mg. daily; we shall try to keep this patient on this dosage continuously.

Fig. 6 shows a marked remission in a haematological respect. A change in the patient's polycythaemic appearance could also be clearly seen.

Comment

The short clinical histories and the diagrams show that a distinct remission occurred in at least five out of six polycythaemic patients in response to the oral administration of β -naphthyl-di-2-chloroethylamine for periods varying from a few weeks up to a few months. At first we were cautious with the dosage; 500–600 mg. might be given daily to start with for a few months, after which the dose should be reduced. An attempt was made to keep two patients stable on a small continuous dose (200 mg. daily), so far with good result.

We have also seen a fall in the leucocyte values during the treatment: in one case a fall to as low as 1,200 leucocytes per c.mm. occurred, but a spontaneous and rapid rise set in 12–14 days after the drug was discontinued.

It appears from this and what was earlier stated that the substance is a potential bone-marrow poison inherent in which is the risk of damage to the bone marrow, with aplastic anaemia or perhaps rather granulocytosis as a result. It is therefore necessary that these patients should be carefully and constantly followed with blood counts during treatment. As is known, polycythaemia is in itself a relatively benign disease and usually the patients have a fairly long expectation of life (cf. Dameshek (1950) and Videbæk (1950), amongst whose groups of patients there were several with a history of over 20 years), and therefore emphasis must be placed on caution during the treatment.

Summary

Six patients with long-continued polycythaemia were treated orally with β -naphthyl-di-2-chloroethylamine. The dosage was between 300 and 600 mg. daily. Treatments were given in series; in only two patients was it possible to give the drug continuously. In five out of the six cases a marked fall in the percentage of haemoglobin and red-cell counts occurred, and, parallel with this, a decrease in the redness and a subjective improvement. In one of the patients the remission has so far lasted for 15 months.

Attention is directed to the toxic effect of the substance on the bone marrow, which necessitates careful and constant control by blood examinations. Gastro-intestinal symptoms were not observed during our tests with the substance.

ADDENDUM

Follow-up, April, 1951

Case 1.—Hb, 106%; erythrocytes, 4,710,000; leucocytes, 8,000. The patient feels well. No erythrosis of the face. Has been without treatment for seven months.

Case 2.—Hb, 106%; erythrocytes, 4,590,000; leucocytes, 5,300. The patient feels well. No erythrosis of the face. Has been without treatment for 19 months.

Case 3.—Hb, 135%; erythrocytes, 5,620,000; leucocytes, 12,900. The patient feels well. Face less erythrotic. Is under permanent treatment with 300 mg. daily, and has been so for 14 months.

Case 4.—Hb, 113%; erythrocytes, 6,020,000; leucocytes, 10,900. The patient feels well. Face less erythrotic. Has

been without treatment for 20 months, but because of the enlarged spleen the treatment will be continued.

Case 5.—Hb, 107%; erythrocytes, 5,160,000; leucocytes, 4,400. The patient feels well. No erythrosis of the face. Has been without treatment for 10 months.

Case 6.—Hb, 126%; erythrocytes, 5,850,000; leucocytes, 5,700. The patient feels well. Has been without treatment for five months, but because of the rise of haemoglobin the treatment will be continued.

REFERENCES

- Bjurwill, B. (1947). *Nord. Med.*, **36**, 2059.
 Burchenal, J. H. (1948). *Radiology*, **50**, 494.
 Dameshek, W. (1950). *J. Amer. med. Ass.*, **142**, 790.
 Gilman, A., and Philips, F. S. (1946). *Science*, **103**, 409.
 Haddow, A., Kon, G. A. R., and Ross, W. C. J. (1948). *Nature, Lond.*, **162**, 824.
 Iversen, K. (1951). In press.
 Matthews, W. B. (1950). *Lancet*, **1**, 896.
 Rhoads, C. P. (1946). *J. Amer. med. Ass.*, **131**, 656.
 Videbæk, Aa. (1950). *Acta med. scand.*, **138**, 179.

OBSERVATIONS ON ALL BIRTHS (23,970) IN BIRMINGHAM, 1947*

IV. "PREMATURE BIRTH"

BY

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Our objects in this communication are, first, to present evidence on the mortality experience of a large series of births, and, secondly, against the background of this information to comment on the current conception of "prematurity." The use of weight as an index of maturity is so firmly rooted in contemporary practice that the strongest of reasons would be needed for changing it. We shall suggest reasons for reconsidering it, recognizing that on a matter of this kind the last word is not with the research worker but with the practising obstetrician and paediatrician.

