	.2	%
			3645	411	5684	39	19	p.c.m.
K.T.	3/12	14,400	30	18.7	59	1.7	.5	%
			4320	1252	8496	244	72	p.c.m.
G.D.	5/12	16,000	10.6	5	81.3	2.6	.3	%
			1696	800	13,008	416	48	p.c.m.
C.P.	5/12	14,000	33.2	4.2	54	8	.5	%
			4648	588	7560	1120	70	p.c.m.
F.G.	5/12	14,800	26.5	3.7	64.2	5.2	.2	%
			3922	547	9501	770	29	p.c.m.

Name	Age	Whites	Poly.	L.L.	S.L.	E.	B.	
E.M.	8/12	11,000	39.7	8	49.5	2.5	.2	%
			4360	880	5450	272	22	p.c.m.
S.O.	8/12	15,000	19.7	9.7	69.7	.5	.2	%
			2955	1455	10,455	75	30	p.c.m.
M.A.	8/12	8,800	33.3	1.3	65.3			%
			2930	114	5746			p.c.m.
M.F.	9/12	10,200	25.7	5.2	67.5	1.2	.2	%
			2621	530	6885	122	20	p.c.m.
M.B.	11/12	9,800	47	10.2	39.5	3	.2	%
			4606	999	3871	294	19	p.c.m.
M.	11/12	8,200	20.5	10	68.7	.5	.2	%
			1681	820	5633	41	16	p.c.m.
A.	11/12	12,000	49.5	3.7	46.5			%
			5940	444	5580			p.c.m.
H.	11/12	14,400	15.2	1.5	79.7	3.5		%
			2408	218	11,476	504		p.c.m.
M.	1/12	10,200	39.5	5	55	.5		%
			4029	510	5610	51		p.c.m.
H.	1/12	9,400	35	2.5	56	6.2	.2	%
			3290	245	5264	583	19	p.c.m.

Name	Age	Whites	Poly.	L.L.	S.L.	E.	B.	
G.S.	1/12	14,000	22.2	7.7	66	3.7	.2	%
			3108	1078	9240	518	28	p.c.m.
G.M.	1/12	15,600	20	2.5	74	3.5		%
			3120	390	11,544	546		p.c.m.
F.P.	1/12	13,000	20.3	7.6	70.6	1	.3	%
			2639	988	9178	130	39	p.c.m.
J.M.	1/12	18,400	34	8	56.7	1.2		%
			6256	1472	10,422	220		p.c.m.
A.G.	1/12	16,800	20.2	15	64.2	.2	.2	%
			3360	2520	10,800	33	33	p.c.m.
C.B.	1/12	10,600	37.5	4	55.7	2.5	.2	%
			3975	424	5904	265	21	p.c.m.
R.C.	1/12	13,400	35	7.7	55.2	1.5	.5	%
			4690	1031	7396	201	69	p.c.m.
J.I.	1/12	12,000	41.5	7	49.2	2.2		%
			4980	840	5804	26		p.c.m.
C.B.	1/12	7,800	27.5	11	57	3.5	1	%
			2145	858	4446	273	78	p.c.m.
L.R.	1/12	10,800	36.7	7	52.7	3.2	.2	%
			3963	756	5691	345	21	p.c.m.

Name	Age	Whites	Poly.	L.L.	S.L.	E.	B.	
C.L.	1 10/12	14,000	17.2	3.7	77.2	1.5	.2	%
			2408	518	10,808	210	28	p.c.m.
A.G.	1 10/12	14,800	34.5	4.7	60.2	.2	.2	%
			5086	675	8909	29	29	p.c.m.
R.B.	2	10,000	45.2	9.5	44.2	.7	.2	%
			4520	950	4420	70	20	p.c.m.
F.S.	2	11,800	31.7	6.2	60	2		%
			3740	731	7080	236		p.c.m.
S.J.	2	10,000	58.7	10.2	27.5	3	.5	%
			5870	1020	2750	300	50	p.c.m.
C.G.	2	14,000	22	7.6	68.3	1	1	%
			2800	1064	9562	140	140	p.c.m.
T.C.	2	10,000	24.2	9.2	61.5	4.2	.7	%
			2420	920	6150	420	70	p.c.m.
G.A.	2	8,200	38.2	6.2	54.2	1.2		%
			3132	508	4442	108		p.c.m.
F.W.	2	11,400	42.5	3.2	53.2	1		%
			4845	364	6064	114		p.c.m.
W.G.	2 1/2	12,000	50	6	40	4		%
			6000	720	4800	480		p.c.m.

Name	Age	Whites	Poly.	L.L.	S.L.	E.	B.	
F.F.	3	8,600	32.5	9.5	50.5	7.5		%
			2795	817	4343	645		p.c.m.
J.W.	3	10,000	55.5	2.5	40.2	1.7		%
			5550	250	4020	170		p.c.m.
E.S.	3½	15,200	56.5	3.2	37.5	2.7		%
			8588	486	5700	410		p.c.m.
R.G.	3½	11,600	77.5	6	15.7	.7		%
			8990	696	1821	116		p.c.m.
P.C.	4	10,000	40	6.2	42	11.2	.5	%
			4000	6206	4200	1120	50	p.c.m.
F.S.	4½	14,800	51.2	4	42.2	2	.5	%
			7578	592	6246	296	72	p.c.m.
E.P.	4½	12,000	39.7	9.5	43.5	6	1.2	%
			4764	1140	5220	720	144	p.c.m.
A.W.	4½	12,200	52.2	4.7	41.7	1.2		%
			6364	573	5087	146		p.c.m.
L.C.	5	7,800	52.7	14.5	30	2.2	.5	%
			4110	1131	2340	171	39	p.c.m.
F.J.	5	12,600	54.7	4	40.5	.7		%
			6892	564	5103	88		p.c.m.
J.B.	5	12,200	4840	5.4	49.7	2.6	.2	%
			4880	488	6063	732	24	p.c.m.

Name	Age	Whites	Poly.	L.L.	S.L.	E.	B.	
H.D.	5	5,600	44.3	5.3	48.6	2.3	.3	%
			2480	296	2721	128	16	p.c.m.
A.D.	5	10,800	43	9.7	43.5	3.7		%
			4644	1047	4698	399		p.c.m.
H.A.	5	14,600	60	9.2	25.3	5	.5	%
			8760	1343	3693	730	73	p.c.m.
E.M.	5	10,000	40	7.7	48.5	3.2	.5	%
			4000	770	4850	320	50	p.c.m.
S.G.	6	10,600	54	6.2	36.7	2.7	.2	%
			5725	638	3890	286	21	p.c.m
H.O.	6	8,200	40	3.6	51.3	5		%
			3280	295	4200	410		p.c.m.
S.W.	6	10,600	57.2	12.2	26.7	3	.7	%
			6070	1295	2830	318	74	p.c.m.
W.F.	6¼	10,200	37.5	1.7	48	12.7		%
			3820	176	4900	1285		p.c.m.
W.W.	6½	10,000	52	8.3	38.6	1		%
			5200	830	3860	100		p.c.m.
L.S.	6½	8,800	56.5	6.7	34	2.2	.5	%
			4970	590	2990	193	44	p.c.m.

Name	Age	Whites	Poly.	L.L.	S.L.	E.	B.	
N.G.	6½	6,800	43	6.7	47.7	2.5		%
			4920	455	3240	170		p.c.m.
S.S.	7	11,400	35	4.7	54	6	.2	%
			3990	526	6160	684	22	p.c.m.
J.S.	7	11,400	53	4	39.7	2.7	.5	%
			6050	456	4520	308	57	p.c.m.
W.V.	7	7,800	41	8.5	47.2	3	.2	%
			3190	660	3680	234	15	p.c.m.
E.S.	8	9,200	43.5	7.5	43	5.5	.5	%
			4000	690	3950	505	46	p.c.m.
L.S.	8	8,400	38	6.5	48	6	1.5	%
			3190	545	4030	504	126	p.c.m.
V.Y.	8	9,800	50.2	5.2	40.2	3.7	.5	%
			4910	509	3940	362	49	p.c.m.
D.W.	8	9,400	60	6.5	29.5	3.7	.2	%
			5640	610	2770	347	18	p.c.m.
J.P.	8	8,800	68.2	7.2	22.7	1.5	.2	%
			6000	633	2000	132	17	p.c.m.
A.L.	8	8,200	53	10.5	33	3.2	.2	%
			4350	860	2710	262	16	p.c.m.

Name	Age	Whites	Poly.	L.L.	S.L.	E.	B.	
E.B.	8	12,400	64	11.2	23.8	.8	.2	%
			7950	1390	2960	99	24	p.c.m.
C.B.	9	14,000	66.7	4.5	27.7	.5	.5	%
			9300	630	3880	70	70	p.c.m.
H.L.	10	9,400	44.6	8.6	43.6	2.6	.3	%
			4200	808	4100	244	28	p.c.m.
A.A.	10	9,600	48	4.7	44	3	.2	%
			4600	450	4220	288	19	p.c.m.
L.W.	10	11,400	60.2	3.7	30.5	5.5		%
			6860	421	3480	626		p.c.m.
W.W.	10	9,400	49.5	7	38.5	5		%
			4750	657	3620	470		p.c.m.
C.F.	10	5,200	46	6.6	41.6	5.3	.3	%
			2390	342	2160	276	15	p.c.m.
L.P.	10	8,000	63.5	5.2	27.2	3.7	.2	%
			5075	416	2169	256	16	p.c.m.
W.G.	11½	6,800	60	6.7	25.7	7.2	.2	%
			4080	455	1750	490	13	p.c.m.
B.L.	11	9,400	71.3	14.3	12.2	1.6	.3	%
			6700	1340	1155	150	28	p.c.m.

REFERENCES.

Sahli "Diagnostic Methods" p. 797. p. 789.

Hutchison "Lectures on Diseases of Children" p. 319

Da Costa "Clinical Haematology"

Gulland and Goodall. "Blood." p. 73 - 74.

BLOOD IN WHOOPING COUGH.

The accounts given in various text books on the examination of the blood vary to a very marked degree in this subject. All are agreed on one point, namely that there is usually an increase in the white cells. The average count of course varies. Sahli puts it at between 15,000 and 30,000 per cubic millimetre, Barach at the outset finds an average of 17,000 to 18,000 per cubic millimetre. The original investigators Fröhlich and Meunier found an average of 27,800 in 30 cases. De Amicis and Pacchioni in corroborating this observation consider that the increase is somewhat less, having found an average count of 17,943 for their cases. Wanstall in 15 cases, and Stengel and White in four obtained even lower leucocyte values (no increase being noted in many instances). Crombie in the catarrhal stage had an average of 20,237 p.c.m.

With regard to the differential count there is a difference of opinion. Sahli writing on this point says "Pertussis leads to an increase of the lymphocytes, and to a less marked degree, also to an increase of polymorphonuclear leucocytes." Barach finds an increase in all forms at the outset, then a small lymphocytosis (51%) and a less marked increase in the number of large lymphocytes, bilobed small lymphocytes/

lymphocytes and degenerated large mononuclears are frequently seen. Later there is a gradual decrease in leukocytosis and a return to the normal differential count, except for a slight eosinophilia (5%) which may persist for months. On the other hand we find Da Costa writing "Lymphocytosis, generally relative, but sometimes absolute, is a characteristic finding in whooping cough. As a consequence of this change there is a coincident diminution in polynuclear neutrophils and eosinophils. In Allbutt it is stated that during the paroxysmal stage there is a high percentage of large lymphocytes. Crombie who slumps large and small lymphocytes together finds an increase of lymphocytes, usually about double the number of polymorphs present.

The writer has examined thirty-two cases. These children were seen at the Out Patient Department of the Paddington Green Children's Hospital on Saturday afternoons only. In view of this fact two difficulties were met. Firstly, that one seldom saw a case of whooping cough before the whoop had developed, unless the child was a member of a family already attending with whooping cough; and secondly, as there was no infectious block in the Hospital none of the complicated cases with pneumonia could be admitted for observation/

observation.

The cases in which the blood was examined were chosen with a view to keeping them under observation from the earliest possible date and then examining once a week or latterly once a fortnight.

The following are the clinical facts and blood examinations. In each case 400 cells were counted for every differential count.

Date	Laurie Lee	Aet. 7 wks.
17:2:12	Cough: one month. No. whoop. Chokes with cough. Sometimes vomits. A very fat baby. Signs of Bronchitis all over both lungs.	
(week 4)	Blood. Whites 29,600 p.c.m. P. 30.4 % = 9050 p.c.m. L.L. 4 1185 S.L. 64.8 19200 E. .8 237	
24:2:12	Has been coughing up blood. Sweats a great deal. Bronchitis much worse. Looks very ill. Subsequently developed bronchopneumonia and died: 1:3:12.	

Date	Arthur Dodd Aet. 1 5/12		
20:1:12	Cough 3 days. Worse at night. No whoop.		
27:1:12	Still no whoop. Very bad at night.		
	Blood Whites	20,400	
	P.	24%	= 4900 p.c.m.
	L.L	5.5	= 1120
(week 2)	S.L.	65.7	13420
	E.	4.5	920
	B.	.2	48
3:2:12	Has begun to whoop.		
10:2:12	Still whooping.		
	Blood. W.	14,600	
	P.	17%	= 2480 p.c.m.
	L.L.	4.7	686
(week 4)	S.L.	73.2	10700
	E.	5	730
17:2:12	Paroxysms still continuing.		
	Blood. W.	12,800 p.c.m.	
	P.	33%	= 4225 p.c.m.
	L.L.	2.7	346
(week 5)	S.L.	56	7160
	E.	7.7	986
	B.	.5	64

Date	Gladys Cordor Aet 2 years			
10:2:12	Cough one week. Whoop at night. Vomits everything.			
	Blood.	W.	32,000	
		P.	22.7% =	7320 p.c.m.
(week 1)		L.L.	4	1290
		S.L.	71.2	22900
		E.	1.5	484
		B.	.5	161
17:2:12	Still severe cough. Vomiting as before			
24:2:12	Cough in statu quo. Vomits everything.			
	Blood	W.	26,400	
		P.	23.7% =	6250 p.c.m.
(week 3)		L.L.	2.5	659
		S.L.	72.5	19100
		E.	1.2	316
2:3:12	Coughing up blood. Cough more severe.			
9:3:12	Less vomiting. Cough better.			
	Blood	W.	11,400	
		P.	40.2% =	4590 p.c.m.
(week 5)		L.L.	3.2	366
		S.L.	54.2	6190
		E.	2.2	251

Date	James Huggin			Aet. 3 y.
17:2:12	Cough two weeks. Whoop one week. Vomits every time.			
	Blood.	W.	14,200	p.c.m.
		P.	34.2%	= 4860 p.c.m.
		L.L.	11.7	1660
(2)		S.L.	44	6250
		E.	9.7	1378
		B.	.2	28
2:3:12	No. whoop. Cough better.			
23:3:12	Whoop returned.			

Date	Charles Beaumont			Aet. 4 y.
	Has had cough ten days. No whoop, no vomiting.			
16:3:12	Blood	W.	18,400 p.c.m.	
		P.	36.5% =	6720 p.c.m.
		L.L.	5.2	960
(week 2)		S.L.	53.7	9900
		E.	4.2	774
		B.	.2	36
30:3:12	Much better as regards cough. Has developed an internal stabismus.			
	Blood	W.	14,000 p.c.m.	
		P.	36.7% =	5040 p.c.m.
(week 4)		L.L.	4.2	587
		S.L.	56.2	7870
		E.	2.7	378
20:4:12	Stabismus as before . Cough better			
	Blood	W.	8,400	
		P.	33.3% =	2800 p.c.m.
(week 7)		L.L.	9.3	782
		S.L.	53.6	4500
		E.	3.6	320

Date	Lily Dibble Aet. 4 y.		
3:2:12	Has had cough for fortnight. Whooped first two days ago. Cough worse at night. No vomiting.		
	Blood W.	25,400 p.c.m.	
	P.	50% = 12700 p.c.m.	
	L.L.	4.2	1070
(week 2)	S.L.	45.5	11580
	E.	0	0
	B	.2	50
10:2:12	Cough less. Still whoops.		
17:2:12	Much better. No vomiting.		
24:2:12	No whoop. Very little cough.		
	Blood. W.	13,400 p.c.m.	
	P.	62% = 8330 p.c.m.	
	L.L.	5.5	738
(week 5)	S.L.	28	3760
	E.	3.2	430
	B.	1.2	161
9:3:12	Only has occasional cough.		
	Blood. W.	10,000 p.c.m.	
	P.	56.5% = 5990 p.c.m.	
	L.L.	5.2	552
(week 7)	S.L.	36.7	3880
	E.	1.2	127
	B.	.2	26
13:4:12	Quite well.		

Date	Florence Taylor			Aet. 4.
13:1:12	Has had cough two weeks. Whoop began three days ago.			
	Blood.	W.	12,000 p.c.m.	
		P.	30.7% = 3680	
(week 2)		L.L.	2.7	324
		S.L.	63.2	7580
		E.	3.2	384
20:1:12	Both cough and whoop more severe. No vomiting.			
	Blood	W.	23,600	
		P.	18.2% =	4300 p.c.m.
		L.L.	1	236
(week 3)		S.L.	79	18650
		E.	1.2	281
		B.	.5	118
27:1:12	Paroxysms less severe.			
3:2:12	Cough as before, but vomits now.			
	Blood.	W.	17,000 p.c.m.	
		P.	23.7% =	4040 p.c.m.
		L.L.	5.5	937
(week 5)		S.L.	70.2	11920
		E.	.5	85
10:2:12	Cough and vomiting less. Looks well.			
17:2:12	Much better. Occasional whoop.			

P.T.O.

	Blood	W.	12,000 p.c.m.	
		P.	44.2 =	5300
(week 7)		L.L.	2.2	264
		S.L.	52.2	6260
		E.	1.3	156
9:3:12	Cough as before. Occasional whoop.			
	Blood.	W.	7,200 p.c.m.	
		P.	33.2 =	2390 p.c.m.
(week 10)		L.L.	3	216
		S.L	60	4320
Pete		E. Vice Taylor	3.7	267

Date	George Blake		Aet. 4.
30:12:11	Has had a cough five weeks. Began to whoop a week ago.		
	Blood	W.	11,000 p.c.m.
		P.	33.7 = 3710 p.c.m.
(week 5)		L.L.	9.7 1070
		S.L.	50.2 5525
		E.	6.2 662
6:1:12	Cough easier. Whooping less.		
	Blood	W.	9,800 p.c.m.
		P.	58.4% = 5720 p.c.m.
(week 6)		L.L.	2.4 235
		S.L.	34.8 3401
		E.	4.4 432
13:1:12	Has no whoop now.		
20:1:12	Looking much better.		
17:2:12	No cough, No whoop.		
	Blood	W.	6,800 p.c.m.
		P.	20.2% = 4780 p.c.m.
(week 11)		L.L.	6.5 442
		S.L.	22 1495
		E.	1 68
9:3:12	Perfectly well.		

Date	Alfred Webster		Aet. 4 y.
9:12:11	Has had a cough for three weeks. Has just begun to whoop. No vomiting.		
	Blood	Whites	17,000 per c.m.
		P.	43.2% = 7350 p.c.m.
(week 3)		L.L.	7.2 1226
		S.L.	48.2 8210
		E.	1.2 204
16:12:11	Has had slight epistaxis. Chest shews signs of slight bronchitis.		
23:12:11	Cough much better. Whoops occasionally and has had more epistaxis.		

Date	Ida Gibbon		Aet. $4\frac{1}{2}$ y.
27:1:12	Has had cough three weeks and whooped one week. Vomits occasionally.		
	Blood	W.	12,000 p.c.m.
		P.	39% = 4680 p.c.m.
(week 3)		L.L.	5 600
		S.L.	55 6600
		E.	1 120
3:2:12	Cough and vomiting worse. Very slight bronchitis present.		
10:2:12	Cough improving. Vomits occasionally.		
17:2:12	Cough better . No vomiting.		
16:3:12	Very much better.		
30:3:12	Quite well.		

Date	Florence Hunt	Aet. 4 10/12
16:3:12	Cough began three weeks ago. Whooped for first time yesterday. Does not vomit.	
(week 3)	Blood Whites	16,200 p.c.m.
	P.	37% = 5990 p.c.m.
	L.L.	5.5 894
	S.L.	56.5 9150
	E.	1 162
30:3:12	Has developed a subconjunctival haemorrhage. Cough is less frequent and paroxysms less severe. Worse at night. Vomits now after coughing.	
(week 5)	Blood W.	11,200 p.c.m.
	P.	50.5% = 5650 p.c.m.
	L.L.	5.7 639
	S.L.	43.5 4875
	E.	.2 22
13:4:12	Does not cough during day; but still coughs at night. No vomiting now.	

Date	Herbert Toms		Aet. 5 y.
16:3:12	Has had a cough three weeks. Whoop began three days ago. Has vomited after coughing for two weeks.		
	Blood	W.	10,400 p.c.m.
		P.	46.7 = 4850
(week 3)		L.L.	6 624
		S.L.	44.5 4620
		E.	2.7 221
23:3:12	Only coughs after meals which induces vomiting.		
30:3:12	Much better		
	Blood	W.	11,200 p.c.m.
		P.	55% = 6150 p.c.m.
		L.L.	5.2 582
(week 5)		S.L.	36 4025
		E.	3.2 358
		B.	.2 22
13:4:12	Has only very slight cough. No whoop . No vomiting.		

Date	Emma Lee			Aet. 5 y.
10:2:12	Began to cough a week ago. Whooped first two days ago. Vomits after every cough.			
	Blood	W.	41,800 p.c.m.	
		P.	45.2% = 18950 p.c.m.	
(week 1)		L.L.	3.2	1340
		S.L.	51	21400
		E.	.5	209
17:2:12	Coughing less.			
24:2:12	Much better. Still whoops. No vomiting.			
	Blood	W.	25,000 p.c.m.	
		P.	57.5% = 14400 p.c.m.	
		L.L.	6	1500
(week 3)		S.L.	34.5	8650
		E.	1.5	376
		B.	.5	125
2:3:12	Improving.			
16:3:12	Cough and whoop still persisting.			
	Blood	W.	14,200	
		P.	69.2 = 9850 p.c.m.	
(week 6)		L.L.	7.5	1064
		S.L.	19	2690
		E.	4	569
		B.	.2	28
30:3:12	Still improving. Has occasional attacks.			

Date	Lucy Pearce	Aet. 5 y.
10:2:12	Began to cough two weeks ago. Whoop at night for last few days. Vomits occasionally.	
	Blood W.	18,000 p.c.m.
	P.	33.7% = 6060 p.c.m.
(week 2)	L.L.	3.2 576
	S.L.	61.7 11120
	E.	1.2 216
17:2:12	Vomits more frequently now.	
24:2:12	Cough and vomiting less.	
	Blood W.	14,800 p.c.m.
	P.	32.2% = 4775 p.c.m.
(week 4)	L.L.	2 296
	S.L.	64.2 9502
	E.	1.5 222
9:3:12	Cough much less. Vomits occasionally.	
	Blood W.	11,000 p.c.m.
	P.	45% = 4950 p.c.m.
(week 6)	L.L.	4.7 517
	S.L.	47.5 5230
	E.	2.7 297
23:3:12	Cough almost gone. No vomiting. Whoops occasionally.	
	Blood W.	9,800 p.c.m.
	P.	41.2% = 4060 p.c.m.
	L.L.	5.7 557
(week 8)	S.L.	50 4890
	E.	3 294
13:4:12	Is now quite well	

Date	Ernest Perkins			Aet. 5 y.
20:1:12	Began to cough a fortnight ago. Whooped once last week. Vomits after coughing.			
	Blood	W.	22,400 p.c.m.	
		P.	31.7% = 7100 p.c.m.	
(week 2)		L.L.	8.7	1950
		S.L.	57.2	12800
		E.	2	448
		B.	.2	48
27:1:12	There is no vomiting now. Cough is easier. Has had an attack of epistaxis.			
	Blood	W.	10,000 p.c.m.	
		P.	37.5% = 3980 p.c.m.	
		L.L.	6	636
(week 3)		S.L.	49.2	5220
		E.	7	743
		B.	.2	21
10:2:12	Much better.			
24:2:12	No whoop.			
9:3:12	Slight cough.			
	Blood	W.	10,800 p.c.m.	
		P.	54.7% = 5910 p.c.m.	
(week 9)		L.L.	5.7	616
		S.L.	35.2	3800
		E.	4.2	455
30:3:12	Quite well.			
	Blood	W.	10,800 p.c.m.	
		P.	30.2% = 3260 p.c.m.	
(week 12)		L.L.	4.7	507
		S.L.	60.3	6502
		E.	4.7	507

Date	Nellie Peddison Aet. 5.		
13:1:12	Cough began on 26:12:11 i.e. three weeks ago. Whooped first nine days ago. Has not vomited.		
	Blood	Whites	10,400 p.c.m.
		P.	38.7% = 4020 p.c.m.
(week 3)		L.L.	4.7 488
		S.L.	54.7 5690
		E.	1.7 176
27:1:12	Coughing less. Vomits occasionally.		
3:2:12	Cough much less frequent. Slight Haemoptosis.		
	Blood	W.	13,600 p.c.m.
		P.	59.2% = 8050 p.c.m.
(week 6)		L.L.	6 816
		S.L.	33.7 4590
		E.	1 136
10:2:12	Cough very occasional. Whoops occasionally.		
17:2:12	Hardly coughs at all. No whoop.		
	Blood.	W.	13,000 p.c.m.
		P.	55.7 = 7250
(week 8)		L.L.	4.5 585
		S.L.	38.7 5040
		E.	1 130
30:3:12	Quite well.		

Date	Frank Dodd		Aet. 5 y.
6:1:12	Began to cough two weeks ago. Whooped first three days ago. No vomiting.		
	Blood	W.	11,200 p.c.m.
		P.	44.3% = 4860p.c.m
(week 2)		L.L.	6.3 705
		S.L.	47 5260
		E.	2.3 257
13:1:12	Still whoops. Cough less frequent.		
20:1:12	Still coughing. No whoop.		
	Blood	W.	8,800 p.c.m.
		P.	43.5% = 3820 p.c.m.
(week 4)		L.L.	8 704
		S.L.	42.7 3750
		E.	5.5 483
		B.	.2 17
27:1:12	Whoop has returned slightly.		
3:2:12	Occasional cough and whoop with vomiting.		
	Blood	W.	5,400 p.c.m.
		P.	49% = 2640 p.c.m.
		L.L.	7.7 415
(week 6)		S.L.	37.7 2040
		E.	4.7 254
		B.	.2 10
10:2:12	Only whooped once this week.		
17:2:12	Much better.		

17:2:12	Frank Dodd.			
	Blood	W.	6,800 p.c.m.	
		P.	61.2% =	4160 p.c.m.
		L.L.	8.2	558
(week 8)		S.L.	25.2	1730
		E.	5	340
		B.	.2	13
24:2:12	Quite well.			

Date	Fred Mills			Aet. 5 y.
30:12:11	Began to cough two weeks ago. Whoop for a week. Haemoptosis occasionally. No vomiting.			
	Blood	W.	17,400 p.c.m.	
		P.	44% = 7660 p.c.m.	
(week 2)		L.L.	4.5	785
		S.L.	48.7	8500
		E.	2.7	470
6:1:12	Still brings up blood but not so often. Cough easier. Still whoops.			
	Blood	W.	18,400 p.c.m.	
		P.	50.7% = 9350 p.c.m.	
(week 3)		L.L.	2.7	496
		S.L.	45.5	8390
		E.	1	184
13:1:12	Symptoms as before but less severe.			
20:1:12	In statu quo.			
	Blood	W.	9,200 p.c.m.	
		P.	56.2% = 5160 p.c.m.	
(week 5)		L.L.	5.7	525
		S.L.	32.5	2995
		E.	5.5	505
27:1:12	Symptoms less marked.			
3:2:12	Very occasional cough and whoop.			

Fred Mills.

	Blood	W.	14,400 p.c.m.	
		P.	65%	= 9100 p.c.m.
(week 7)		L.L.	7.2	1035
		S.L.	24	3460
		E.	5.7	821
17:2:12	Has been worse last two days.			
	Blood	W.	12,800 p.c.m.	
		P.	70.2%	= 9000 p.c.m.
		L.L.	6.5	834
(week 9)		S.L.	17.7	2260
		E.	4.7	602
		B.	.7	89
9:3:12	Quite well.			
	Blood	W.	10,000 p.c.m.	
		P.	57%	= 6050 p.c.m.
(week 12)		L.L.	8.2	871
		S.L.	27.7	2940
		E.	7	743

Date	Eva King	Aet. 5 y.
9:12:11	Cough began four weeks ago followed by whoop three weeks later. Child vomits after nearly every cough.	
	Blood Whites	21,800 per c.m.
	P.	32.3% = 7050 p.c.m.
(week 4)	L.L.	12.6 2740
	S.L.	54.6 11900
	E.	..3 65
16:12:11	Cough is now less frequent.	
	Blood W.	12,000 p.c.m.
	P.	43.3% = 5210 p.c.m.
(week 5)	L.L.	4.6 553
	S.L.	51.3 6160
	E.	.6 72
23:12:11	Cough much less severe. Less vomiting.	
	Blood W.	12,600 p.c.m.
	P.	46% = 5800 p.c.m.
(week 6)	L.L.	4.6 580
	S.L.	49.3 6210
30:12:11	Improving. Only occasional whoop. Has only vomited three times this week.	

Date	Eva King			
30:12:11	Blood	W.	11,200 p.c.m.	
		P.	43% = 4810 p.c.m.	
(week 7)		L.L.	8.2	920
		S.L.	45.2	5060
		E	2.7	302
		B	.2	22
6:1:12	Very occasional cough. No whoop.			
13:1:12	Slight return of cough.			
	Blood	W.	7,600 p.c.m.	
		P.	37.5% = 2850 p.c.m.	
		L.L.	8	609
(week 9)		S.L.	52	3925
		E.	2	152
		B.	.5	38
27:1:12	Much better. Only occasional cough.			
10:2:12	No cough.			
	Blood	W.	8000 p.c.m	
		P.	37% = 2960 p.c.m.	
		L.L.	5.7	455
(week 12)		S.L.	52.2	4160
		E.	4.7	376
		B.	.2	16

Date	Willie Hopkins		Aet. 5 y.
9:12:11	Began to cough three weeks ago. Whooped first a week ago. Vomits occasionally.		
	Blood	Whites	19,400 p.c.m.
		P.	48.8% = 9470 p.c.m.
(week 3)		L.L.	6.5 1260
		S.L.	42.5 8250
		E.	2.2 426
16:12:11	Improving.		
	Blood	W.	15,800 p.c.m.
		P.	46.5% = 7350 p.c.m.
(week 4)		L.L.	6.7 1060
		S.L.	43.5 6875
		E.	3.2 505
23:12:11	Is now vomiting more frequently.		
	Blood	W.	12,200 p.c.m.
		P.	45.6% = 5550 p.c.m.
(week 5)		L.L.	7 855
		S.L.	45.3 5525
		E.	2. 244
6:1:12	Whoop has gone now. Coughs very little.		
	Blood	W.	12.000 p.c.m.
		P.	50.2% = 6025 p.c.m.
(week 7)		L.L.	3.5 420
		S.L.	43.2 5200
		E.	3 360
13:1:12	Cough much better.		

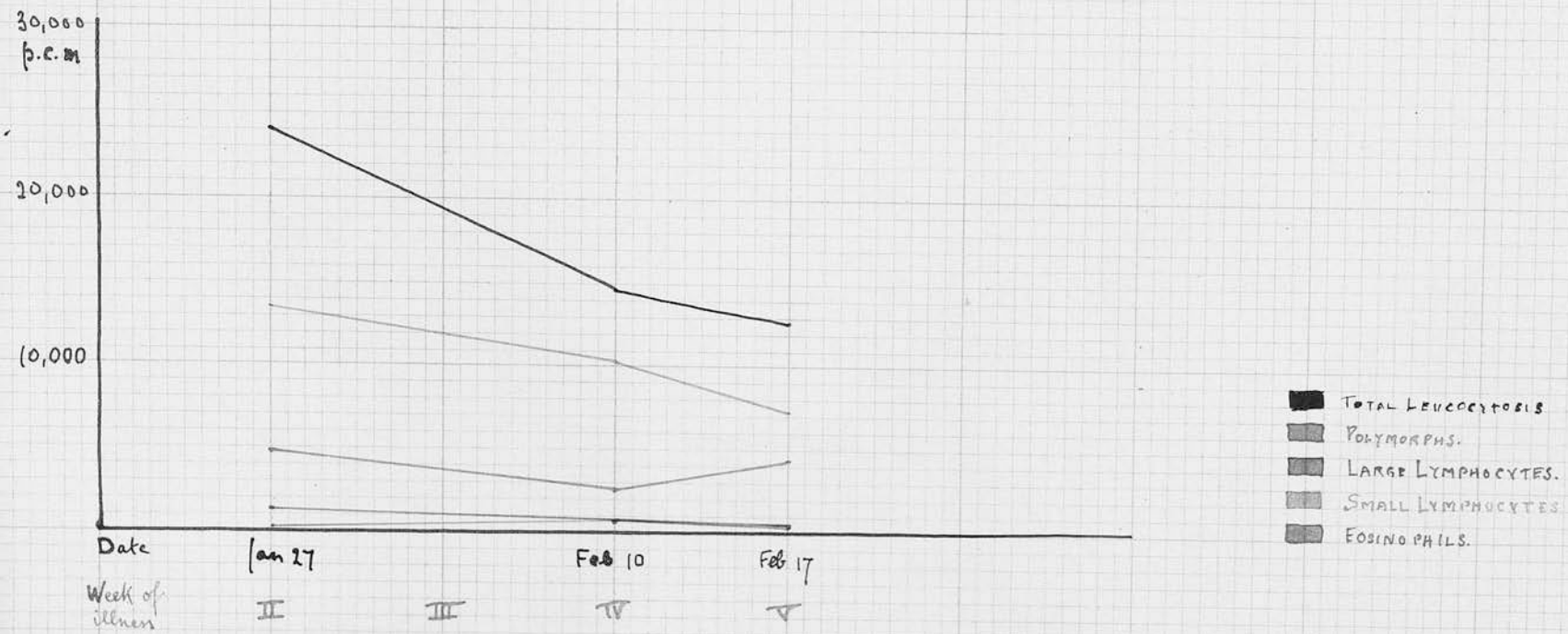
Date	Albert Gibbons Aet 5½		
13:1:12	Cough began six weeks ago. Whooped first five days ago. No vomiting.		
	Blood	W.	14,600 p.c.m.
		P.	48.5% = 7075 p.c.m.
(week 6)		L.L.	8.2 1198
		S.L.	40.7 5950
		E.	2 292
		B.	.5 73
27:1:12	Cough easier. Whoop in statu quo.		
	Blood	W.	12,200 p.c.m.
		P.	42.2% = 5150 p.c.m.
(week 8)		L.L.	8.7 1061
		S.L.	48.2 5880
		E.	.2 24
		B.	.5 61
3:2:12	Cough better. Still whoops. No vomiting.		
10:2:12	Improving.		
16:3:12	No cough now.		
	Blood	W.	9,800 p.c.m.
		P.	48.5% = 4750 p.c.m.
(week 15)		L.L.	6.7 655
		S.L.	42.2 4140
		E.	2.5 244
30:3:12	Quite well.		

Date	Charles Bryant			Aet. 5 11/12.
10:2:12	Cough began two weeks ago. Whoop one week. More troublesome at night. Occasional vomiting.			
	Blood	Whites	19,400 p.c.m.	
		P.	35.2% = 6825 p.c.m.	
		L.L.	3.2	621
(week 2)		S.L.	60	11640
		E.	1.5	291
17:2:12	Has been spitting blood; cough and whoop more troublesome.			
24:2:12	Cough less frequent. Vomiting oftener.			
	Blood	W.	10,800 p.c.m.	
		P.	65% = 7020 p.c.m.	
		L.L.	6.5	702
(week 4)		S.L.	25.7	2770
		E.	2.2	237
		B.	.5	54
9:3:12	Is now much better in every way.			
	Blood	W.	5,800 p.c.m.	
		P.	42% = 2440 p.c.m.	
		L.L.	7	405
(week 6)		S.L.	46.6	2705
		E.	4	232
		B.	.3	17
23:3:12	Quite well.			

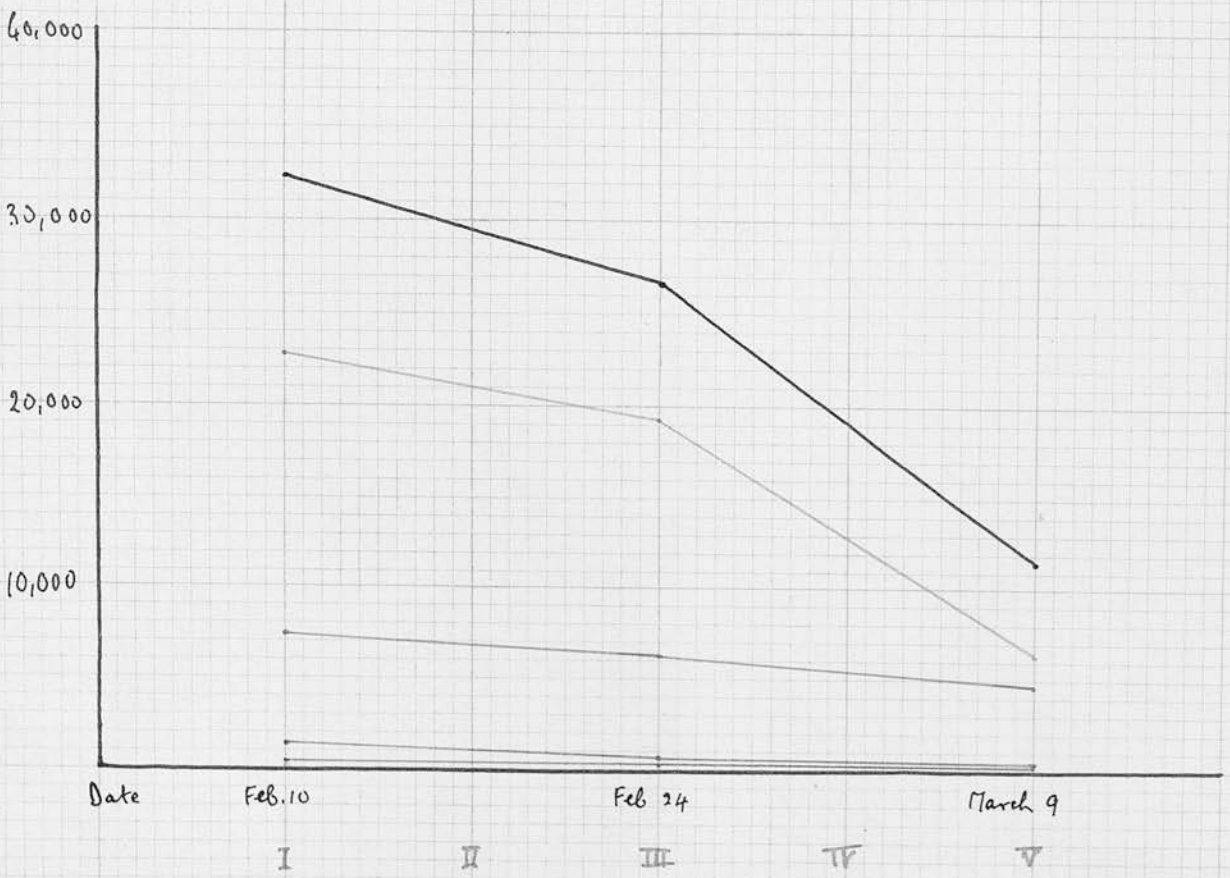
Date	Leslie Haines		Aet. 6 y.
23:3:12	Cough began two weeks ago, whooped first four days ago. No vomiting.		
	Blood	Whites	18,000 p.c.m.
		P.	39.7% = 7150 p.c.m.
(week 2)		L.L.	5.5 990
		S.L.	50.7 9150
		E.	4 720
6:4:12	Cough much better, has vomited once.		
	Blood	W.	15,400 p.c.m.
		P.	64% = 9875 p.c.m.
(week 4)		L.L.	6.7 1040
		S.L.	25 3850
		E.	4.2 656
20:4:12	Very much better. No vomiting.		
	Blood	W.	8,800 p.c.m.
		P.	59.5% = 5230 p.c.m.
(week 6)		L.L.	5.2 456
		S.L.	31.7 2790
		E.	3.5 308

Date	Cyril Pratt	Aet. 8 y.
3:2:12	Has had a cough four weeks and whoop three weeks. Most troublesome at night. No vomiting.	
	Blood Whites	7,000 p.c.m.
	P.	49.5% = 3460 p.c.m.
	L.L.	6.7 469
(week 4)	S.L.	40.7 2850
	E.	3. 210
2:3:12	Almost well now.	

Arthur Dodd.

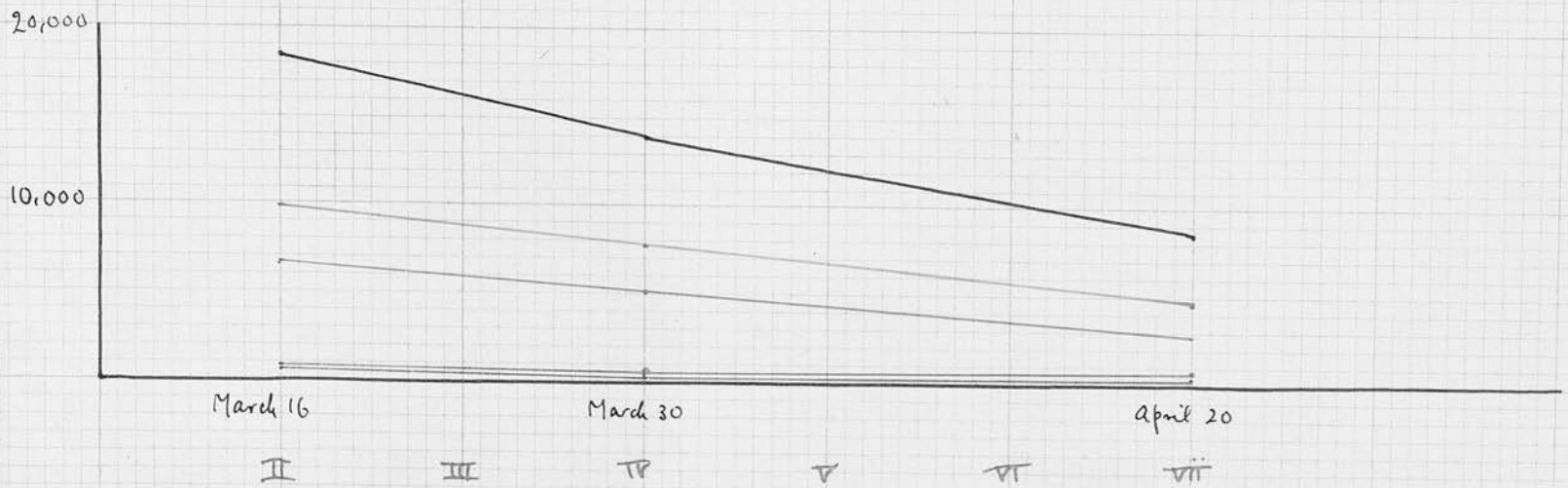

30,000
p.c.m
20,000
10,000
Date
Jan 27
Feb 10
Feb 17
Week of illness
II
III
IV
V
TOTAL LEUCOCYTOSIS
POLYMORPHS.
LARGE LYMPHOCYTES.
SMALL LYMPHOCYTES
EOSINOPHILS.