It may be useful to recall briefly the circumstances in which the word "premature" was given a precise meaning. Ylppö (1920) suggested that births of infants less than 2,500 g. in weight should be considered not mature, in the sense that they had not remained long enough in the uterus. He justified the use of weight as an index of maturity on the grounds that it was as good as or better than any single alternative, and explained that the limit of 2,500 g, though quite arbitrary, was one below which most births were not fully developed. He recognized that the word "premature" was unsatisfactory, but thought that as it was well established in the literature it would be wise to retain it.

It should be noted that these views were not based on information about a large series of births; Ylppö himself reported on only 670 individuals. Nevertheless had his proposal been seriously in error it seems certain

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that subsequent experience would have exposed it. But the question to be considered is not only whether weight is a useful index of maturity but whether in all circumstances it is preferable to any alternative. A confident answer cannot be given without more data than have hitherto been available.

We have previously recorded observations on all single births in Birmingham during 1947, and have described sources of information on the three issues here examined in relation to premature birth: duration of gestation, birth weight, and the history of survival. It will suffice to state that birth weight was recorded for domiciliary as well as for hospital and nursing-home births, and that the duration of gestation was estimated from the date of birth and the date of the first day of

TABLE I.—Distribution of Births by Duration of Gestation. A Comparison of Birmingham Data with Data Published by Hosemann (1948)

Duration of Gestation (Week)	Birmingham, 1947		Data Published by Hosemann	
	No.	%	No.	%
29.30*	54	0.32	43	0.36
31.32	104	0.61	74	0.62
33.34	196	1.15	128	1.07
35.36	442	2.59	312	2.62
37.38	1,197	7.01	816	6.85
39.40	4,879	28.58	3,868	32.46
41.42	7,803	45.71	5,292	44.41
43.44	1,922	11.26	1,114	9.35
45.46	353	2.07	218	1.83
47.48	87	0.51	32	0.27
49.50	31	0.18	20	0.17
51.52	4	0.02	—	—
Total	17,072	100	11,917	100

$\chi^2 = 77.92$, $n = 11$, $p < 0.0001$
* Week 29 = 196–202 days.

the last menstrual period as given in antenatal documents. We have not used records in which an approximate date was given, nor have we accepted the mother's statement as recorded after the birth of the child. This does not of course eliminate all sources of error, but it ensures that the observation is as accurate as can be obtained from existing documents.

The requisite information was available for 17,072 births delivered after the end of the 28th week, whose distribution by duration of gestation is compared in

TABLE II.—Distribution of "Premature" and Not "Premature" Births by Duration of Gestation

Duration of Gestation (Week)	Births 5½ lb. (2.5 kg.) and Under			Births over 5½ lb. (2.5 kg.)		
	No.	%	Cumulative %	No.	%	Cumulative %
29	16	1.61	1.61	—	—	—
30	16	1.61	3.22	—	—	—
31	23	2.31	5.53	—	—	—
32	46	4.63	10.16	4	0.02	0.02
33	42	4.22	14.38	2	0.01	0.03
34	66	6.64	21.02	10	0.06	0.09
35	71	7.14	28.16	40	0.25	0.34
36	89	8.95	37.11	177	1.12	1.46
37	98	9.86	46.97	337	2.14	3.60
38	108	10.86	57.83	654	4.15	7.75
39	106	10.66	68.49	1,379	8.75	16.50
40	130	13.08	81.57	3,264	20.72	37.22
41	98	9.86	91.43	4,686	29.74	66.96
42	49	4.93	96.36	2,970	18.85	85.81
43	25	2.51	98.87	1,398	8.87	94.68
44	6	0.60	99.47	491	3.12	97.80
45	5	0.50	100	226	1.43	99.23
46	—	—	—	112	0.71	99.97
47	—	—	—	5	0.03	100
All births of known duration of gestation	994	100		15,755	100	

FIG. 1.—Distribution of "premature" and not "premature" births by duration of gestation.

Table I* with the largest series previously recorded in the literature (Hosemann, 1948). The comparison is made because doubts are sometimes expressed about the consistency of observations on the duration of gestation. For reasons elsewhere discussed (McKeown and Gibson, 1951) we excluded 323 births, and other tables are based on records of 16,749 deliveries.