Gladys Cordor

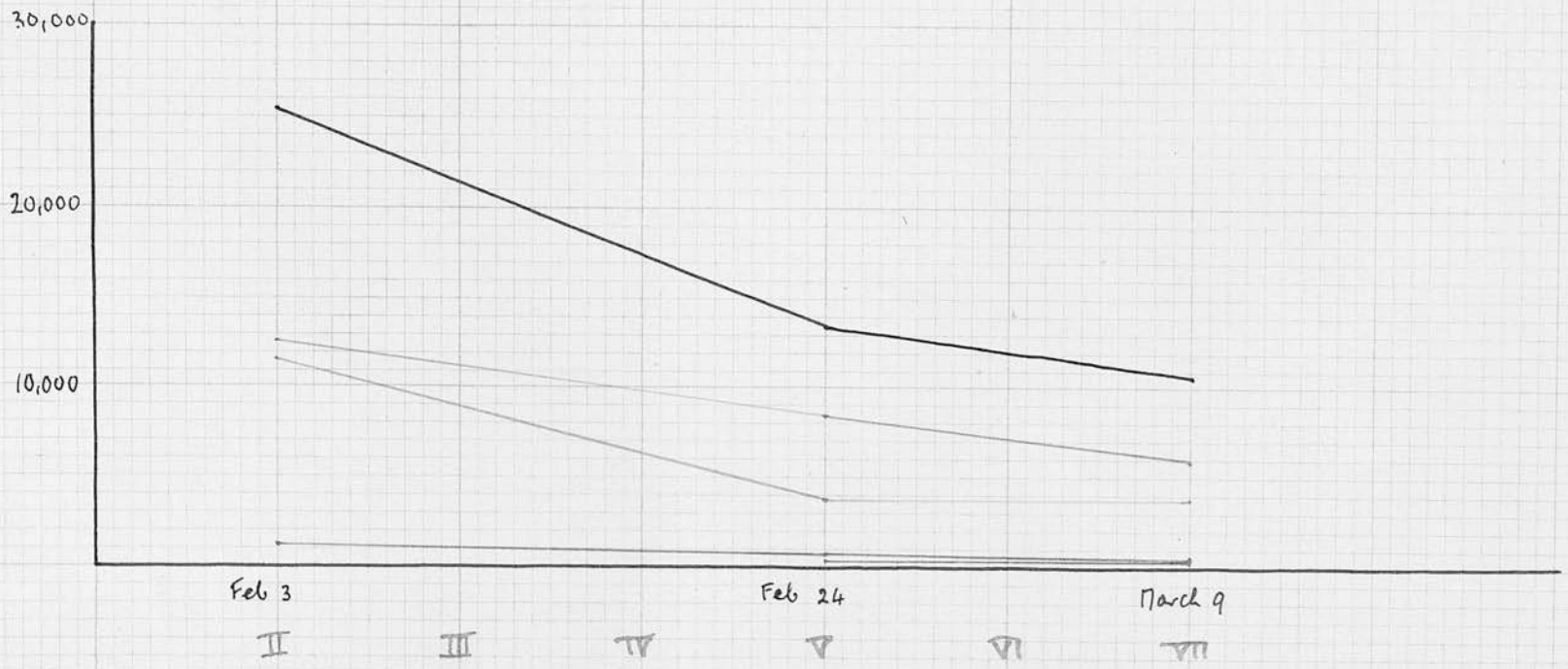


Charles Beaumont

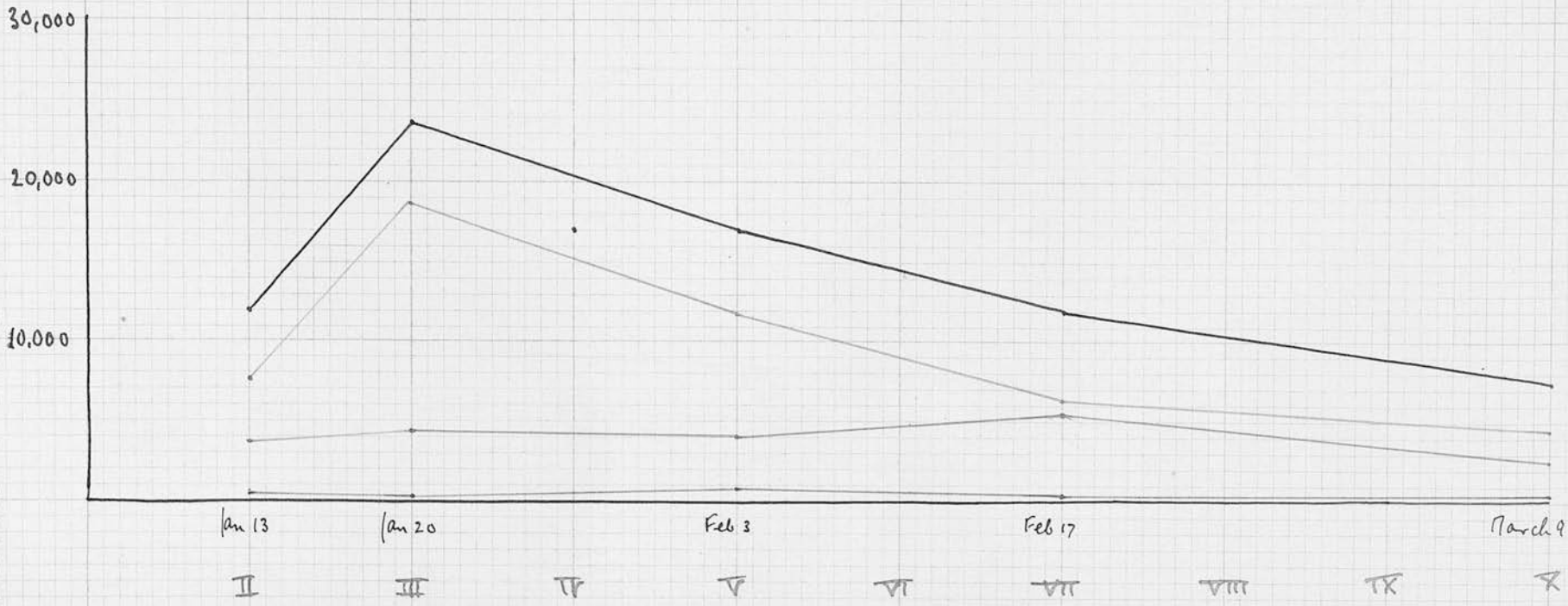
THE MOST TYPICAL CASE



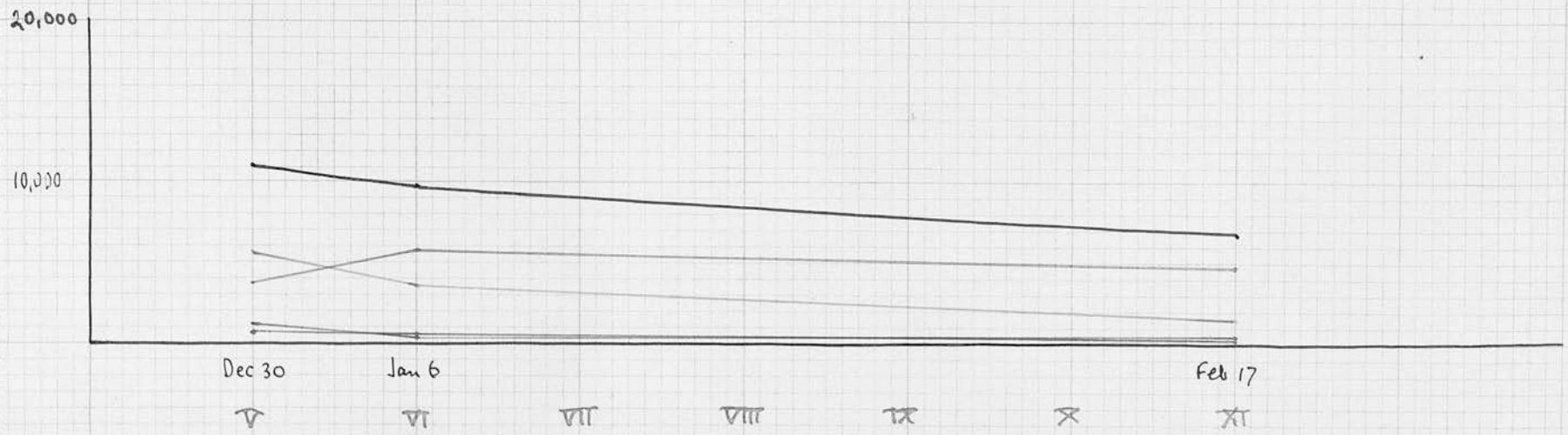
Lily Dibble



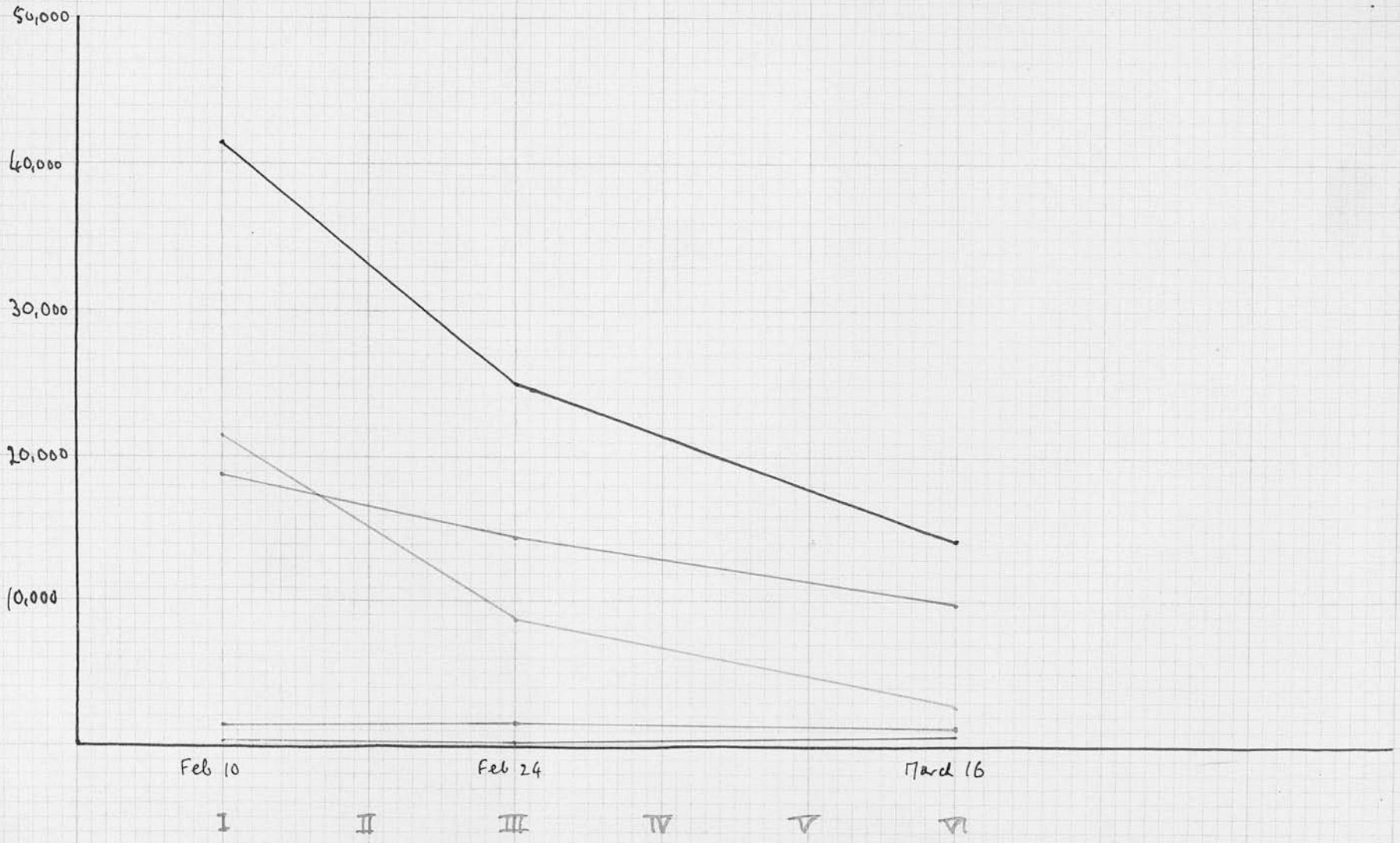
Florence Taylor



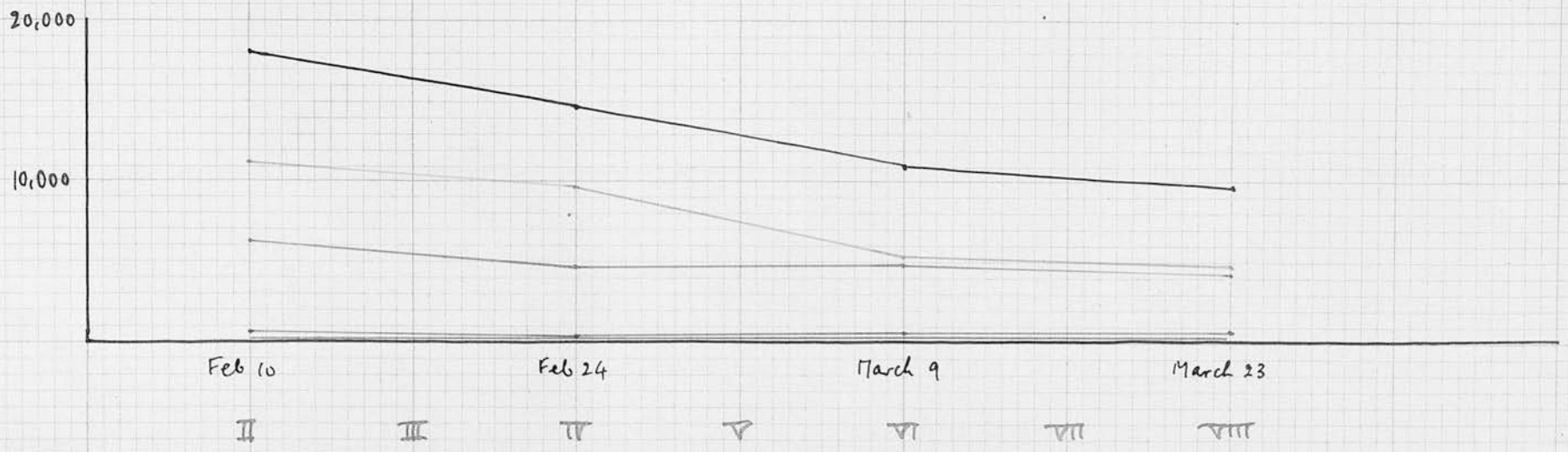
George Blakie



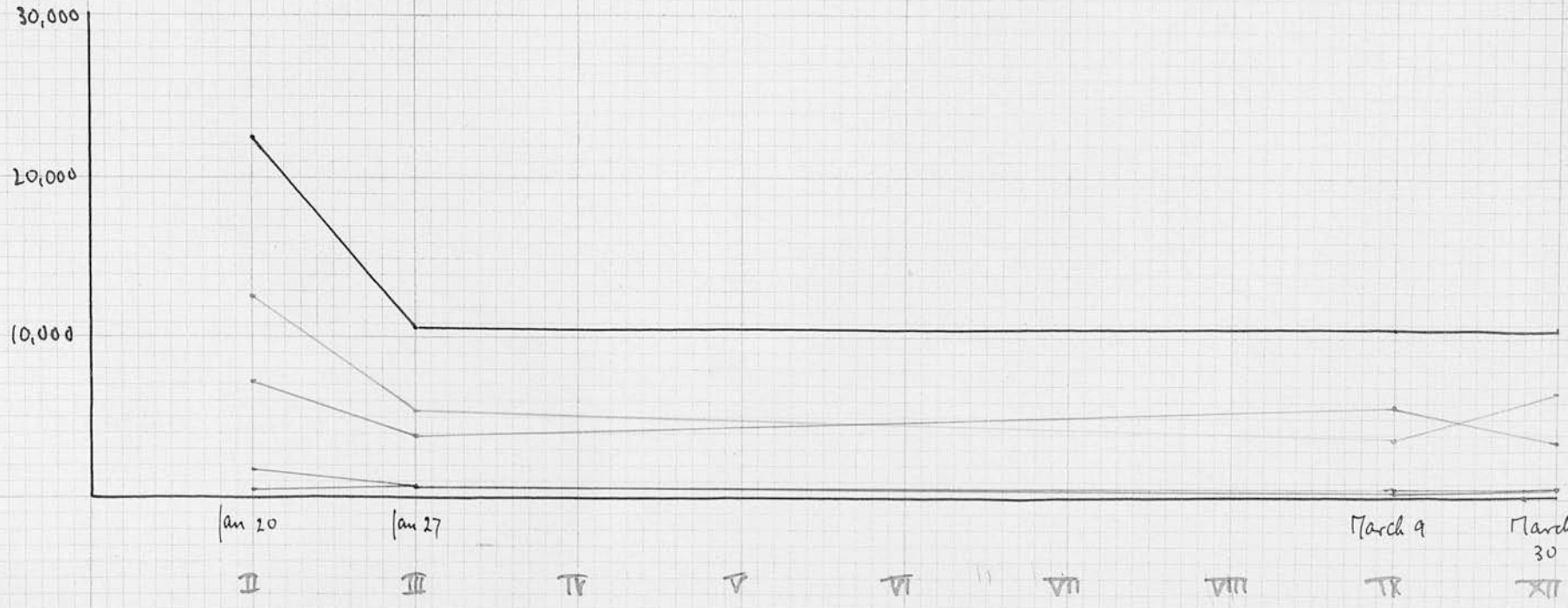
Emma Lee


50,000
40,000
30,000
20,000
10,000
Feb 10
Feb 24
March 16
I
II
III
IV
V
VI

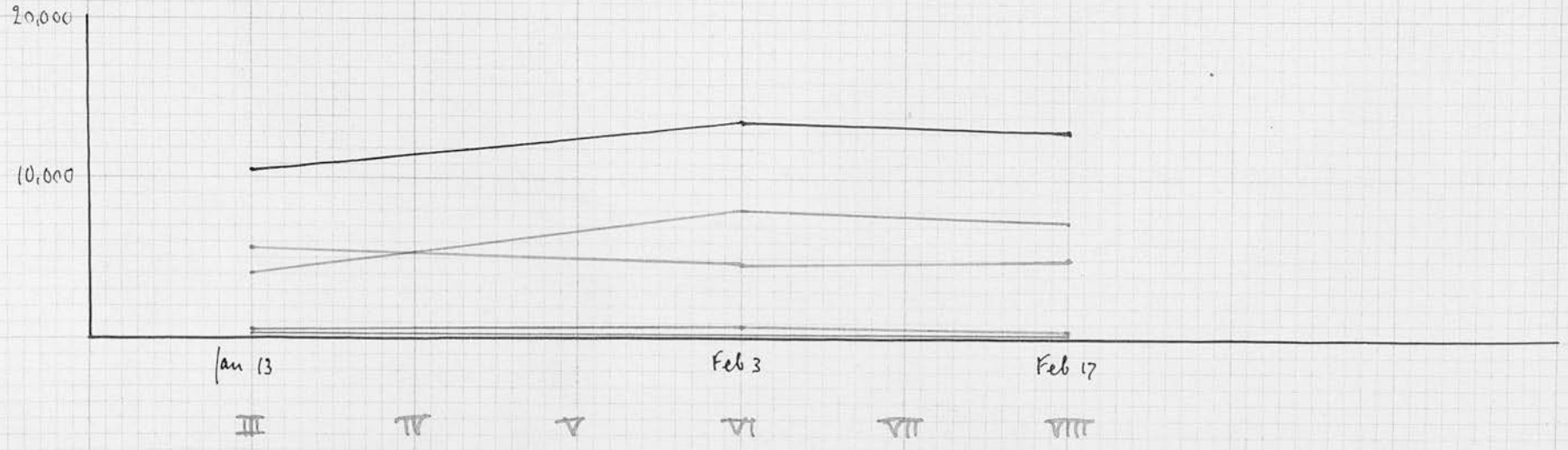
Lucy Pearce.


20,000
10,000
Feb 10
Feb 24
March 9
March 23
II
III
IV
V
VI
VII
VIII

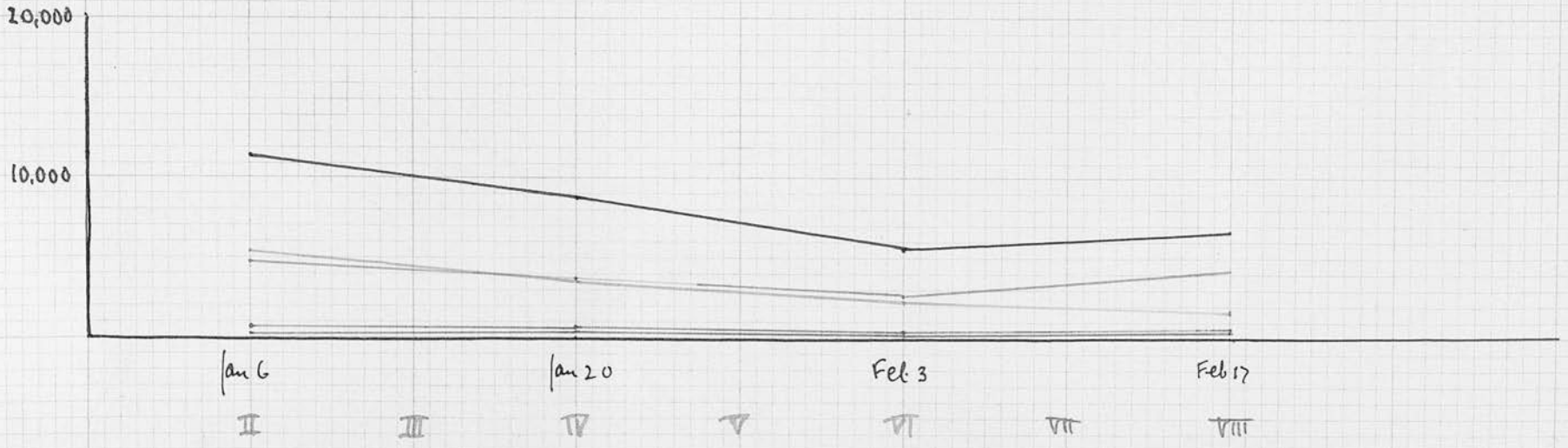
Ernest Perkins



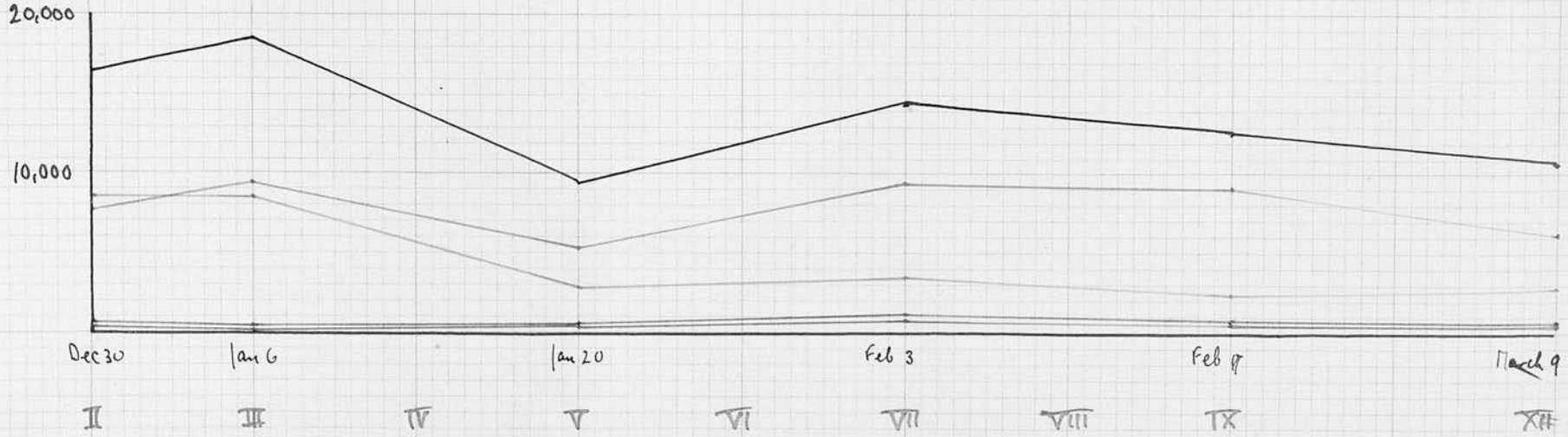
Nellie Pedersen



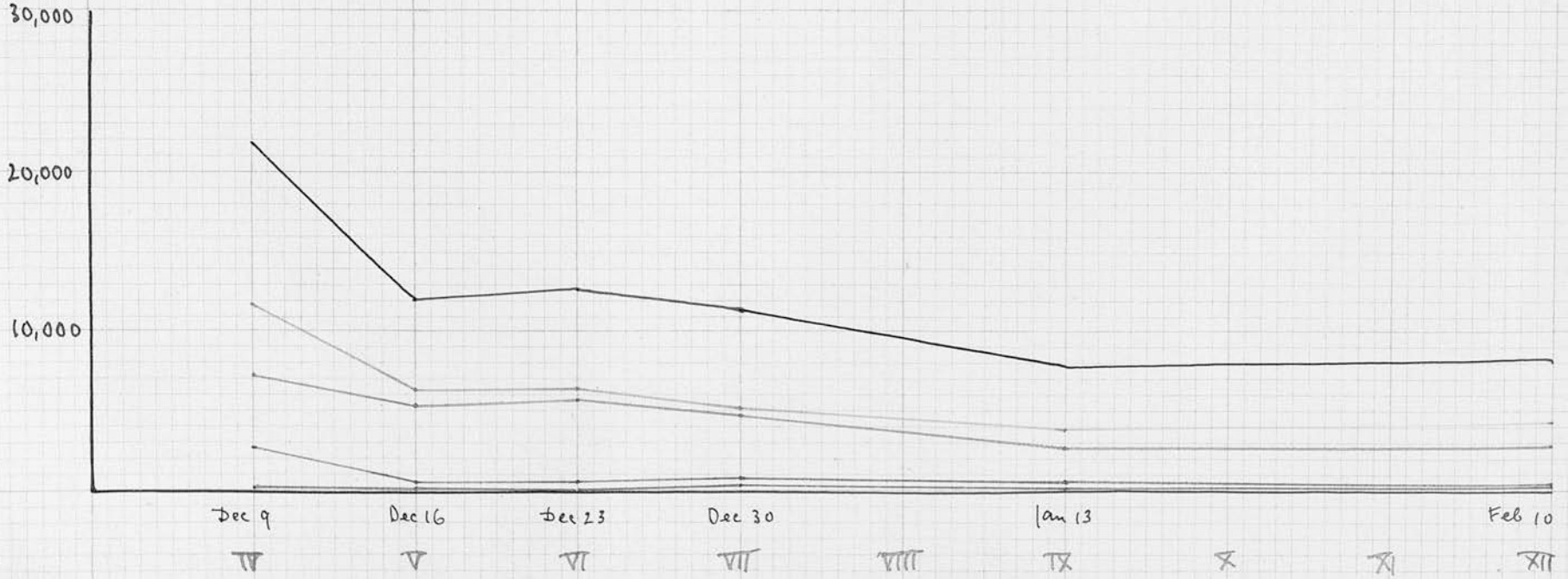
Frank Dodd.



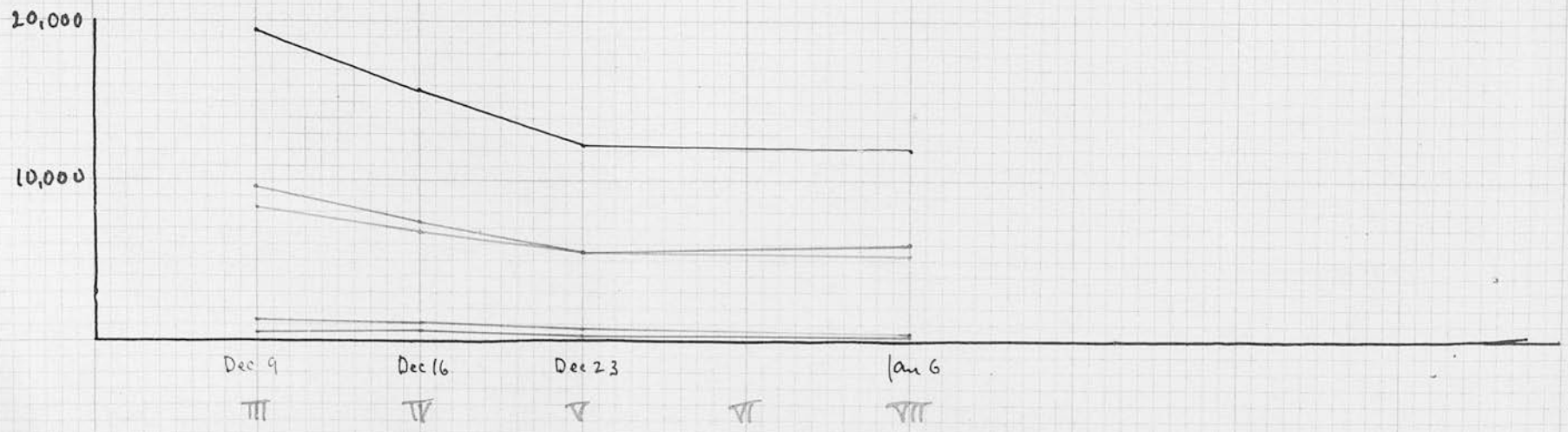
Fred Mills


20,000
10,000
Dec 30
Jan 6
Jan 20
Feb 3
Feb 17
March 9
II
III
IV
V
VI
VII
VIII
IX
XII

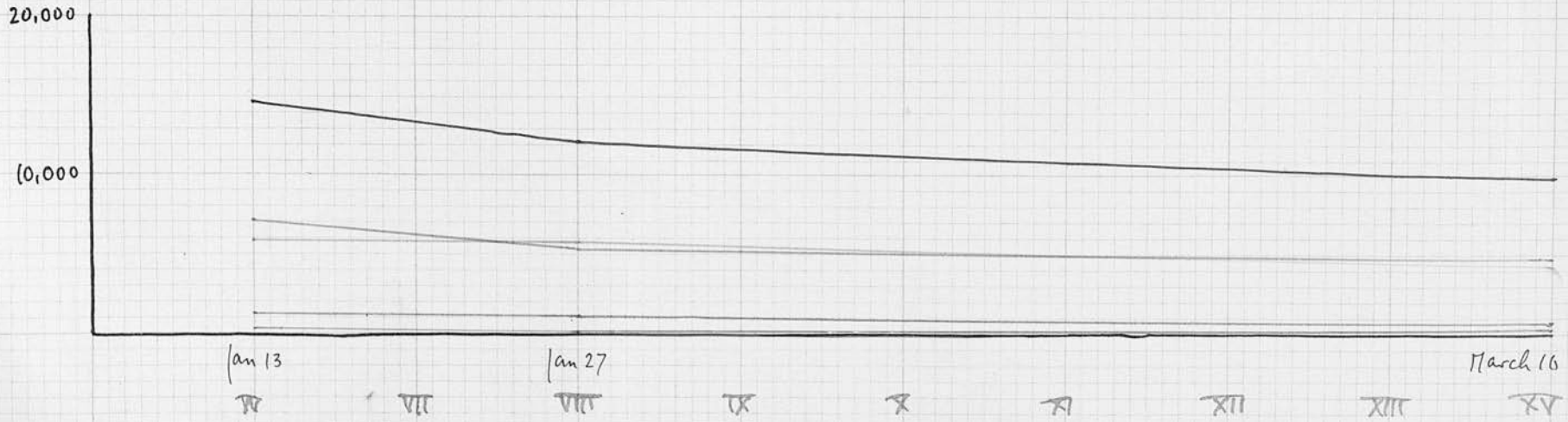
Eva King.



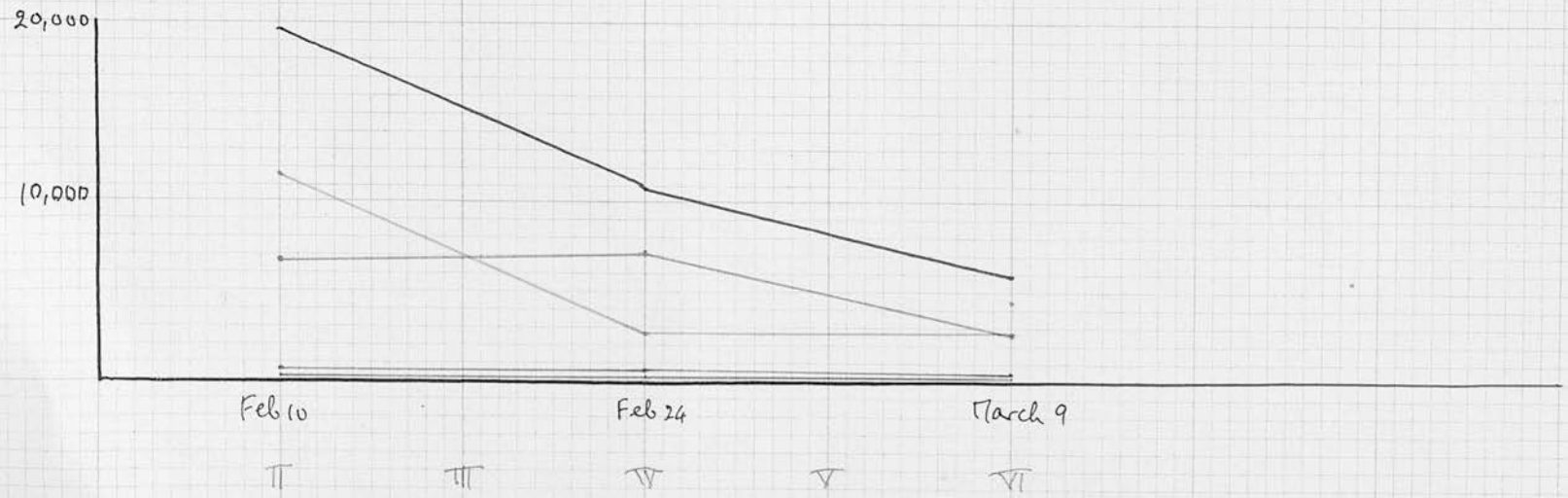
Willie Hopkins



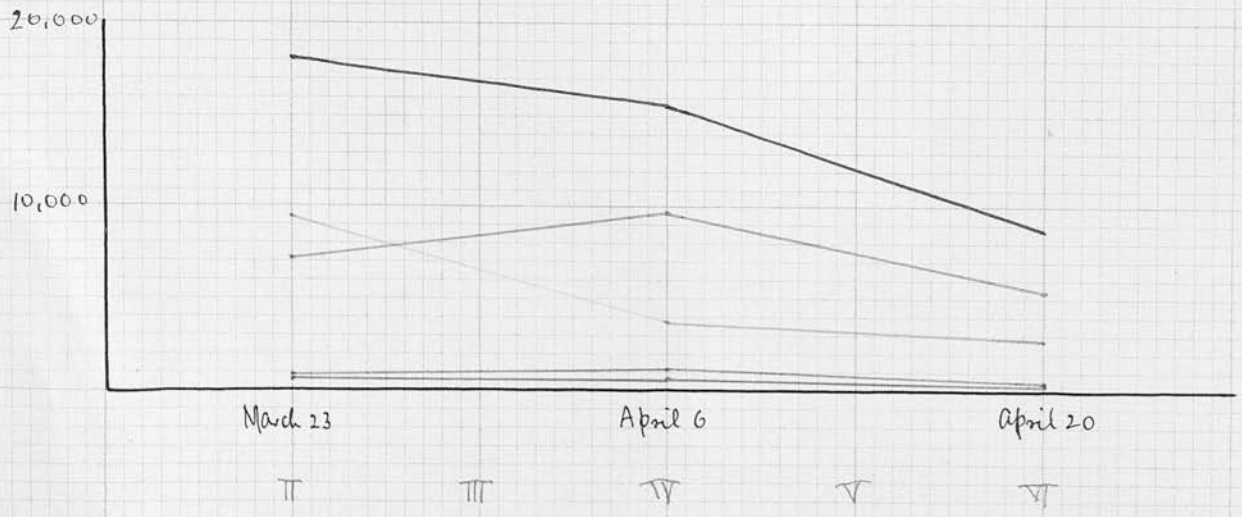
Albert Gibbons



Charles Bryant



Leslie Harries



In his paper on the subject of the leucocytosis of whooping cough, Dr Crombie has divided his cases according to the onset of the characteristic cough. This does not seem the logical division, because many cases never develop the whoop at all, and others develop it within a week of the first symptom namely the cough. The writer has therefore examined the cases from the point of view of the beginning of the illness.

The following are the average counts:-

Week	Total	Polym.	Large Lymph.	Small L.	Eosin	Basop.	Cases
1st	37,000	13,135	1,315	22,150	346	80	2
2nd	17,900	6,600	978	9,750	565	19	11
3rd	17,200	6,780	783	9,320	282	24	11
4th	15,260	5,992	946	7,926	372	7	10
5th	12,140	5,061	561	5,793	361	24	10
6th	10,630	5,750	630	3,960	280	14	9
7th	11,530*	5,670	662	4,720	438	8	6
(8th (and (onward	9,650	4,813	613	3,776	32	17	13

* One case (Fred Mills) had an exascerbation this week.

When one comes to consider each week separately, which is most conveniently done by referring to the chart/

chart, one is unfortunately bound almost to ignore the first week as it represents the average of only two cases. On the other hand it is important in as much as it indicates, that these cases were so unusually severe, that the mothers recognised early what the children were suffering from. The total average of 37,000 is certainly striking and what is more interesting is the differential count. In reviewing the literature of this subject the writer has drawn attention to the difference of opinion with regard to the differential counts. This first week supports in a most convincing manner the opinion expressed by Barach that there is an increase in all the forms at the onset.

The polymorpholeucocytes will be seen to be increased to over 13,000 per c.m. compared with the usual 5000 about this age. Dr. Crombie's finding however out only about 6,800 per c.m.

The most marked increase however is admittedly in the small lymphocytes. In the writer's cases at this stage the average is 22,150 compared with the normal 4,500 to 5,000 per c.m. Dr. Crombie's average is 13,500 per c.m.

Even the large lymphocytes shew an increase to nearly double their usual figure.

The eosinophils in addition are increased by about/

about 100 per c.m.

In eleven cases examined during the second week of the disease the total leucocytosis was found to average 17,900 per c.m. The differential count is still above the normal for every form of leucocyte except the basophils, about whose physiology, however, too little is known to give any weight to an exception such as this in pathology. There is however already a slight relative diminution in small lymphocytes.

Let us now consider the behaviour of the different cells by following their average count in totals per cubic millimetre throughout the weeks of the disease.

POLYMORPHONUCLEAR LEUCOCYTES.

As has already been noted there is a marked increase in this form of leucocyte in the first week. In the second and third weeks it is still 2,000 per c.m. above normal. Thereafter the count falls, till by the fifth week the normal line is reached and is followed fairly faithfully subsequently.

SMALL LYMPHOCYTES.

This is the cell around which most interest centres in whooping cough.

When Dr. Crombie's results are reduced to totals per/

per cubic millimetre instead of percentages, one finds that from the beginning of the catarrhal stage till the end of the 3rd week of the paroxysmal stage the small lymphocyte count remains constant between 13,000 and 15,000.

The writer's results have no claim to such similarity from week to week, but they do show an almost perfectly steady diminution from the second to the sixth week from 9,750 p.c.m. to 3,960 p.c.m. and thereafter remains about the normal line.

Strangely enough in his case which he publishes as typical Dr. Crombie gives figures which when worked out shew a similar decline from 22,400 to 7,800 p.c.m.

LARGE LYMPHOCYTES.

Apart from the initial increase during the first two weeks the large lymphocytes remain almost constantly about the normal figure of 700 p.c.m. throughout.

TYPICAL CASE.

On looking over individual charts one would choose that of Charles Beaumont as being the most typical.

Although counts were made at the second, fourth and eighth weeks, when they are plotted graphically the total leucocytoses, small lymphocytes and polymorphonuclear/

Uncomplicated Whooping Cough

Average Counts each week.

Total Leucocytes Per Cubic Millemetre
Polymorphonuclear Leucocytes P.C.M.
Large Lymphocytes P.C.M.
Small Lymphocytes P.C.M.

Dotted lines shew average normal counts between ages of 3 and 6 years.

Eosinophils and Basophils not shewn. Both are within Physiological limits.

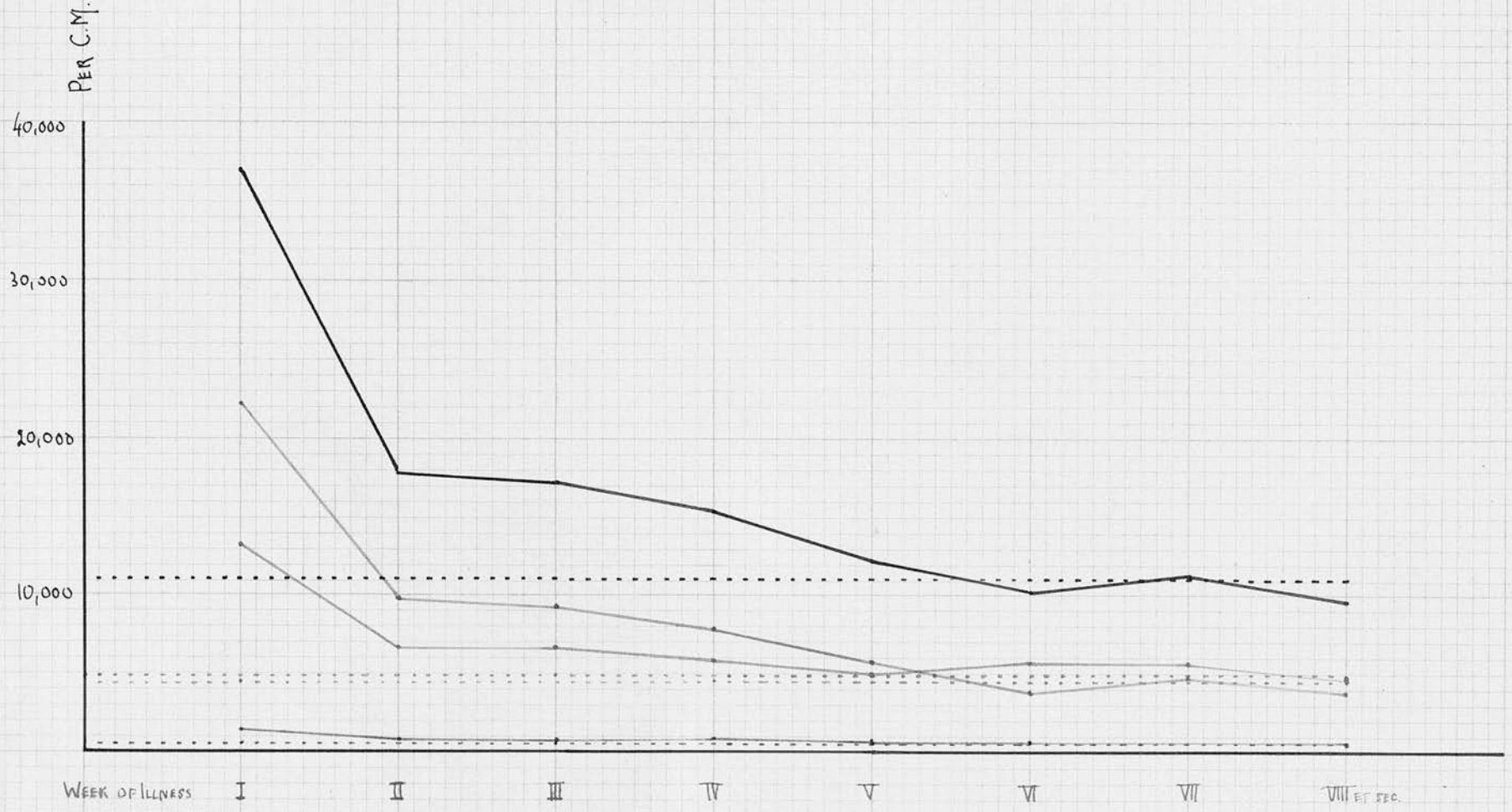


Chart of J. Frank Crombie's Cases

Compiled from Results
Published in
The Edinburgh Medical Journal
Sept. 1908.

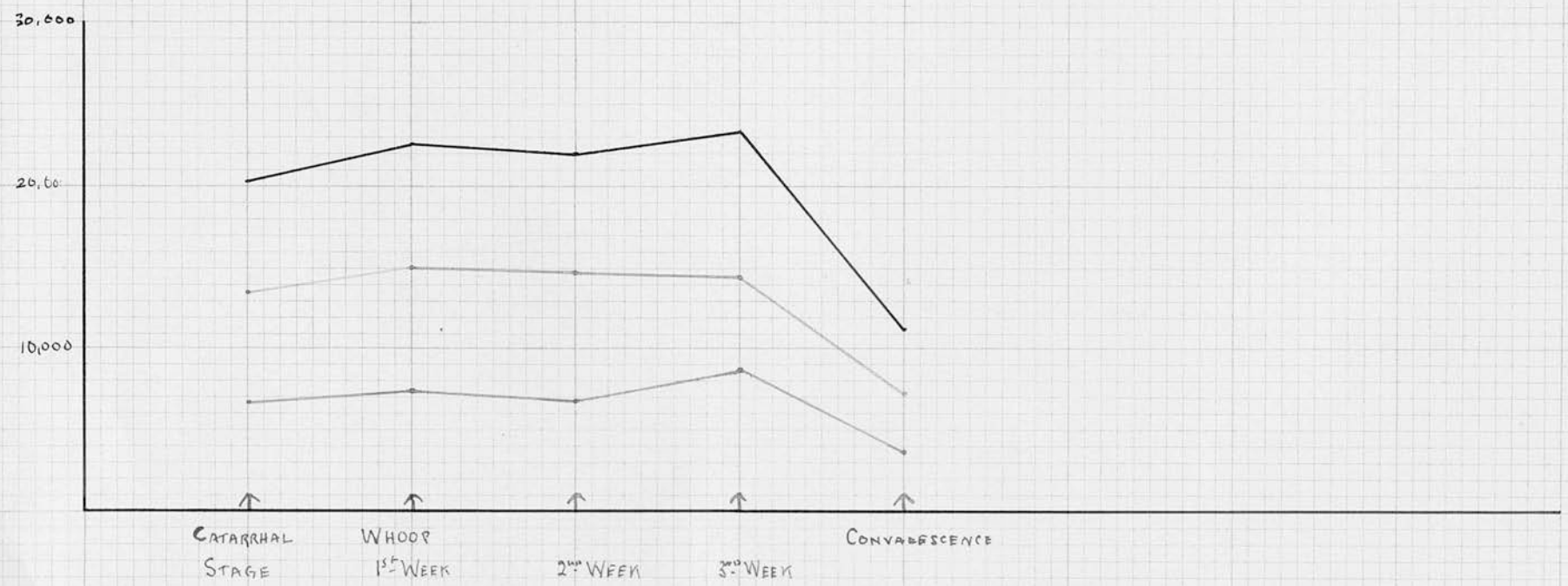
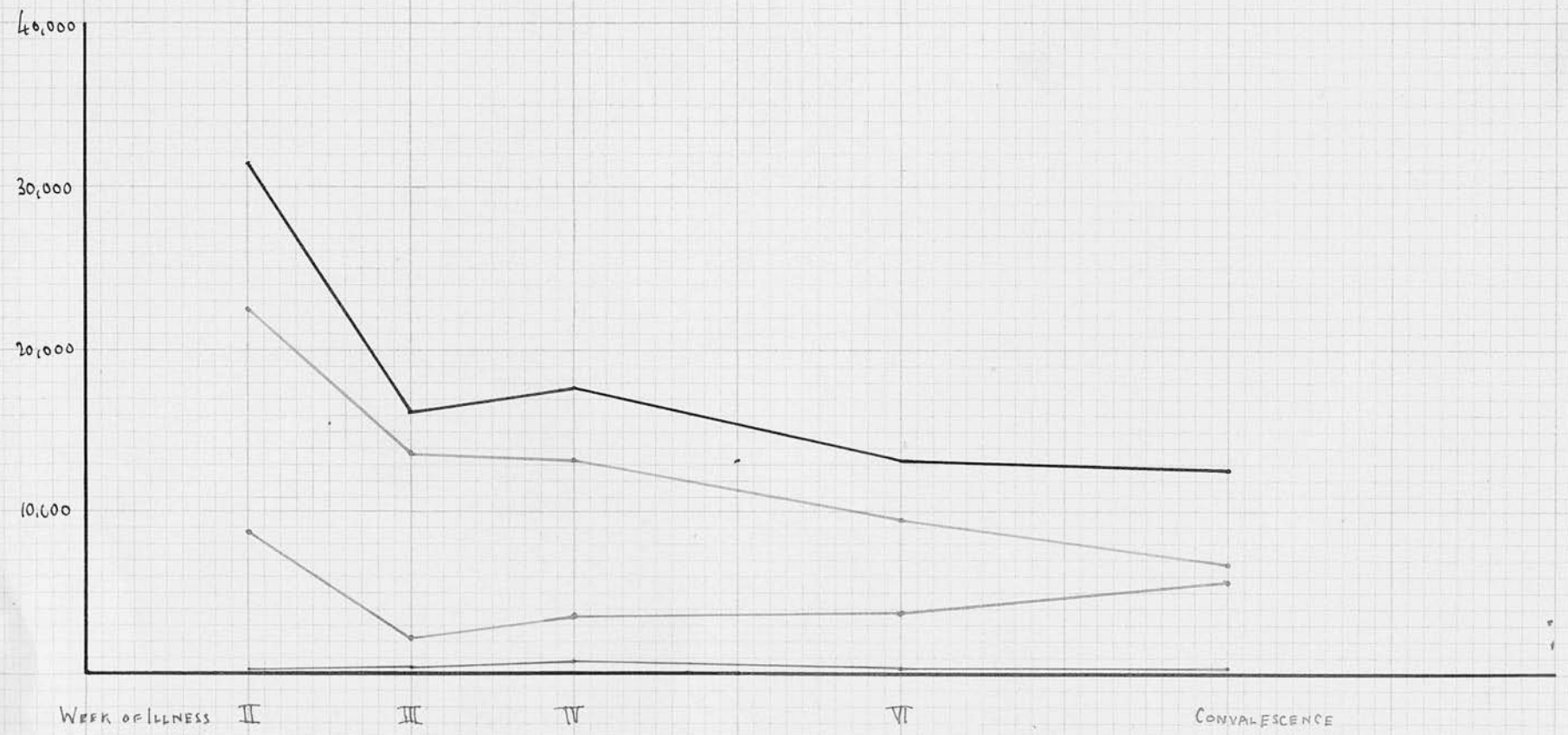


Chart of J. Frank Crombie's Typical Case

Compiled from Case Published in
The Edinburgh Medical Journal
Sept. 1908.



polymorphonuclear leucocytes are each represented by a straight line.

Even down to the detail of showing the initial increase of large lymphocytes, eosinophils and perhaps basophils this case is typical.

COMPLICATIONS.

Da Costa in writing about the effect of complications on the blood counts in whooping cough states that such complications as Bronchitis, Catarrhal Pneumonia and Otitis do not appear to exaggerate it. This statement is not borne out as regards pneumonia by Dr. Crombie's paper where he had leucocytosis of 120,000 and 141,000 p.c.m. in two cases of Broncho pneumonia. Carr has had similar experience.