Distribution of "Premature Births" by Duration of Gestation

Writers on "prematurity" have been well aware that not all births below the prescribed weight are born early, in the sense that the duration of gestation is shorter than could be regarded as compatible with full development. This view is consistent with data shown in Table II (see also Fig. 1), which gives the percentage

TABLE III.—Percentage of Births "Premature" at Different Durations of Gestation

Duration of Gestation (Week)	All Births	Births 5½ lb. (2.5 kg.) and Under	
	No.	No.	%
29	16	16	100.0
30	16	16	100.0
31	23	23	100.0
32	50	46	92.0
33	44	42	95.4
34	76	66	86.8
35	111	71	63.9
36	266	89	33.4
37	435	98	22.5
38	762	108	14.2
39	1,485	106	7.1
40	3,394	130	3.8
41	4,784	98	2.0
42	3,019	49	1.6
43	1,423	25	1.7
44	497	6	1.2
45	231	5	2.2
46	112	—	—
47	5	—	—
All births of known duration of gestation	16,749	994	5.9
All births of known weight	22,454	1,369	6.1

distribution of "premature births" by duration of gestation. More than half the births are born after 37 completed weeks, and about one-third after 39 completed weeks. The percentage of births "premature" at different weeks of gestation is given in Table III (see

*The low "p" of the χ^2 test is less useful as a comment on the distribution than as a reminder that it is important to distinguish clearly between the magnitude and the significance of the difference.

FIG. 2.—Percentage of "premature" births at different weeks of duration of gestation.

of birth weight and duration of gestation respectively to the proportion of stillbirths and neonatal deaths. (In Table IV, in which the duration of gestation is not considered, we have been able to use records of all births of

also Fig. 2), and as would be expected it decreases fairly rapidly as the duration of gestation increases. Nevertheless about 14% of births delivered in the 38th week are "premature."

Survival Related to Weight and Duration of Gestation

Tables IV and V show the relation

known weight—22,454.) The data require no detailed comment, but we may here note two points the significance of which is discussed more fully below: first, that mortality is so closely related to both weight and duration of gestation that there is little to choose between them as indices of the probability of survival; and, secondly, that births less than $5\frac{1}{2}$ lb. (2.5 kg.) have very different death rates according to their weight at birth.

The Conception of "Premature Birth"

If it is difficult to write clearly about "premature birth," as it undoubtedly is, the reason is partly that the conception itself is neither clear nor precise, and it may help to clarify what follows if we state at the outset the ideas which seem to lie behind it. It is well known that pathological examinations invariably attribute a considerable proportion of stillbirths and neonatal deaths to the fact that labour has occurred too early, with the result that the foetus is not mature enough to survive, and dies either during labour or shortly after delivery. In some cases there is an explanation for the premature onset of labour—for example, a multiple pregnancy or the presence of a congenital malformation—in respect of which the question of early birth is a secondary consideration. But in many cases no such explanation is forthcoming, and on the face of it death is preventable (a) if the pregnancy can be carried on to term, or (b) if the live-born child can be kept alive for a reasonable period after birth. It is the latter problem which challenges the clinician and research worker, not only because such infants may be expected to enjoy good health if they survive (so far as we can judge from present evidence), but also because we have at present no grounds for optimism about some of the other major causes of early death.

As clinical criteria of maturity are difficult to interpret uniformly, particularly when deliveries are conducted by persons other than doctors, it was clearly desirable to agree if possible on a simpler index of the state of development of the newborn infant. The most useful was undoubtedly birth weight. Of the two obvious alternatives, length is a more accurate index of maturity, but in the newborn this observation presents considerable technical difficulties; duration of gestation cannot be relied on in some cases and cannot be given at all in others (15% in our experience*). Weight, on the other hand, can be recorded easily and reliably, in hospital to the nearest ounce, and in domiciliary practice to the nearest quarter pound if portable spring balances are used with reasonable care. There is thus nothing to criticize in Ylppö's suggestion that, as a rough guide to the maturity of the foetus, birth weight is at least as useful as any single alternative. Certainly our own data do not conflict with this view.