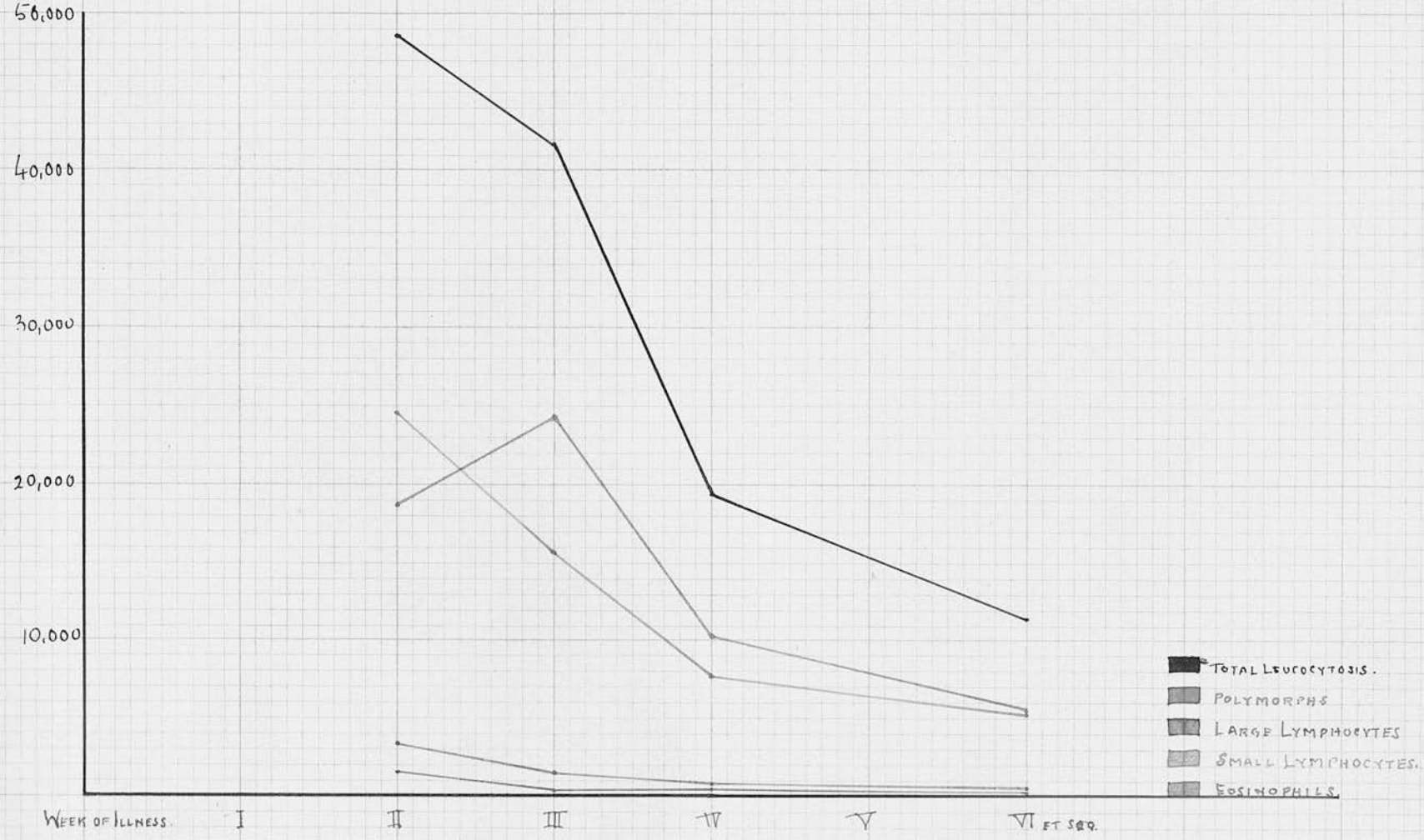
The writer has unfortunately had no opportunity of studying whooping cough cases complicated by pneumonia. With regard to bronchitis however there are one or two points of interest. Out of three cases two were examined repeatedly. Both of these cases came under observation before any signs of Bronchitis had developed. In each case the leucocytosis was exceptionally high, one was 39,800 p.c.m. and the other 57,200 p.c.m. Now, when these patients developed bronchitis there was no increase in the total leucocytosis, in fact it diminished; but when one examines the chart, it is at once obvious that the blood count has been affected by the Bronchitis, in as much as the polymorphonuclear leucocytes increase in number, in one case to 30,000 per c.m., instead of diminishing as in uncomplicated cases.

Dr. Crombie finds with regard to bronchitis that/

that these cases have a leucocytosis higher than the average, due more probably to the severity of the whooping cough than to the bronchitis.

This is certainly borne out in these cases where the very high count was followed within a week by signs of bronchitis.

Chart shewing Average weekly count in cases of Whooping Cough Complicated by Bronchitis.



Date	Norah Nolan			Aet. 5 y.
6:1:12	Cough began two weeks ago. Whooped first four days ago.			
	Blood	Whites	39,800 p.c.m.	
		P.	39.5% =	15710 p.c.m.
(week 2)		L.L.	5.5	2190
		S.L.	47.7	19000
		E.	7.2	2870
13:1:12	Still coughing as before but less whoop. Has v. slight bronchitis.			
	Blood	W.	37,600 p.c.m.	
		P.	47.2 =	17750 p.c.m.
(week 3)		L.L.	2	752
		S.L.	49.7	18700
		E.	1	376
20:1:12	In the mother's opinion child is better. Still has some bronchitis.			
	Blood	W.	27,000 p.c.m.	
		P.	61.2% =	16510
(week 4)		L.L.	3	810
		S.L.	35	9450
		E.	7	189
10:2:12	Has been in bed with "pleurisy". Slight cough. No whoop. No vomiting. No bronchitis.			
	Blood	W.	9,600 p.c.m.	
		P.	37.5 =	3600 p.c.m.
(week 7)		L.L.	2.2	211
		S.L.	59	5650
		E.	1.2	115

date	Fred Tame	Aet. 5 y.
27:1:12	Cough began two weeks ago. Whoop for five days. Vomits after every attack. Haemaptosis yesterday.	
	Blood Whites	57,200 p.c.m.
	P.	38.5% = 22,050 p.c.m.
	L.L.	7.5 4300
(week 2)	S.L.	52.5 30100
	E.	.5 286
	B.	.7 400
3:2:12	Child looks ill and wasted. Pulse rapid and chest shews signs of acute bronchitis. Has been vomiting everything.	
	Blood W.	46,000 p.c.m.
	P.	66.7% = 30700 p.c.m.
	L.L.	4.7 2160
(week 3)	S.L.	28 12900
	E.	.2 92
	B.	.2 92
9:3:12	Child has been too ill to come up for three weeks. There has been a patch of pneumonia in right lung at base. He looks better now. Still whoops with cough and vomits occasionally.	
	Blood W.	11,200 p.c.m.
	P.	61% = 6810 p.c.m.
(week 6)	L.L.	4.5 504
	S.L.	33.7 3770
	E.	.7 78

Date	Fred Tame
23:3:12	Child is much better. Coughs only at night.
	Blood W. 13,400 p.c.m.
	P. 46.7% = 6250 p.c.m.
	L.L. 4.7 630
(week 8)	S.L. 45.7 6120
	E. 2.5 335
	B. .2 26
13:4:12	Is now well.

Date	Willie Bastard Aet. 5 y.
20:1:12	Cough began a month ago. Whooped first last week. On examination : General Bronchitis. Blood W. 11,600 per c.m. P. 32.7% = 3800 p.c.m.
(4)	L.L. 9 1046 S.L. 54.2 6300 E. 4 465
27:1:12	Vomits occasionally now. Bronchitis less.
10:2:12	Some bronchitis still present.
24:2:12	Child has gone off his food. Still coughs.
9:3:12	No cough. No whoop. No vomiting. No Bronchitis.
23:3:12	Perfectly well.

Noral Nolan


40,000
30,000
20,000
10,000
Jan 6
Jan 13
Jan 20
Feb 10
II
III
IV
V
VI
VII


Fred Tame
60,000
50,000
40,000
30,000
20,000
10,000
Jan 27
Feb 3
March 9
March 23

CHRONIC CASES.

In studying chronic cases two points of interest have occurred.

On taking the average of 11 counts done on cases which have been affected with whooping cough for months, and which had for a time lost the characteristic cough or had continued to whoop, the results are as follows.

Total Leucocytosis:

	15,800	p.c.m.
Poly.	8905	p.c.m.
L.L.	1020	"
S.L.	5140	"
E.	738	"
B.	96	"

It will be seen that the polymorphonuclear leucocytes are somewhat increased, and to a less extent the small lymphocytes. But what is striking is that the large lymphocytes shew an increase amounting to almost half as many again as normal. The explanation of this is not apparent.

Barach writing on the appearance of the blood late in the disease says there is a gradual decrease in leukocytosis and a return to the normal differential/

differential count, except for a slight eosinophilia (5%) which may persist for months.

Now 738 per c.m. of eosinophils is just about 5% of 15,800. The average eosinophilia during the first eight weeks of writer's cases is 384 per c.m.

There seems to be something suggestive in the analogy of the eosinophilia of a prolonged spasmodic disease such as whooping cough which has lasted for months, and spasmodic asthma.

It is not clear if Barach refers to cases in which all symptoms had disappeared for months in which he finds the eosinophilia, or if they were chronic cases.

Date	May Antony	Aet 4 y.
16:12:11	Patient had an attack of whooping cough in May i.e. seven months ago. The illness lasted two months. For last fortnight has been coughing again and has vomited after each meal.	
	Blood Whites	16,400 per c.m.
	P.	47.5% = 7,800 p.c.m.
	L.L.	9 1470
	S.L.	36.5 5980
	E.	7 1150
30:12:11	Cough much less troublesome. Has not whooped and vomiting has ceased.	
	Blood W.	15,600 p.c.m.
	P.	57.5% = 8980 p.c.m.
	L.L.	3.2 499
	S.L.	35 5450
	E.	4.2 655
6:1:12	Still has a slight cough.	
	Blood W.	13,400 p.c.m.
	P.	56.7% = 7600 p.c.m.
	L.L.	5.2 696
	S.L.	35 4690
	E.	3 402
13:1:12	Somewhat better.	
	Blood W.	14,600 p.c.m.

P.T.O.

Date	May Antony.		
13:1:12	P.	58.2%	= 8500 p.c.m.
	L.L.	2.2	321
	S.L.	38	5550
	E.	1.2	175
	B.	.2	29

Date	Bob Antony	Aet. 3 y.
16:12:11	Cough began in July (i.e. five months ago), and has continued to whoop since. On examination. Bronchitis present.	
	Blood W.	11,000 p.c.m.
	P.	38.3% = 4220 p.c.m.
	L.L.	9 992
	S.L.	42 4620
	E.	10.6 1170
23:12:11	Cough in statu quo. Bronchitis slight.	
	Blood W.	15,600 p.c.m.
	P.	67% = 10460 p.c.m.
	L.L.	7.3 1140
	S.L.	23.6 3680
	E.	2 312
30:12:11	Still slight bronchitis. Whoop less.	
	Blood W.	11,600 p.c.m.
	P.	47.6% = 5525 p.c.m.
	L.L.	7 812
	S.L.	40.3 4675
	E.	5 580
6:1:12	No bronchitis. Still whoops a little.	
	Blood W.	12,400 p.c.m.
	P.	46.5% = 5770 p.c.m.
	L.L.	5 620
	S.L.	46 5700
	E.	2.5 310
13:1:12	Still a few accompaniments in chest.	

Date	Percy Mundy. Aet. 4 y.
2:12:11	Patient had whooping cough two years ago. Cough began again in Summer. Whoop returned three weeks ago. Vomits after coughing. Cough more troublesome at night. Blood Whites 21,200 per c.m. P. 47.6% = 10100 p.c.m. L.L. 10.6 2250 S.L. 39.3 8550 E. 2.3 487
9:12:11	Has now signs of bronchitis. Blood W. 20,200 p.c.m. P. 69% = 13900 p.c.m. L.L. 8.5 1710 S.L. 16.7 3370 E. 5.7 1150
16:12:11	Cough and whoop much better. Is still sick occasionally. Blood W. 22,200 p.c.m. P. 68.2% = 15100 p.c.m. L.L. 3.2 710 S.L. 20.2 4480 E. 8 1725 B. .2 44

Date	Evelyn Partridge Aet 6
25:11:11	Attack of whooping cough began six months ago, which ran usual course. Ten days ago cough returned with whoop four days later. No vomiting. Blood Whites 24,400 per c.m. P. 74.5% = 18200 p.c.m. L.L. 13.4 3270 S.L. 11.9 2910 E. .2 48
2:12:11	Improving. Blood W. 12,200 p.c.m. P. 66.6% = 8150 p.c.m. L.L. 8 976 S.L. 23.2 2830 E. 2 244 B. .2 24
9:12:11	Cough less frequent and less severe. Blood W. 12,200 p.c.m. P. 63.5% = 7720 p.c.m. L.L. 9 1100 S.L. 24.7 3010 E. 2.5 305 B. .3 36

P.T.O

16:12:11

Still slight cough.

Blood	W.	12,800 p.c.m.	
	P.	61	= 7810 p.c.m.
	L.L.	7.7	986
	S.L.	28.5	3625
	E.	2.7	346

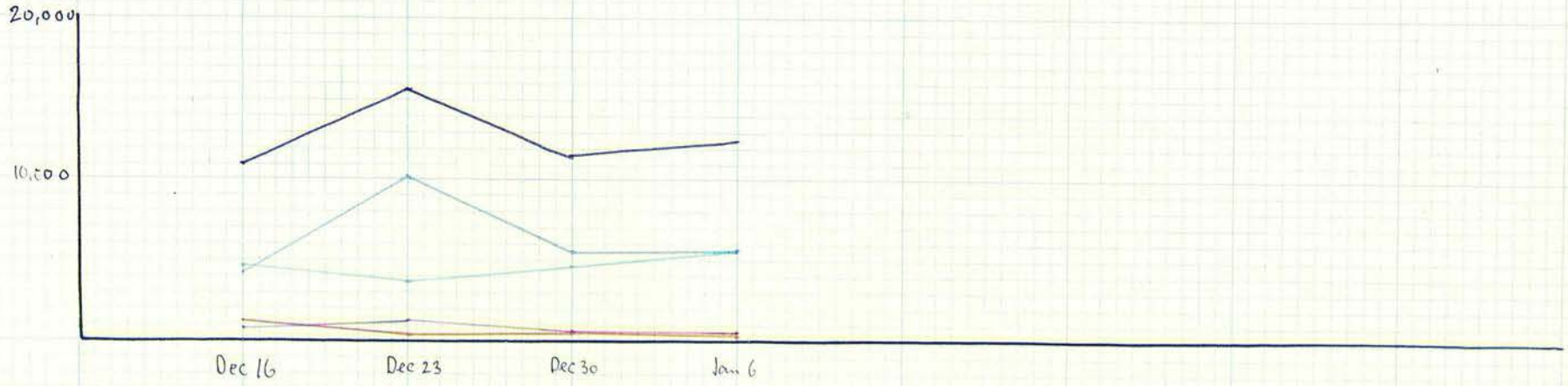
23:12:11

Evelyn Partridge

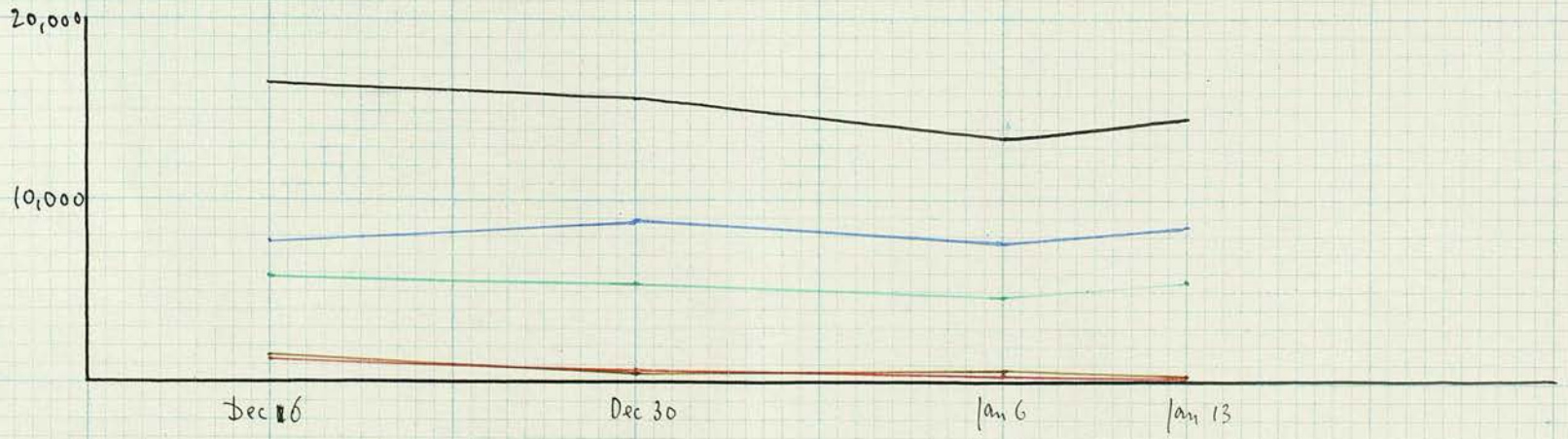
Still slight cough. No whoop.

Blood.	W.	11,000 p.c.m.	
	P.	64.7%	= 7140 p.c.m.
	L.L.	7.7	850
	S.L.	25.5	2810
	E.	1.7	187
	B.	.2	22

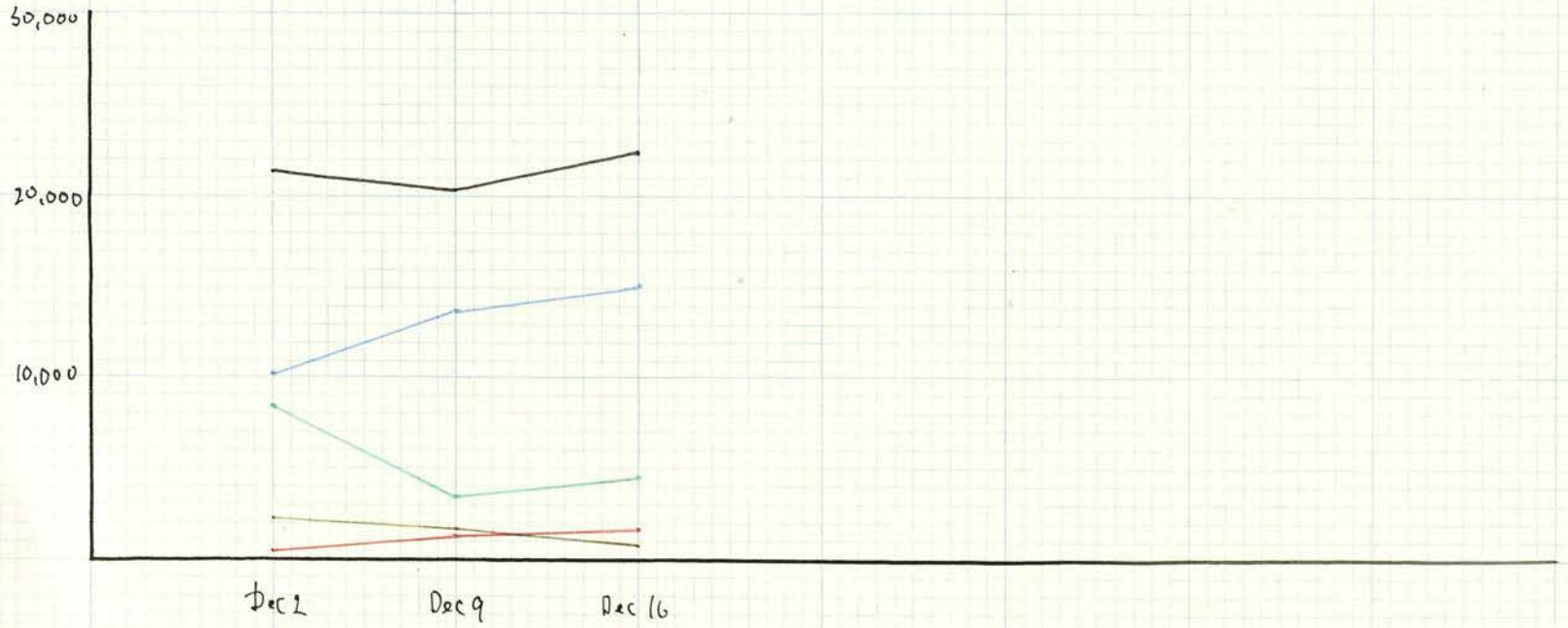
Bob Antony



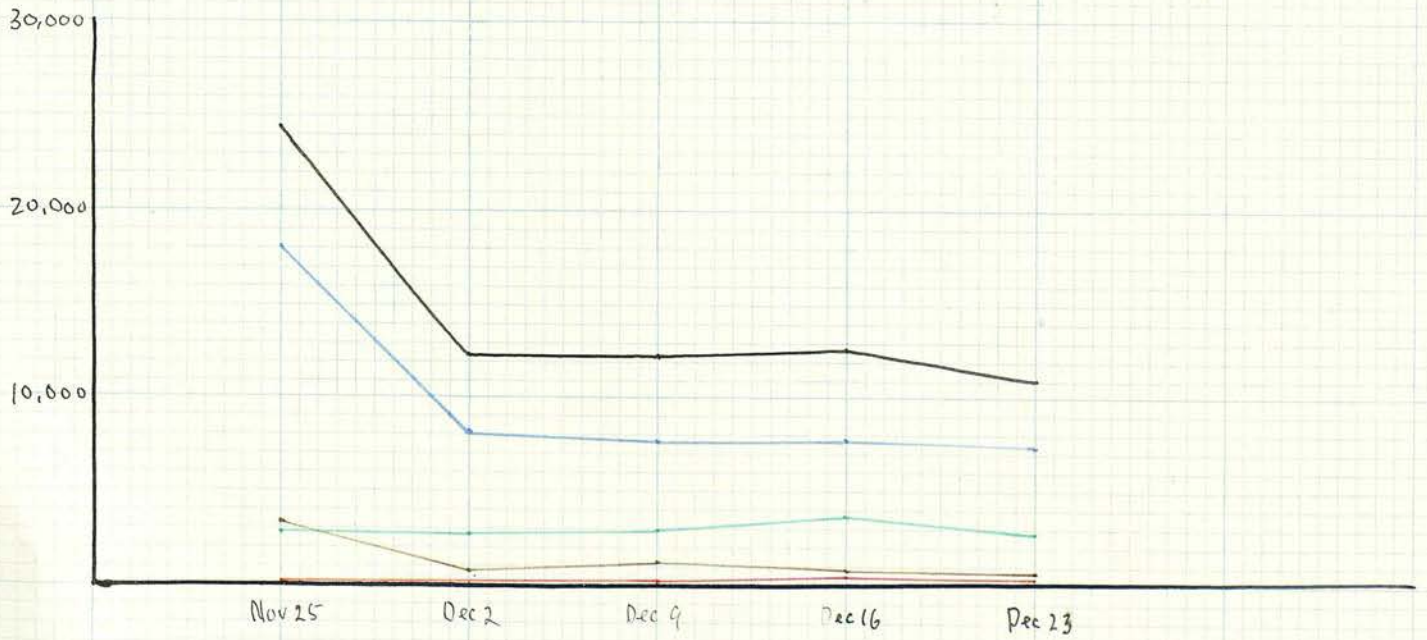
May Antony



Percy Munday.



Evelyn Partridge.



C O N C L U S I O N S.

In nearly all cases of whooping cough there is an increase in the white blood cells at the onset of the disease . The higher the leucocytosis the more severe the infection. This may be as great as 57,500 per cubic millimetre, and gradually diminishes as the disease progresses and the total leucocyte count returns to normal by the end of the sixth week in uncomplicated cases which do not become chronic.

The differential count at first shews an increase of all the different white cells in the blood, the most marked being the increase of the small lymphocytes and second of the Polymorphonuclear leucocytes. There is then a return by degrees to the normal limit about the end of the sixth week.

In cases complicated by broncho-pneumonia the count may rise to very high. In bronchitis the high counts occur before the bronchitis and are not increased by it, except that the polymorphonuclear leucocytes are relatively increased.

In chronic cases there may be an increase of large lymphocytes and eosinophils.

REFERENCES.

Sahli's "Diagnostic Methods" ..... p.798 & 802.

Barach Arch. Med. July 1908.

Da Costa "Clinical Haematology" ..... p. 502.

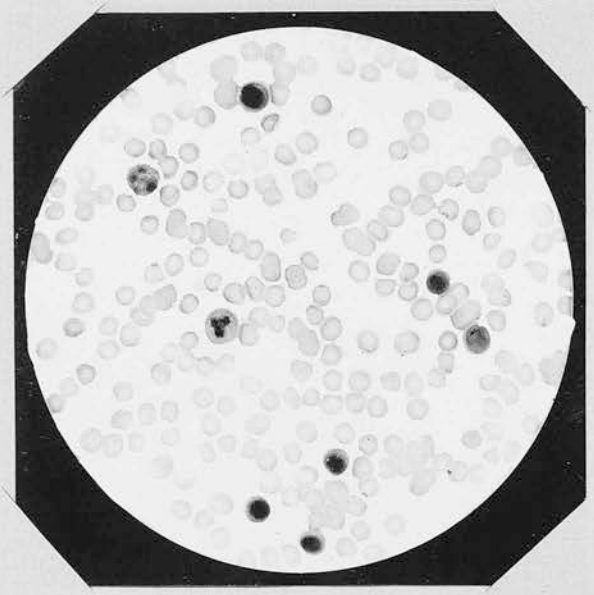
Allbutt Vol. II. Part I.

Gulland & Goodall "The Blood". ..... p. 251.

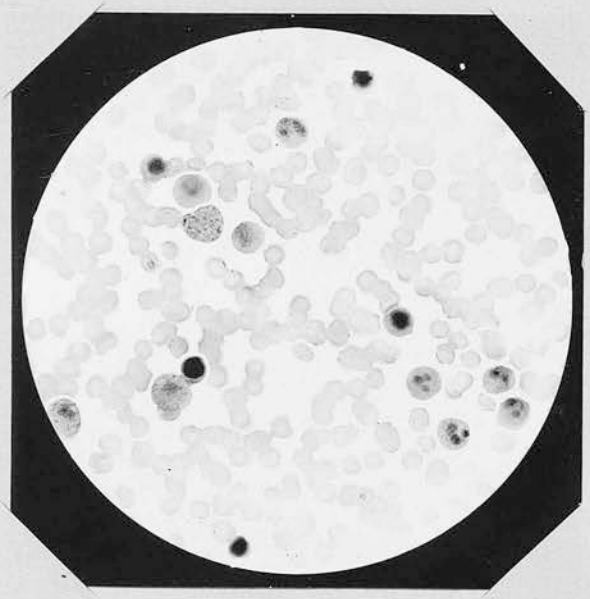
Crombie Ed. Med. Journal Sept. 1908.

Carr "Manual of Fevers."

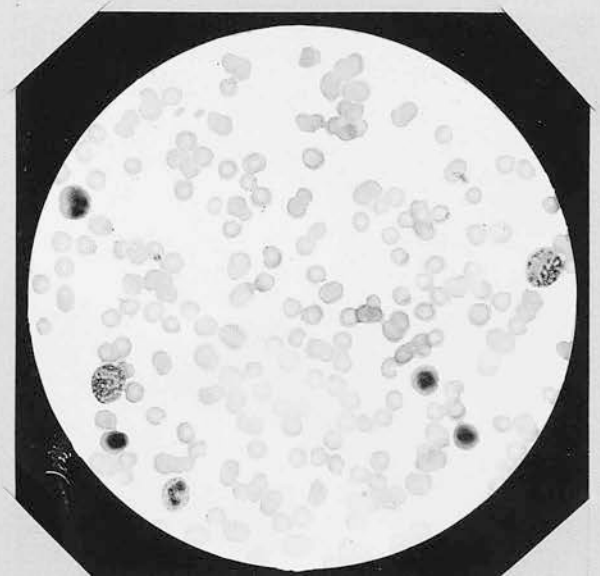
A.



B.



C.



Micro-photographs of Blood in Whooping Cough reproduced by Mr. R. Muir. Magnification x400.

A. Florence Taylor Aet 4.

Typical field in an average case shewing increase of small lymphocytes in addition to total increase in white cells.

B. Fred Tame Aet 5.

Count 57,000 p.c.m. Field shews an increase in all the forms of leucocytes.

C. Bob Antony. Aet 3.

Chronic case with 10% of eosinophils. Two eosinophils shown in field.

LEUCOCYTOSIS IN LOBAR PNEUMONIA IN CHILDREN.

This subject does not seem to have been specially investigated by anyone.

Some authorities on children's diseases consider that lobar pneumonia in young children is an extremely rare disease. They are of opinion that cases, which shew very much the characteristic signs and end by crisis, are really patches of broncho-pneumonia, and not true lobar. In addition they maintain that post mortem a pneumonic lobe in a young child is quite unlike an adult lobar pneumonic lung, as it is not nearly so solid. As this paper, however, is not concerned with this controversial point, but with leucocytosis, let it suffice therefore that all the cases recorded here were seen by one or other of the physicians to the Paddington Green Children's Hospital, and were considered by them to be cases of lobar pneumonia.

Writing on Blood in Pneumonia in general, Gulland and Goodall say, "The rule is an increased number of leucocytes. This increase does not correspond either to the temperature or the amount of lung involved, but is rather the expression of the resistance of the patient to the toxin. While the phenomenon is of diagnostic importance, it is probable that it has even/

even more value as a prognostic guide. Cases with slight symptoms may have no increase of white cells, but this very rarely occurs. In such cases there is usually a slight leucocytosis. On the other hand cases with very severe symptoms may show no increase or more often a diminution of leucocytes. There are cases in which the tissues including the bone-marrow, are overwhelmed by the toxin before they can react, and they are invariably fatal. In a great majority of cases there is an increase of white cells, ranging from 11,000 to 50,000 p.c.m. Our highest count has been 65,000 , but a count of 100,000 has been recorded. Leucocytosis is generally found when cases first come under observation. We have found it present within three hours of the initial rigour. There is little variation throughout the disease till a day or so before the crisis, the count then shows a tendency to fall in favourable cases, but in some fatal cases the same thing is found. Although the leucocytes may have begun to diminish before the fall of temperature, they do not reach their normal number for several days after the crisis, and in cases ending by lysis their fall may be very gradual. When the leucocytes fall in number about the time of the crisis but fail to return to their normal within three or four days we have/

have an almost vertain indication of some complication such as empyema, toxic nephritis or pericarditis.

"Differential counts - up to the crisis there is an increase of polymorphs, which may constitute 95% of the white cells. A few myelocytes are almost invariably present in severe cases. Transitional cells and large lymphocytes are also increased absolutely though the percentage may be low. Small lymphocytes and eosinophils on the other hand are absolutely and relatively diminished. The latter may disappear altogether ..... after the crisis the small lymphocytes and eosinophils are gradually restored to their normal numbers.

"Glyeogen reaction." This is always present. It can be made out when cases come under observation, but becomes rather more intense and affects a large number of cells a day or two before the crisis. After the crisis the reaction remains for a few days and may be distinctly present after the leucocyte count has returned to normal. In severe leucopenic cases the glycogenic reaction is always intense, but if polymorphs are diminished of course relatively few cells will show the change."

This has been quoted at some length as it is the best description of the cytology of the blood in pneumonia ever written.

The/

The writer's object is not to try to disprove a word of the above, but rather to show how closely children come under the principles laid down; and, how in a few details they differ from adults.

The following are the clinical facts and results of blood examination in forty-five cases of lobar pneumonia in childhood.

For statistics, cases without physical signs have been classed as basal; as apical pneumonias are most unlikely to give no physical signs.

Beatrice Capon Aet. 9/12

Patient came under observation on the fifth day of disease. At that time temperature was 103.8° Pulse 160 and respirations were forty per minute. On examination there were all the typical signs of lobar pneumonia at the left base, involving the whole of the lower lobe.

Blood examination same evening showed:-

Whites	17,200 per c.m.	
P.	61%	= 10,492 per c.m.
L.L.	6.6	1,135
S.L.	31.6	5,435
E.	.6	103

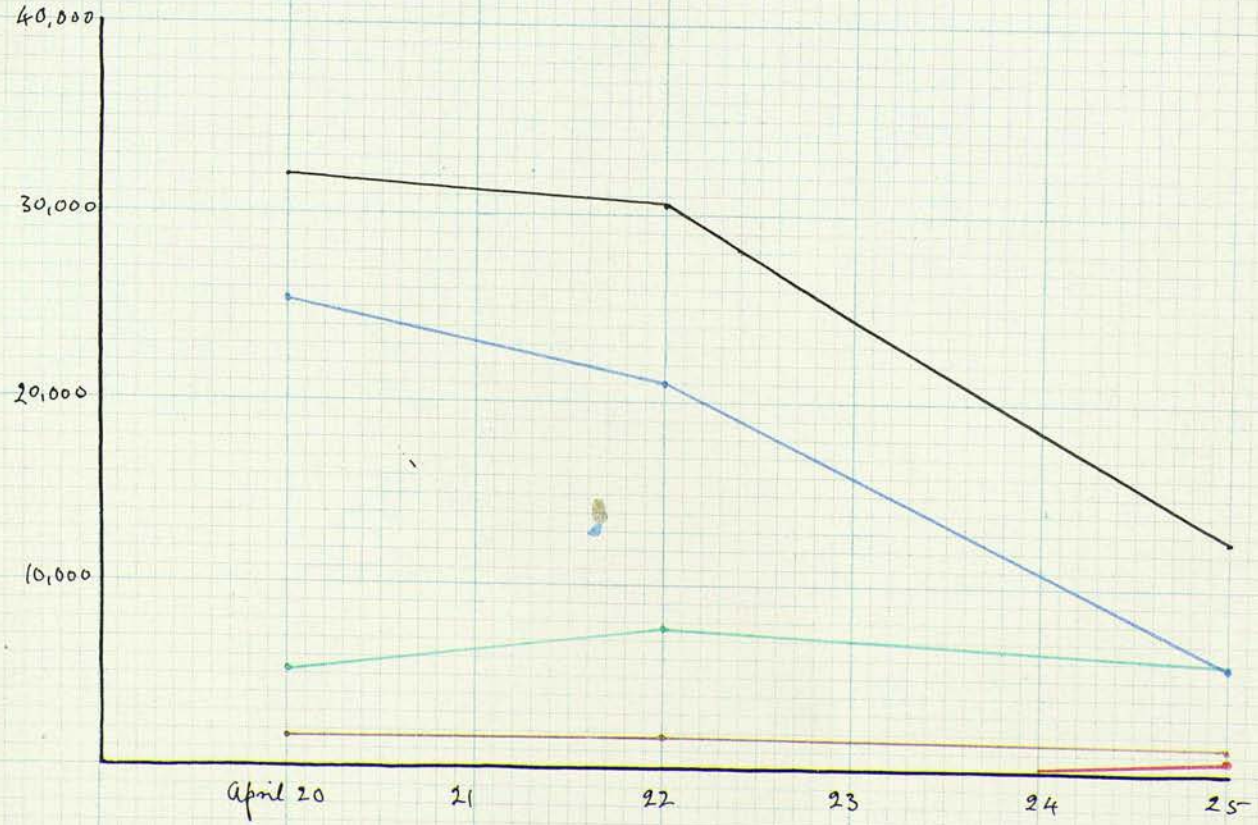
Glycogen reaction. Positive.

On the seventh day temperature dropped to 97° with pulse 120 and respirations 44.

An uninterrupted recovery followed.

Date	Sam Smith Aet. 9/12
19:4:12	Patient was admitted on the first day of illness. Temperature 105° Pulse 140 Respirations 56. On examination the right apex was found to be dull with loud tubular breathing and increased vocal resonence.
	Blood examination was made at the end of 24 hours from onset of illness and shewed.
20:4:12	Whites 32,000 p.c.m.
	P. 79% = 25,250 p.c.m.
	L.L. 5 1600
	S.L. 16 5150
	Glycogen reaction very marked.
21:4:12	Middle lobe involved.
22:4:12	Patient doing well. T. 104°. P. 152. R. 56.
	Blood W. 30,400 p.c.m.
	P. 68.2% = 21,000 p.c.m.
	L.L. 6.3 1,950
	S.L. 25.3 7,620
	Glycogen reaction very marked.
24:4:12	Temp. came down by crisis to 97° with Pulse 132 and respirations 40.
25:4:12	Blood W. 12,800 p.c.m.
	P. 42.7 = 5475 p.c.m.
	L.L. 9 1150
	S.L. 43.2 5525
	E. 5 640
	Glycogen reaction still very marked. Made a good recovery.

Sam Smith



Doris Clutterbuck Aet. 10/12

Patient was admitted on third day of illness with T. 102.6° P. 168 R. 80.

Signs of lobar pneumonia at left base.

Blood shewed.

W.	9,800 p.c.m.	
P.	62.5% =	6125 p.c.m.
L.L.	9	882
S.L.	28.5	2793

Glycogen reaction present.

Three days later Temperature fell to 100° with P. 176 and R. 80 but the crisis did not come till ninth day of illness when T. 97° : P. 132 : R. 48.

Uninterrupted convalescence.

Nellie Richardson. Aet. 11/12

Patient was admitted on second day of illness. T. 103 : P. 176 : and R. 48. On examination a small patch of consolidation was found at the right base.

Blood on day of admission.

W.	14,000 p.c.m.	
P.	64.5% =	9030 p.c.m.
L.L.	12.2	1708
S.L.	22.5	3150
E.	.7	98

Glycogen reaction moderately marked.

A typical crisis followed on fourth day of illness. T. 97.8 : P. 112 : R. 28.

Perfectly normal convalescence.

Henry Izzard Aet. 1 2/12

Date	
	Admitted with vomiting and diarrhoea. Small patch of pneumonia in midaxillary line right side. T. 103.8 P. 156 R. 52.
	Blood W. 13,000 p.c.m.
	P. 63% = 8190 p.c.m.
	L.L. 5 650
	S.L. 32 4160
	Glycogen reaction present.
	By degrees the whole of the right lung became involved in pneumonic process.
3:12:11	On 7th day of illness child began to vomit, this continued till 11th day.
	Temperature came down on 9th day but no resolution followed.
6:12:11	On 10th day severe uncontrollable diarrhoea began.
7:12:11	On 11th day small patch in left lung.
8:12:11	On 12th day left submaxillary gland inflamed.
9:12:11	On 13th day child died.
	P.M. Unresolved lobar pneumonia right lung. Small patch bronchopneumonia left lung. Submaxillary adenitis.

William Godbold Aet. 2/12

Admitted third day of illness with T. 102.6° P. 160 R. 52. Left apex consolidated.

Blood	W.	18,200 p.c.m.	
	P.	55% =	10,010 p.c.m.
	L.L.	15	2,730
	S.L.	29.7	5,405
	E.	.2	36

Glycogen reaction slight.

Pneumonic process gradually spread to the whole of the left lung.

Child had a crisis of 9th day, T 97.4° P. 102 R. 36.

Perfect recovery.

Pauline Weller. Aet. 1 3/12.

Child had had some diarrhoea and vomiting for about a month before coming under observation.

A week before admission began to have a cough.

State on admission ? 6th day.

Temperature 101° Pulse 148 Respirations 56.

Physical examination showed signs of lobar pneumonia affecting the right upper lobe both anteriorly and posteriorly with some bronchitis over both bases.

Blood examination.

Whites	28,000	p.c.m.
Of which P.	70%	= 19630 p.c.m.
L.L.	7.2	2010
S.L.	22.7	6340

Glycogen reaction markedly present.

Following day Temperature fell to 97° Pulse to 116 and respirations to 40.

Consolidation beginning to clear up.

Result. Complete recovery.

Date	Alfred Koeher Aet 1 4/12.
6:2:12	Admitted on third day of illness with consolidation of most of the right lung but not extending to the surface. Some rhonchi over both lungs both anteriorly and posteriorly. On admission Temperature 102° Pulse 144 Respirations 78 per minute. Blood examination. Whites 9,600 p.c.m. P. 55% = 5280 p.c.m. L.L. 8 768 S.L. 36.2 3475 E. .5 48 B. .2 19 Glycogen reaction very slight
13:2:12	On 10th day child had his crisis Temperature 97.4° Pulse 128 Respirations 48. Subsequent history. Developed double pneumonia and empyeme at convalescent home. Was operated on and returned to hospital. On readmission blood shewed:- Whites 9,000 p.c.m. P. 46.5% = 4175 p.c.m. L.L. 5.5 495 S.L. 47 4230 E. 1 90 Positive glycogen reaction. Made good recovery.

Walter Jones Aet. 1 4/12

Child was admitted on fourth day of illness with temperature 103.6°, Pulse 168 Respirations 60.

A patch of pneumonia was made out on the right side anteriorly extending from about second to fourth ribs.

Some general bronchitis also present.

Blood shewed.

Whites	16,000	p.c.m.	
P.	77%	=	12320
L.L.	8		1280
S.L.	15		2400

Glycogen reaction marked.

On the 7th day of illness child had a satisfactory crisis.

Temperature 97° Pulse 128 and Respirations 40

Result. Uninterrupted recovery.

Lilian Hatton Aet. 1 6/12.

Admitted on third day of illness with temperature 106° Pulse 168 Respiration 76. Pneumonia at left apex.

Blood	W.	12,200	
	P.	57.5%	= 7015 p.c.m.
	L.L.	5.7	695
	S.L.	36.7	4477

Glycogen reaction extremely marked.

Pneumonia spread to left lower lobe.

On 10th day after admission signs appeared at right apex in addition.

On 12th day child died.

P.M. On opening thorax an empyema was found. The pus was located between the diaphragm and the right lower lobe.

In addition to this, the right apex was in state of grey hepatisation. The left lung was resolving.

John Munn Aet. 1 7/12.

Patient was admitted on third day of illness with Temperature 104.8° Pulse 176 and Respirations 72.

Physical examination shewed pneumonia of the right upper lobe.

Blood examination.

Whites	14,800	p.c.m.	
P.	69.2%	= 10,241	p.c.m.
L.L.	5.2	769	
S.L.	25.2	3729	
B.	.2	29	

Glycogen reaction present.

On 5th day of illness child had his crisis and made a good recovery.

Temp. 98.4° P. 136 Respirations 48.

James Jeoffreys Aet. $1\frac{8}{12}$

Admitted 2nd day of disease.

Temperature 102.8° Pulse 156 Respiration 36.

Blood	Whites	22,000	p.c.m.
	P.	79.8%	= 17,360
	L.L.	8	1760
	S.L.	12.2	2680

Glycogen reaction marked.

Crisis 6th day.

Child never had any localising signs.

Result recovery.

Wilfred Smith Aet 2

No definite history of onset of illness available from child's mother.

State on admission. T. 102 P. 144 R. 44. Bronchitis with impairment of resonence on right side and distant bronchial breathing.

Blood examination.

Whites	17,400	p.c.m.	
P.	85.3	= 14,842	p.c.m.
L.L.	5.6	974	
S.L.	8.3	1444	
E.	.6	104	

Glycogen reaction slight.

Next day child was much better. T. 96.6 P. 108 R. 32, and made good recovery.

Elizabeth Rudge Aet 2.

No definite history available.

On admission T. 103.4 P. 168 R. 60.

Marked right apical pneumonia present.

Blood.	Whites	8,600	p.c.m.
	P.	71.3% =	6131 p.c.m.
	L.L.	6.3	541
	S.L.	22.3	1917

Glycogen reaction marked.

Pneumonic process spread to whole of right lung and remained unresolved, with swinging temperature.

Was explored on 12th, 17th and 21st days after admission on right side but no pus found.

Second count shewed Whites only 7,600 p.c.m.

Child died on 23rd day after admission.

P.M. Right lung collapsed and in course of resolution.

Small patch in left upper lobe.

Some pus over left lower lobe, and also pyopericardium.

Arthur Hutton Aet. 2½ y.

Admitted 2nd day of disease with T. 104.6 P. 176 and R. 60.

Physical signs of pneumonia at left Base.

Blood.	Whites	18,200 p.c.m.	
	P.	69.5% =	12,625 p.c.m.
	L.L.	7	1274
	S.L.	23.2	4222
	E.	.2	36

Glycogen reaction positive.

Next day had a pseudo crisis. Temperature falling to 98.6° .

On the 4th, 5th and 6th days of disease had slight pyrexia, running about T. 100° P.112 R.36.

On 7th day everything settled down and child completely recovered.

Leslie Gibbs. Aet. 3 y.

Admitted on 8th day with T.103.8 P.168 and R.60. No physical signs.

Blood examination.

Whites.	22,000 p.c.m.	
P.	66.6% =	14680 p.c.m.
L.L.	9.6	2115
S.L.	23	5060
E.	.3	67
B.	.3	67

Glycogen reaction present.

On following day had a crisis but on 11th day temperature rose again and on 12th day for the first time physical signs of pneumonia developed at left base.

Signs became more marked and dullness became stony.

On 18th day seropus was withdrawn from left side about the angle of the scapula.

Next day child was removed by parents.

Walter Carter Aet 3 5/12.

Was admitted on 5th day of illness without physical signs but with a history of abdominal pain strongly suggestive of acute appendicitis.

On admission T.104 P.148 R.52.

Blood	W.	25,600	p.c.m.
	P.	72%	= 18450 p.c.m.
	L.L.	14.2	3610
	S.L.	13.7	3510

Glycogen reaction marked.

6th day there was slight impairment of resonence over right lower lobe with diminished vocal resonence and breath sounds.

7th day. Temperature dropped from 104° to 97° in 12 hours while pulse and respiration fell to 112 and 28 respectively.

For next four days temperature never rose above 98° and child had an uninterrupted convalescence.

Alfred Elliot Aet. 3½

Child was admitted on 2nd day of illness with Temperature 103.2° Pulse 160 Respirations 52.

No physical signs in chest.

Blood shewed.

Whites.	18,200	p.c.m.
P.	82.2%	= 14940 p.c.m.
L.L.	8	1456
S.L.	9.7	1762

Slight glycogen reaction.

Ran an ordinary course of an acute pneumonia without physical signs and had a crisis on 6th day. Temperature 98° Pulse 108 Respirations 36.

James Willis. Aet. 3¾

Was admitted on third day of disease, temperature 103° Pulse 134 and Respirations 32.

Physical signs were typical at the left base.

Blood	Whites	18,800 p.c.m.	
	P.	88.2 =	16600 p.c.m.
	L.L.	4.7	885
	S.L.	7	1316

Glycogen reaction present.

On 6th day temperature came down to 98.4° with Pulse 104 and respirations 48 per minute.

For the next three days there was a slight rise of temperature but after that everything settled down.

On 8th day blood showed.

W.	14,200 p.c.m.	
P.	65% =	9250 p.c.m.
L.L.	14	1990
S.L.	18	2560
E.	3	426

At that time temperature was 99° Pulse 128 and respirations 36.

No subsequent complications.

Roger Clark Aet 4 y.

Admitted on 4th day with temperature 103° Pulse 128 and respirations 64 .

Physical examination gave evidence of general bronchitis with deep patch of pneumonia at the right side.

Blood	Whites	12,000 p.c.m.	
	P.	45.6% =	5480 p.c.m.
	L.L.	18.3	2180
	S.L.	35.3	4240
	E.	.6	72

Very slight glycogen reaction.

Child had a crisis on 7th day.

Subsequently temperature began to swing. On the 11th day blood was as follows.

W.	21,000 p.c.m.		
P.	68.7 =	14420	p.c.m.
L.L.	7	1470	
S.L.	23.5	4940	
E.	.7	147	

Glycogen reaction present.

This was due to an otitis media.

Child made good recovery.

Edward Mattey Aet 4⅔ y.

Admitted on 5th day of illness.

Temperature 102.6° pulse 136 respirations 44.

Physical signs of lobar pneumonia at right base.

Blood	Whites	24,000	p.c.m.
	Poly	89% =	21,360 p.c.m.
	L.L.	5	1200
	S.L.	6	144

Glycogen reaction present. Crisis on 8th day.

Subsequently developed a right sided empyema which was opened by resection of rib.

Ultimately recovered.

Ellen Glidle

Came to hospital on 6th day with Temperature 103.2 pulse 160 and respirations 42.

Signs were mainly those of bronchitis but in addition there was a considerable area of pneumonic consolidation at the left base.

Blood	W.	23,800	p.c.m.
	P.	77.5 =	18460 p.c.m.
	L.L.	9.7	2310
	S.L.	12.7	3020

Glycogen reaction present.

Temperature settled in a day or two and child made an interrupted recovery.

Thomas McGarth Aet. 5 y.

Was admitted on third day with Temperature 104° pulse 140 and respirations 52.

At that time only a small patch of pneumonia could be made out at the left base.

Blood	W.	19,000 p.c.m.	
	P.	79.2% =	15100 p.c.m.
	L.L.	6	1140
	S.L.	14.7	2790

Glycogen reaction very marked.

In course of a day or two the whole of the left lower lobe became involved.

On 7th day there was a typical crisis.

Temperature 98 pulse 90 respirations 28.

Next day the blood was as follows.

W.	12,200 p.c.m.	
P.	53.3% =	6510
L.L.	6.3	769
S.L.	36	4390
E.	4	489
B.	.3	36

Glycogen reaction slight.

Lily White Aet 5 y.

Child came to hospital on the 4th day with a perfectly typical right apical pneumonia.

Blood examination.

W.	30,000	p.c.m.	
P.	88%	=	26400 p.c.m.
L.L.	6		1800
S.L.	5.7		1710
E.	.2		60

Glycogen reaction present.

On 6th day temperature had fallen to 98° and pulse to 96 and respirations to 24.

On 7th day blood was as follows.

W.	25,600	p.c.m.	
P.	76.6%	=	19,640 p.c.m.
L.L.	8		2025
S.L.	6.6		1690
E.	8.3		2120
B.	.3		77

Three days later took German measles.

Went home well.

Date	Marie Chapman Aet 5½.
15:4:12	Admitted 3rd day. T.103° P. 136 R.52. Only physical sign was diminished breathing at right base.
	Blood W. 22,600 p.c.m.
	P. 78.7% = 17800 p.c.m.
	L.L. 5.2 1175
	S.L. 15.2 3460
	E. .7 158
	Glycogen reaction very marked. Temperature continued to swing between 104° and 99°.
19:4:12	T. 104° P.128 R.60.
	Blood W. 22,000 p.c.m.
	P. 77.5% = 17100 p.c.m.
	L.L. 5.7 1252
	S.L. 16.7 3675
	Glycogen reaction very marked. Physical signs now very marked. Extreme dullness over right lower lobe in axillary line.
22:4:12	Explored to exclude empyema.
23:4:12	Temperature still swinging. Physical signs unchanged.
	Looks quite well when temperature is down.

P.T.O.

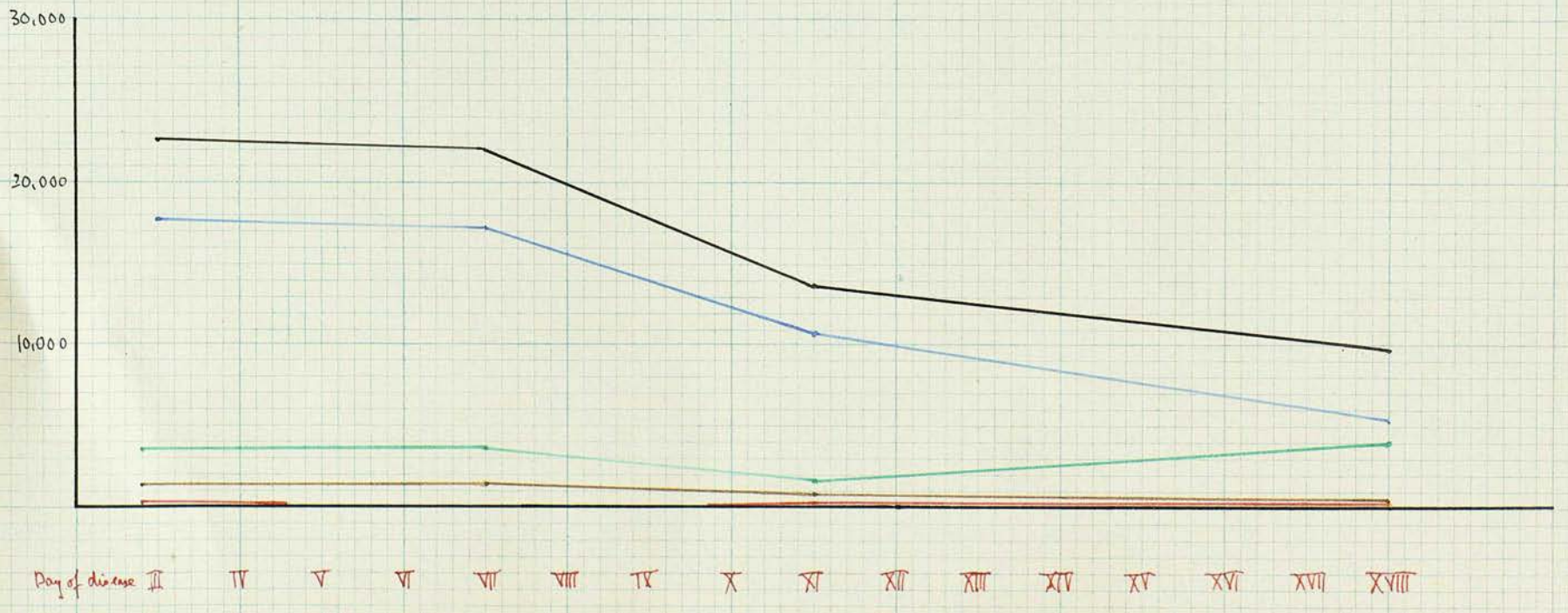
Date	Marie Chapman
	Blood W. 13,600 p.c.m. P. 79.5% = 108.0 p.c.m. L.L. 6.7 913 S.L. 13.5 1835 E. .2 27 Glycogen reaction slight.
26:4:12	Explored again. Nothing found.
	Evening T. 104° P.136 R.52.
27:4:12	Morning T.97° P.86 R. 36.
	Evening T. 100.4° P. 136 R. 36.
28:4:12	More settled.
29:4:12)) 30:4:12)) 1:5:12)) 2:5:12)	Temperature consistently 97° morning and evening.
	On 30:4:12 blood examined. Whites. 9,600 p.c.m. P. 53.7% = 5150 p.c.m. L.L. 3 289 S.L. 42 4030 E. 1 96 B. .2 19

This case was particularly interesting clinically on account of, first the late appearance of physical signs, second the swinging temperature which swung higher/

higher and higher for ten days suggesting empyema. No empyema present on exploration. Then the temperature swung down again as it had risen and eventually becoming subnormal on the 17th day of illness.

The lung cleared up subsequently.

Marie Chapman



William Davy. Aet 6.

Indefinite history. Day of admission Temperature rose to 103.8° pulse 142 Resp. 48.

Signs of pneumonia at left base.

Blood	Whites.	19,800 p.c.m.	
	P.	82% =	16,240 p.c.m.
	L.L.	5	990
	S.L.	14	2770

Glycogen reaction slight.

Had his crisis 3rd day in hospital and made an excellent recovery.

James Crowie Aet 6.

Admitted 4th day. Complaining of headache, vomiting, cough and general malaise.

On admission Temperature 103.4° pulse 136 respirations 36.

Physical signs at right base.

Leucocytosis	20, 200 p.c.m.	
P.	87% =	17,574 p.c.m.
L.L.	2	404
S.L.	11	2222

Glycogen reaction marked.

Crisis 6th day.

Normal convalescence.

Ada Sparks Aet 6 y.

Was admitted on 3rd day of illness with temperature 101.4° Pulse 136 and respirations 36.

There were no physical signs in the chest.

Blood examination was as follows:-

Whites	22,200 p.c.m.		
P.	90.7%	=	20,132 p.c.m.
L.L.	4.2	=	932
S.L.	5	=	1110

Glycogen reaction was marked.

Patient never developed any physical signs of pneumonia but on 7th day of illness she had a crisis and had a normal convalescence.

Alfred Gleeson Aet 6 y.

Child was admitted on the 5th day of illness and had a temperature of 102.2° Pulse 116 and respirations 48 per minute.

Blood shewed.

Whites	24,000	p.c.m.
P.	80% =	19200 p.c.m.
L.L.	2	480
S.L.	16	3840
E.	2	480

Glycogen reaction was present.

Patient had his crisis on day of admission, the evening chart reading being Temperature 98.8° pulse 108 respirations 28.

George Munden. Aet 6½.

Patient came to hospital on the 5th day with temperature 103.8° pulse 132 and respirations 44.

Physical signs were well marked over the whole of the right lower lobe.

Blood	Whites	13,000 p.c.m.	
	P.	84% =	10925 p.c.m.
	L.L.	4.7	610
	S.L.	10.2	1325
	E.	.7	91
	B.	.2	26

Glycogen reaction present.

Crisis occurred on 8th day. Temperature 97.2° pulse 112 respirations 36.

Lung cleared up subsequently in normal manner.

Harry Warrener Aet 6½ y.

Was admitted on 5th day with temperature 104° pulse 160 and respirations 44.

Physical examination only revealed a small patch of pneumonia in the left lung about the middle of lower lobe.

There was a very extensive herpetic eruption on the nose.

Blood	W.	26,600	p.c.m.
	P.	83.2% =	22,121 p.c.m.
	L.L.	7.5	1995
	S.L.	9.2	2249

Glycogen reaction very marked indeed.

Crisis followed on the 8th day, temperature 98.4° Pulse 104 respirations 28.

Blood examined same day shewed following changes.

	W.	17,200	p.c.m.
	P.	61.5% =	10,578 p.c.m.
	L.L.	13	2236
	S.L.	22.2	3818
	E.	3.2	550

Some cells shewed positive Glycogen reaction.

Perfect recovery followed.

Elizabeth Goodacre Aet $6\frac{1}{2}$.

Patient was admitted on 2nd day of illness with temperature 102.4° pulse 140 respirations 52.

Lungs showed some bronchitis but also a patch of pneumonia at right base.

Blood	Whites	19,200 p.c.m.	
	P.	90.5% =	17360 p.c.m.
	L.L.	3.2	610
	S.L.	6.2	1190

Glycogen reaction present.

Patient had her crisis on the following day.

Thomas Duncan Aet 7 y.

Admitted 5th day with temperature 101.2° pulse 106 and respirations 44.

Herpes marked on left side of chin. Typical signs of lobar pneumonia at right base.

Blood	Whites	19,200	p.c.m.
	P.	84% =	16220 p.c.m.
	L.L.	3	577
	S.L.	13	2500

Glycogen reaction present.

Crisis on 9th day. T.97° P.84° R. 32.

Had a normal convalescence and gained 3 lbs in weight in a fortnight.

Violet Parrott Aet 7 y.

Admitted on 3rd day T. 105.6 P. 200 respirations 80. Pneumonia affected right, middle and lower lobes. In addition to herpes labialis patient had pain and redness of right upper arm.

Blood examination

W.	13,600	
P.	81%	= 11110 p.c.m.
L.L.	6	819
S.L.	12	1635
E.	1	136

Glycogen reaction present.

Case was subsequently complicated by three large abscesses due to staphylococcus aureus, one of upper arm, a large one over the back which contained almost a pint of pus; both were operated on and a third which evacuated itself per vaginam from which the same organism was grown in pure culture.

Patient eventually made a good recovery.

Isabella Kay Aet. 8.

Admitted 2nd day complaining of fever, vomiting and pain in left side.

Temp. 103° pulse 120 respiration 40

At first signs were indefinite.

Blood 30,000 whites p.c.m.

Poly	91%	= 27,300	p.c.m.
L.L.	5%	1500	
S.L.	4%	1200	

Glycogen reaction present.

Subsequently developed typical signs at left base. Crisis 7th day.

Temp. 96.2° pulse 82 respiration 32.

Normal convalescence.

Annie Lavejoy Aet 8 y.

Admitted 6th day with temperature 104° pulse 152 and respirations 36.

Well marked physical signs at left base.

Blood	Whites	22,600	p.c.m.
	P.	94% =	21220 p.c.m.
	L.L.	1	226
	S.L.	5	1134

Glycogen reaction present.

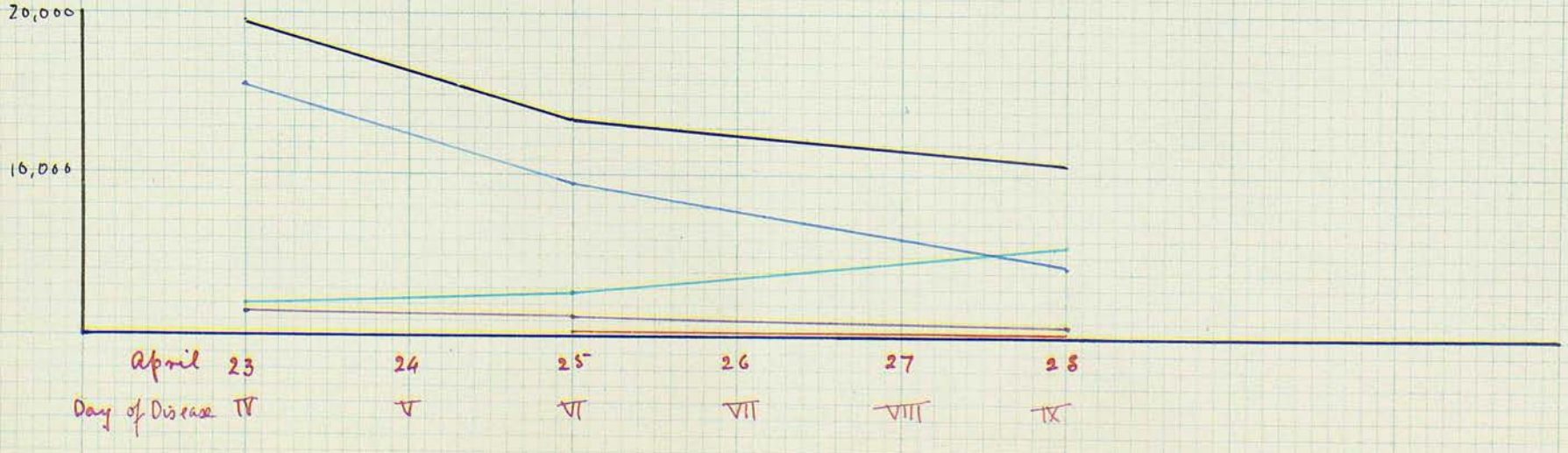
Temperature fell on 8th day and gradually reached subnormal on morning of 9th day.

Date	Francis Spendlowe Aet 9 y.
13:3:12	Illness began three days ago with pain in the side and vomiting. Appetite lost. There was some cough. On admission Temperature 104.8° pulse 128 respirations 40. Patient was very comfortable. Physical examination shewed signs of pneumonia at right base. Blood Whites 28,000 p.c.m. P. 85.2% = 23830 L.L. 6.2 1740 S.L. 8.5 2380 Glycogen reaction present.
15:3:12	Whole of right lower lobe involved and coarse friction in axillary line. Blood W. 19,600 p.c.m. P. 80.7% = 15830 p.c.m. L.L. 4.5 882 S.L. 14.5 2840 E. .2 39 Glycogen reaction marked.
18;3:12	On 9th day crisis occurred. Temperature 97.4° pulse 102 respirations 44. Blood W. 20,000 p.c.m. P. 80.2% = 16060 L.L. 6.2 1240 S.L. 13 2600 E. .5 100 P.T.O.

Date	Francis Spendlowe.
	Glycogen reaction present. Normal convalescence.

Date	Christopher Phillips Aet 9 y.
23:4:12	Patient was admitted on 4th day of illness with temperature 106° pulse 140 respirations 36. Physical signs not well marked but were definitely present in middle lobe. Blood Whites 19,200 p.c.m. P. 81.5% = 15660 p.c.m. L.L. 8 1538 S.L. 10.5 2008 Glycogen reaction slight.
25:4:12	Crisis occurred on 6th day when the temperature dropped from 105.6° to 97° in 24 hours. Blood was again examined on day of crisis. Whites 13,400 p.c.m. P. 70.2% = 9425 L.L. 8 1072 S.L. 21 2825 E. .7 93 Glycogen reaction present.
28:4:12	Blood 10,800 p.c.m. P. 39% = 4210 L.L. 6.6 714 S.L. 51.3 5540 E. 2.6 282 B. .3 32 Glycogen reaction marked.

Christopher Phillips



John Taylor Aet 10.

Came in on 7th day with temperature 101.8 pulse 120 respirations 56.

Left base completely consolidated.

Blood	W.	17,400 p.c.m.	
	P.	81.3% =	14150 p.c.m.
	L.L.	6.3	1096
	S.L.	11.3	1960
	E.	1	174

Glycogen reaction marked.

Temperature settled four days later.

Bernard McCue Aet 11 y.

Admitted 2nd day of illness with temperature 104.2° pulse 120 respiration 48.

Began with pain in right side and is said to have shivered. Vomited once.

Previous health. Has had pneumonia aet 5 and 8.

On admission indefinite signs at right apex.

Blood	Whites	34,000 p.c.m.	
	P.	80% =	29,240 p.c.m.
	L.L.	7	2380
	S.L.	7	2380

Glycogen reaction present.

Signs became marked over right upper lobe and extended downwards involving part of the middle and lower lobes.

Pseudocrisis 9th day.

Unsatisfactory crisis 10th day.

Pulse and respirations settled down finally on 15th day.

Child made good recovery.

William Lambell Aet 11 y.

Admitted on 4th day temperature being 104° pulse 120 respirations 48.

Blood	W.	18,200	p.c.m.	
	P.	84.5%	= 15375	p.c.m.
	L.L.	5.5	1005	
	S.L.	10	1820	

Slight glycogen reaction.

The right base was solid and breathing bronchial in character with increased vocal resonence.

Crisis on 7th day.

Made a good recovery.

Herbert Whittle Aet. 11 y.

Admitted on 2nd day of illness. Temperature 103.4° pulse 120 respirations 32.

Physical signs in right lung which according to previous notes on case was already fibrosed. There was however marked friction in right axillary line at level of 4th and 5th ribs.

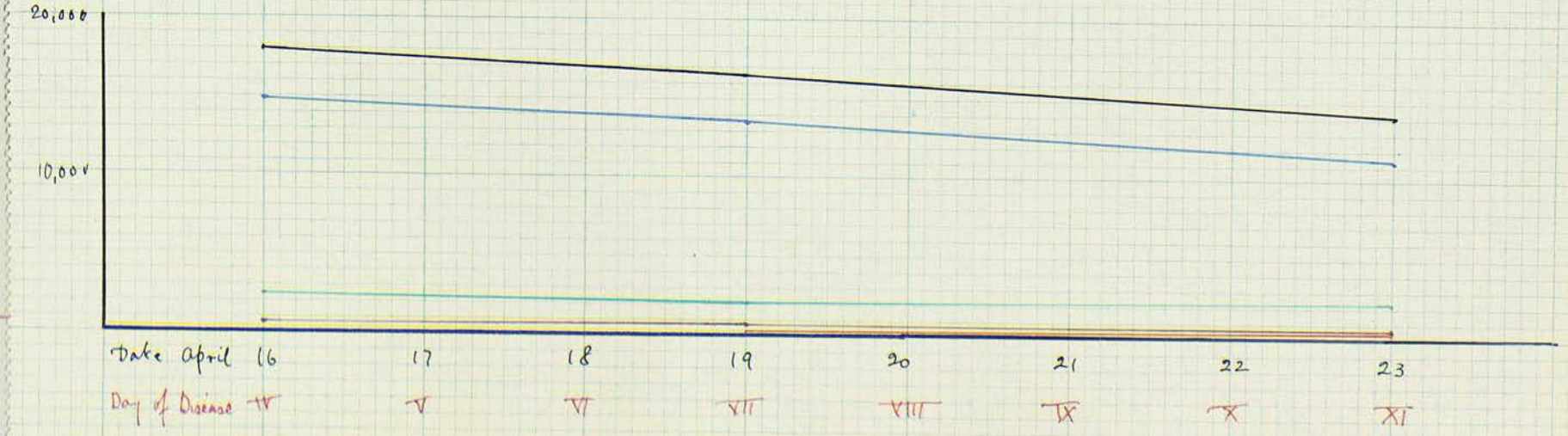
Blood	W.	12,000 p.c.m.	
	P.	60.6% =	7280 p.c.m.
	L.L.	8.6	1032
	S.L.	27.6	3310
	E.	3	360

Glycogen reaction slight.

Had a typical crisis on 6th day.

Date	Ethel English Aet $11\frac{3}{4}$
16:4:12	Admitted 4th day. Temperature 103.4° pulse 128 respirations 44.
	On examination of chest there was impaired resonence and diminished breathing at right base.
	Patient was perfectly comfortable.
	Blood Whites 18,000 p.c.m.
	P. 83.2% = 14980 p.c.m.
	L.L. 3.5 630
	S.L. 13.2 2380
	Glycogen reaction marked.
19:4:12	T. 101 P. 108. R. 32.
	Blood W. 10,400 p.c.m.
	P. 82.2 = 13500 p.c.m.
	L.L. 4.7 772
	S.L. 12.7 2042
	E. .2 32
	Glycogen reaction marked.
20:4:12	Temp. 97.6 pulse 76 respirations 24.
23:4:12	Temp. 98.4 pulse 88 respirations 24.
	No constitutional symptoms.
	Blood W. 14,000 p.c.m.
	P. 79.5% = 11130 p.c.m.
	L.L. 4. 560
	S.L. 15 2100
	E. 1.5 210
	No glycogen reaction.

Ethel English



Ellen Wood Aet 12.

Admitted 4th day. Temp. 103.6° pulse 116. Resp. 48.

Physical signs at right apex.

Leucocytosis 21,000 p.c.m.

Poly	87%	= 18,270 p.c.m.
L.L.	3	630
S.L.	9	1890
E.	1	210

Glycogen reaction present.

Crisis 7th day. Temp. 96.8 pulse 74 Resp. 32.

Normal convalescence.

John Coventry Aet 12 y.

Admitted on 5th day. Began illness with rigor, followed next day by pain in right side.

On admission. Temp. 103.2° pulse 108 Resp. 38.

Physical signs. Dullness over right base with diminished breathing. No accompaniments. Friction in left midaxillary line.

Blood	Whites	20,000 p.c.m.		
	Polym.	90%	=	18,000 p.c.m.
	L.L.	2	=	400
	S.L.	8	=	1600

Glycogen reaction present.

Had crisis on 9th day. Temp. 97° pulse 64 Resp. 28.

Normal convalescence.

The writer's attention was first drawn to the subject by a run of about half a dozen cases in young children none of whom had a leucocytosis over 15,000 p.c.m.. This seemed remarkable in view of the fact that the normal leucocytosis in young children is higher than in adults; and also, that it is an accepted fact, that "the white cells in infancy and childhood are much more responsive to stimuli than in adult life" (Gulland and Goodall).

When one comes to examine the above cases it is seen that this rule has its exceptions.

Let us first consider cases of apical pneumonia.

The average leucocytosis of five cases under 5 years of age is 24,680 p.c.m. with the following differential count.

Polymorphs	17,229	p.c.m.
Large lymph.	1,812	
Small lymph.	5,648	
Eosinophils	7	

In four cases over 5 years of age the average count is:-

Total	27,200	p.c.m.
Polymorphs	23,280	p.c.m.
La. Lymphocytes.	1,322	
Sm. Lymphocytes.	2,455	
Eosinophils	187	

After the crisis the counts had fallen to:-

Total	19,200 p.c.m.
Polymorphs	12,557 p.c.m.
Large lymphocytes ...	1,587
Small lymphocytes ...	3,607
Eosinophils	1,380
Basophils	38

In basal pneumonias on the other hand the average of 15 cases under 5 years of age is:-

Total	17,180 p.c.m.
Polymorphs	12,518 p.c.m.
Large lymphocytes ..	1,457
Small Lymphocytes ..	3,058
Eosinophils.....	35
Basophils	5

In 22 cases in children suffering from basal pneumonia over 5 years of age and under 13, the average is as follows:-

Total	20,480 p.c.m.
Polymorphs	17,260 p.c.m.
Large lymphocytes ..	982
Small lymphocytes ..	2,150
Eosinophils	28

After the crisis the average of eight counts is found to be:-

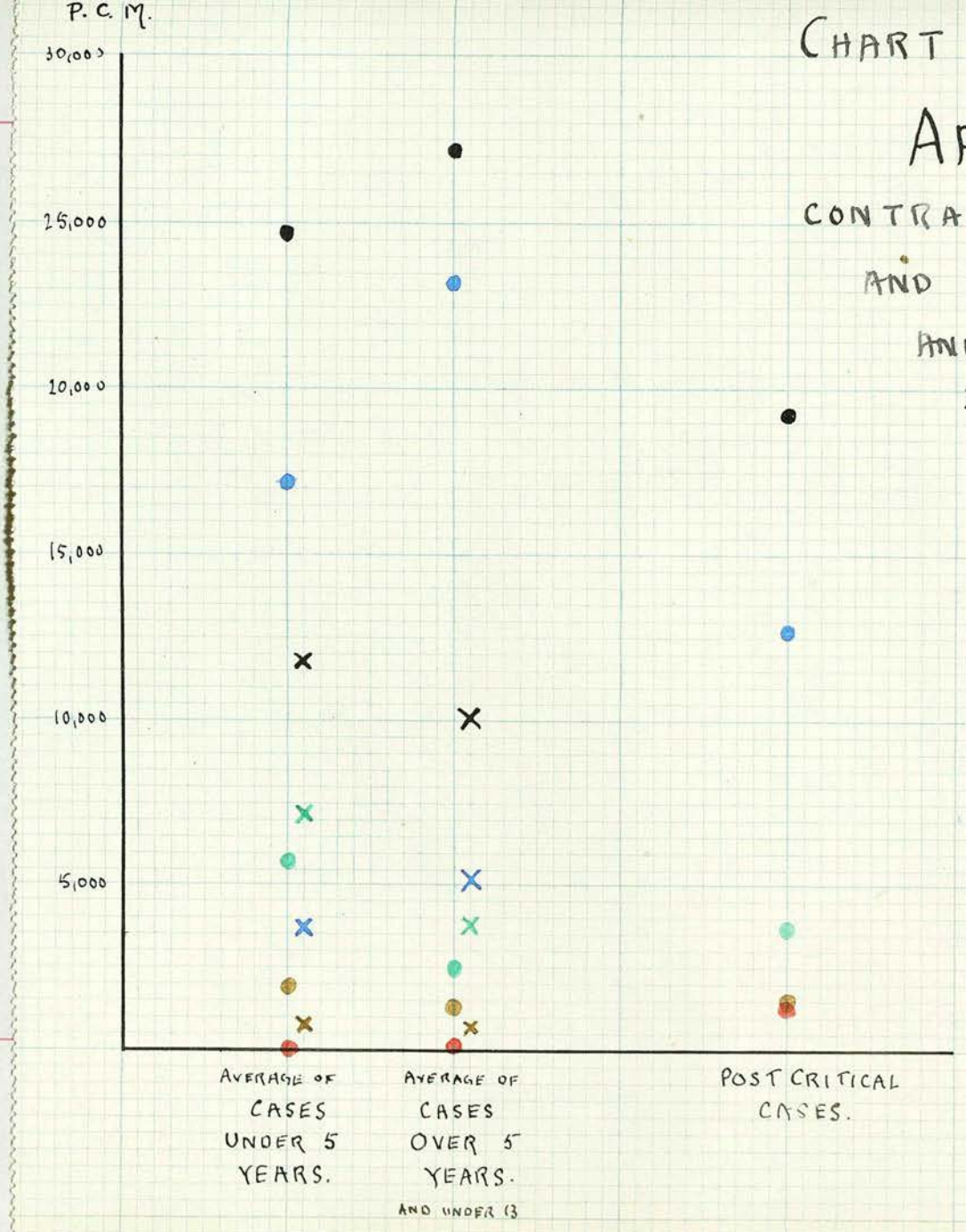
Total/

CHART OF AVERAGE COUNTS IN

APICAL PNEUMONIA

CONTRASTING CHILDREN UNDER AND OVER 5 YEARS OF AGE AND FALL AFTER CRISIS.

X INDICATES NORMAL COUNT AT SAME AGES.



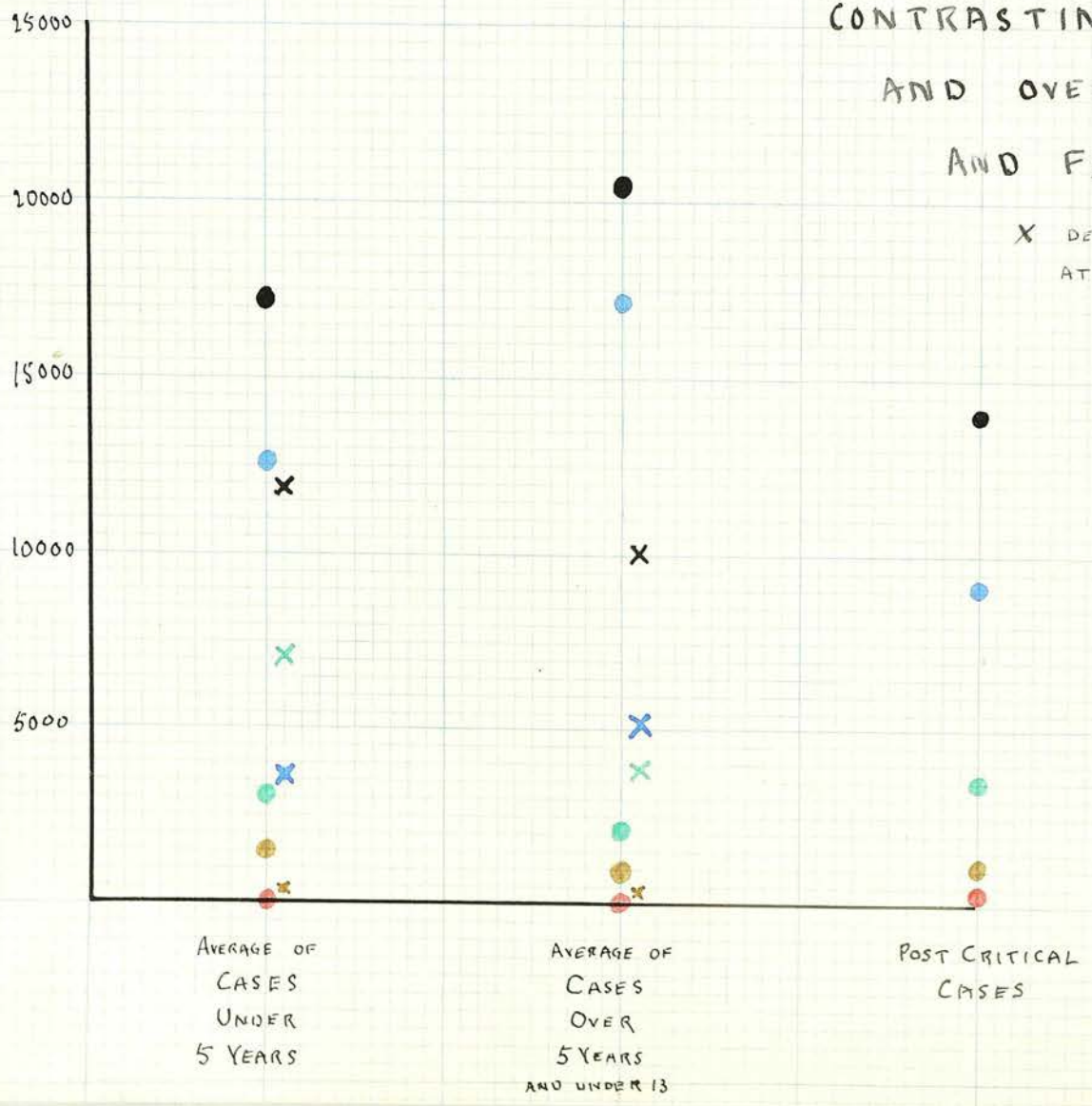
TOTAL LEUCOCYTOSIS
POLYMORPHS
LARGE LYMPHOCYTES
SMALL LYMPHOCYTES
EOSINOPHILS

CHART OF AVERAGE COUNTS IN

BASAL PNEUMONIA

CONTRASTING CHILDREN UNDER AND OVER 5 YEARS OF AGE AND FALL AFTER CRISIS.

X DENOTES NORMAL COUNT AT SAME AGES.



Total	13,900 p.c.m.
Polymorphs	9,040 p.c.m.
Large lymphocytes ..	1,110
Small lymphocytes ..	3,483
Eosinophils	280
Basophils	11

For the sake of more convenient comparison the foregoing figures have been plotted on charts, with the normal average figures for the same age also represented.

Cases of Apical Pneumonia, in addition to their peculiar clinical interest, such as the frequency with which they simulate other diseases, have been recognised for some time as usually having a higher leucocytosis. In children this fact is very well marked. Compare, for example, 24,680 in apical and 17,180 in basal pneumonia in children under five years, 27,200 and 20,480 in children over five years. Now this increase represents, in the case of apical pneumonias under five years, a doubling of the usual average normal count. But in children over five years of age it is increased by 2.7 times. Compare this with/

with basal pneumonia where the younger children have an increase of only 1.5 and the older of two . The counts taken after the crisis will also be seen at a higher figure in apical pneumonia.

That is to say, the average leucocytosis in apical pneumonia is consistently higher than in basal, and the total is as a rule higher after the age of five years.

With regard to differential counts, the greatest increase is in polymorphs in apical pneumonias under five years of age. The actual figure represents an increase of 4.8 times the normal. Whereas, although the children over five years have an average polymorph count 6,000 greater, yet the total is only 4.5 times their normal.

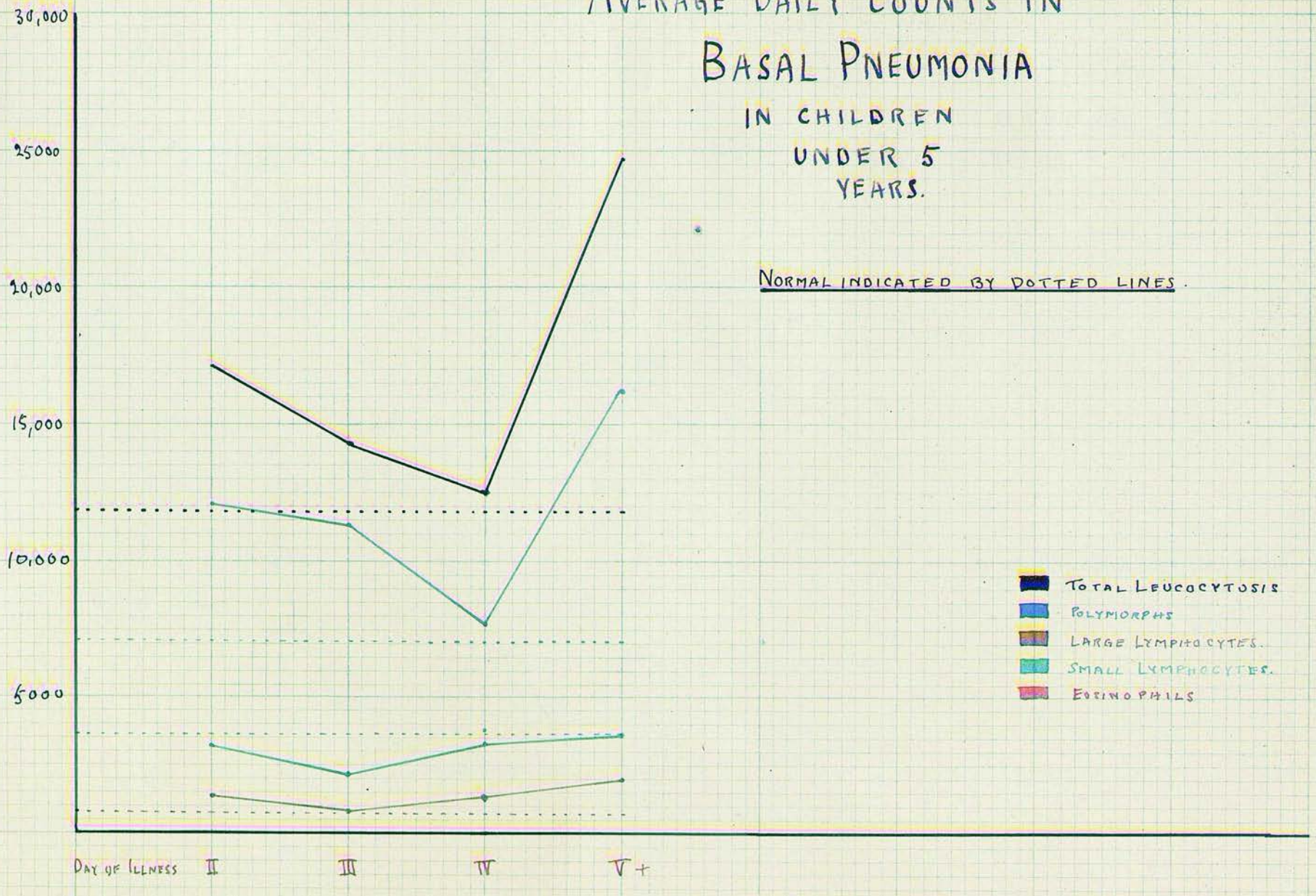
In basal pneumonia the polymorphs are increased under five years by 3.5 and over 5 by 3.4. This shows the same tendency as in Apical cases, namely, that the polymorphs are actually more numerous per c.m. in the older children but the relative increase is slightly greater in the younger. After the crisis there is a marked fall in the number of polymorphs.

Like the polymorphs, as pointed out by Gulland and Goodall, the large lymphocytes shew an increase in numbers. This is more marked in apical cases, where/

where under five years of age the increase is 2.3 times the usual number, and in children over five twice the normal. In basal pneumonia the younger children again have the greater increase, the figures showing an excess of 1.8 compared with 1.5 in those over five. After the crisis this increase rapidly disappears.

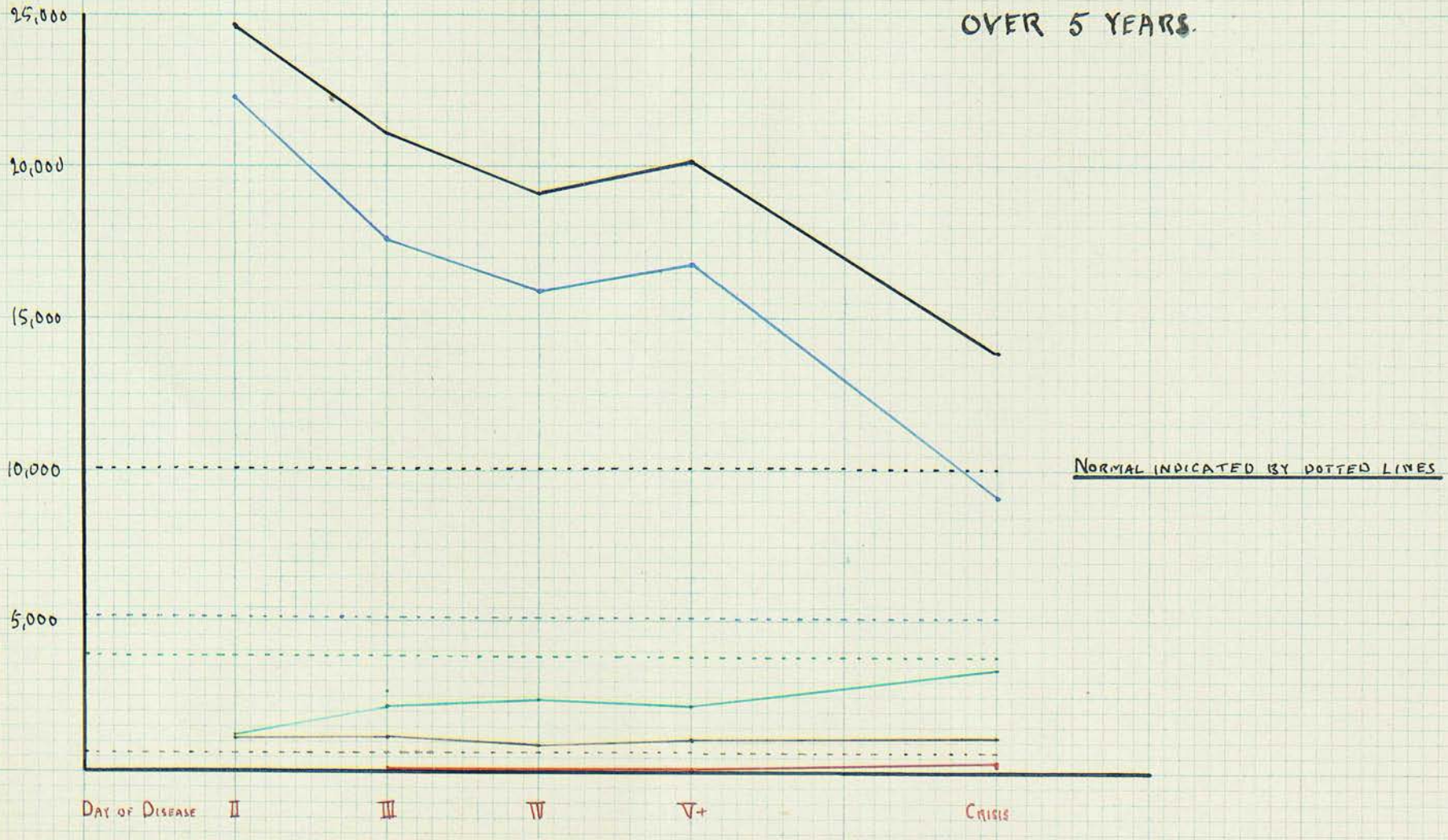
On the other hand small lymphocytes and eosinophils are invariably diminished; the eosinophils so much so, that in many cases they entirely disappear during the disease; but reappear rapidly after the crisis. The small lymphocytes are more diminished in basal cases, where they are only about half the normal, (.43 and .56) at the two age periods under consideration. In apical cases the diminution is less being .79 and .65. Here it will be seen, that the greater diminution, as in the case of the polymorph increase, occurs after the age of five years.

AVERAGE DAILY COUNTS IN BASAL PNEUMONIA IN CHILDREN UNDER 5 YEARS.



NORMAL INDICATED BY DOTTED LINES.

AVERAGE DAILY COUNTS IN BASAL PNEUMONIA IN CHILDREN OVER 5 YEARS.



NORMAL INDICATED BY DOTTED LINES

An attempt has been made to construct daily charts for the basal cases from the material available; but, from the point of view of shewing the expected continuous decline, this is very disappointing.

There is an inexplicable rise in all counts for the 5th day onwards before the crisis in both age periods. In the younger children, this exceeds all other daily counts to such an extent, that it must be fallacious. It may be that children coming in late in the disease had their leucocytosis artificially increased by the moving.

One therefore feels bound to discard the whole of the first chart as unreliable.

In children over five however there is a fairly constant diminution in total count from 24,600 on the 2nd day to 13,900 after the crisis. It will be seen that the polymorphs on the second day have an extraordinarily high figure which gradually falls, but more quickly than the total leucocytosis. The large lymphocytes are fairly constantly increased throughout. At the beginning the small lymphocytes are reduced to about $\frac{1}{3}$ of their normal number, and gradually rise till at the crisis they have almost reached normal.

With regard to the eosinophils, they follow the same rule as the small lymphocytes. On the second day they are entirely absent but gradually begin to return and in the end rise abruptly after the crisis.

FATAL CASES.

The writer's experience of fatal cases is fortunately limited to 3 or 6.5 %.

In these the counts were:-

	(1)	(2)	(3)
W.	13,000	12,200	8,600 p.c.m.
P.	8,190	7,015	6,131
L.L.	650	695	541
S.L.	4,160	4,477	1,917
Glycogen reaction	+	+++	++

This gives an average of:-

Whites.	11,266 p.c.m.
P.	7,112
L.L.	628
S.L.	3518

Compared with the average of two apical and one basal pneumonia at the same age.

W.	22,180 p.c.m.
P.	15,655
L.L.	1693
S.L.	4584

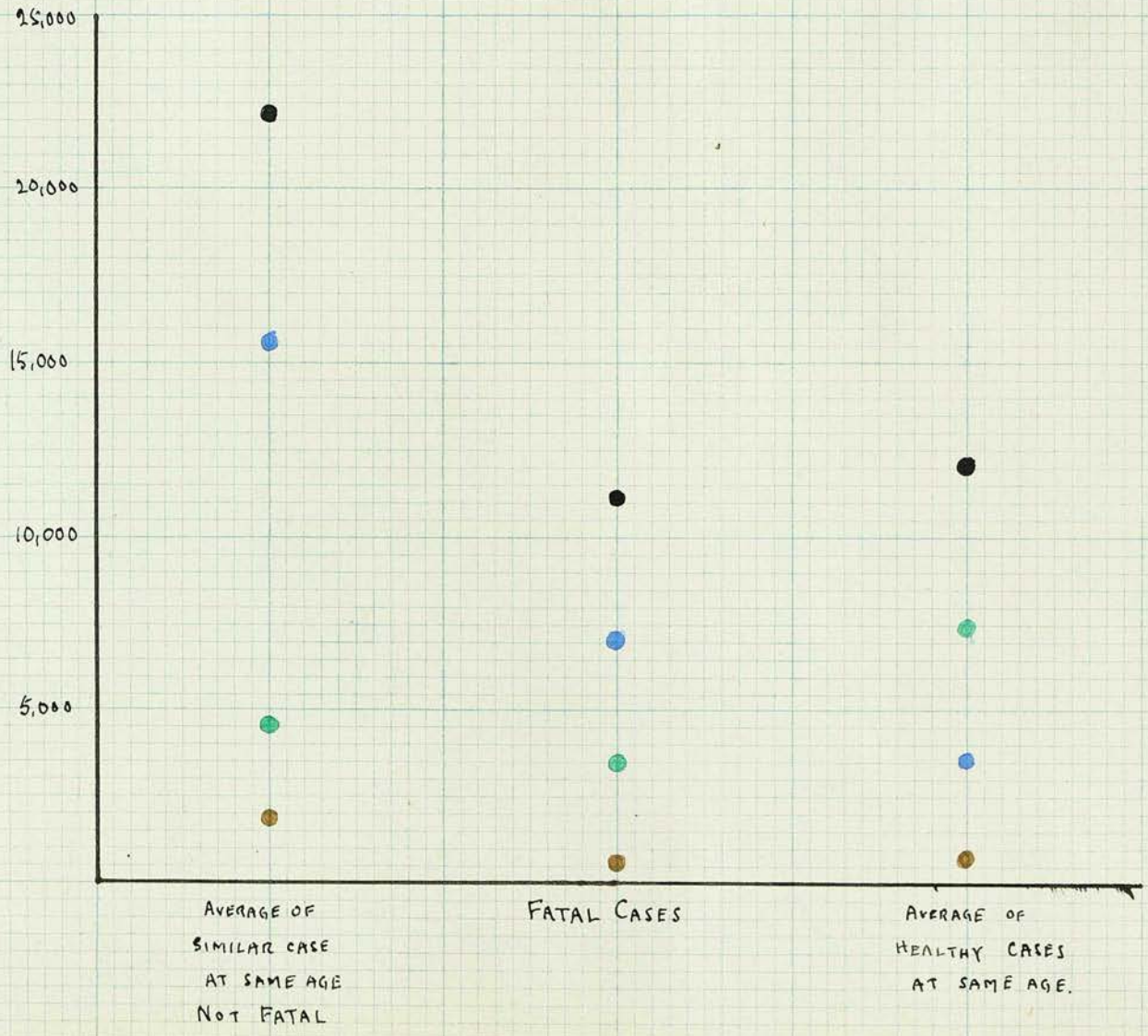
It will be seen that the total count is only about half , and is in fact smaller than for normal healthy children at that age. The polymorphs are only/

only about half as many as they should be, while the large lymphocytes shew no increase and the small lymphocytes are reduced.

These were cases where there was no resistance, and the children were overwhelmed with toxin. One had three lobes involved and pus at the base of the only healthy lobe. Another had an unresolved lung with pus at the other base, and a pyopericardium . In the third the lung was again unresolved, and the child developed a toxic enteritis and submaxillary adenitis in addition.

Chart comparing Fatal cases

with nornal and favourable cases at same age.



GLYCOGEN REACTION.

With regard to this reaction the writer finds very little difference between apical and basal pneumonias. It has a tendency to be more marked in older children.

It is however a very good guide to the severity of the disease and was found to be marked in the fatal cases.

As far as prognosis is concerned there is nothing to add to what Dr. Gulland used to teach; viz. a low leucocytosis with marked glycogen reaction means a bad prognosis. A high leucocytosis with a marked glycogen reaction, calls for a guarded prognosis. At the same time a high or low count with slight glycogen reaction indicates a good prognosis.

CONCLUSIONS.

In lobar pneumonia children under five years of age have a lower leucocytosis than those who are older. In cases of apical pneumonia the total leucocytosis is greater than in basal pneumonia, the increase being due to polymorphs. Also the increase in children over five years of age is due to an increase in the same form of cell. Large lymphocytes are always increased, but most markedly in children under five years of age. Small lymphocytes are very much diminished at the onset of the disease, but gradually return to normal about the crisis. Eosinophils disappear at the beginning of the disease and reappear about the crisis.

During the disease the total count in uncomplicated cases tends to fall; the diminution being chiefly seen in polymorphs.

In fatal cases the leucocytosis is small owing to a failure of the polymorphs and large lymphocytes to react.

Glycogen reaction is most marked in severe cases.