Moreover, objections to the use of weight on other grounds are unlikely to prevail against thirty years' experience, unless they can be shown to suggest a different procedure which offers practical as well as theoretical advantages. Any alternative proposal, if it is to be considered seriously, must therefore take account of the two purposes served by the present convention: first, its administrative use as a yardstick for the

TABLE IV.—Percentage of Births Stillborn or Dead in the First Month of Life Related to Birth Weight

Birth Weight (lb.) (kg.)	Number of			(b) + (c) as Percentage of (a)
	Total Births (a)	Stillbirths (b)	Neonatal Deaths (c)	
1- 0.45-	4	2	2	100.0
1½ 0.68-	19	11	8	100.0
2- 0.91-	49	23	22	91.8
2½ 1.13-	60	30	20	83.3
3- 1.36-	68	25	18	63.2
3½ 1.59-	89	29	19	53.9
4- 1.81-	170	31	22	31.2
4½ 2.04-	223	28	14	18.8
5- 2.27-	580	42	37	13.6
5½ 2.49-	977	31	34	6.7
6- 2.72-	2,107	45	39	4.0
6½ 2.95-	3,080	38	35	2.4
7- 3.18-	4,358	64	39	2.4
7½ 3.40-	3,617	37	23	1.7
8- 3.63-	3,350	34	16	1.5
8½ 3.86-	1,668	14	9	1.4
9- 4.08-	1,127	15	7	2.0
9½ 4.31-	438	3	2	1.1
10- 4.54-	331	7	2	2.7
10½ 4.76-	82	—	—	2.4
11- 4.99-	39	2	1	7.7
11½ 5.22-	11	—	—	—
12+ 5.44+	7	1	—	—
Total ..	22,454	514	369	3.9

TABLE V.—Percentage of Births Stillborn or Dead in the First Month of Life Related to Duration of Gestation

Duration of Gestation (Week)	Number of			(b) + (c) as Percentage of (a)
	Total Births (a)	Stillbirths (b)	Neonatal Deaths (c)	
29	16	3	12	93.8
30	16	8	5	81.3
31	23	8	9	73.9
32	50	17	17	68.0
33	44	13	10	53.2
34	76	18	14	42.1
35	111	9	12	18.9
36	266	23	17	15.0
37	435	28	13	9.4
38	762	26	15	5.4
39	1,485	45	28	4.9
40	3,394	51	33	2.5
41	4,784	59	39	2.0
42	3,019	31	31	2.1
43	1,423	37	8	3.2
44	497	11	5	3.2
45	231	6	3	3.9
46	112	4	2	5.4
47	5	—	—	—
Total ..	16,749	397	273	4.0

*This figure is based on hospital births. Duration of gestation was unknown in a higher proportion of domiciliary births, but only because we were less successful in tracing the antenatal documents.

identification of infants exposed by their early birth to increased risk of stillbirth or infant death; and, secondly, its use in research. We shall consider each of them in turn.

1. "Premature Birth" as an Administrative Device

The data recorded in this communication suggest two observations on the standard procedure as an administrative device—one on the limit of 2,500 g. (5½ lb.), and the other on the invariable use of weight in preference to other criteria of maturity.

Table IV underlines what is of course well known—namely, that the 5½ lb. (2.5 kg.) limit groups together births which have very different prospects of survival (100% of births under 2 lb. (0.9 kg.) were stillborn or died before one month, as compared with 14% of births between 5 and 5½ lb.—2.3 and 2.5 kg.). In so far as the object is to focus attention on a large class (approximately 6% of all births) whose collective risk of stillbirth or neonatal death is about 30%, this may not matter; in so far as it is to identify births for which certain routine precautions are both necessary and practical, the procedure is clearly unsatisfactory. For example, in reports on "premature birth" (Ministry of Health, 1949) Crosse and Miller agree that it is not practical to admit to hospital all live-born children below the prescribed weight, and suggest respectively that babies which weigh more than 4 lb. (1.8 kg.) and 3½ lb. (1.6 kg.) can as a rule be cared for at home. In this case the limit of 5½ lb. (2.5 kg.) is too high to serve as an administrative yardstick without reference to other criteria. The point is of considerable practical importance, particularly in countries such as Great Britain, in which a high proportion of all deliveries are conducted at home.

The second point, and it is the more important, is that the use of weight as an index of maturity fixes attention on the vulnerable infant rather than on the pregnancy which gives rise to it. The fact that an estimate of the duration of gestation sometimes cannot be given with confidence has diverted attention from the very real use to which this important observation, for all its attendant difficulties, can be put. Data shown in Table V leave no doubt that, by using the antenatal record of the date of the first day of the last menstrual period and the date of birth, an estimate of the duration of gestation can be made which, whatever errors are involved, provides as sensitive an index of the risk of death as does the weight at birth. (That the observation cannot be recorded for all births need not discourage us from using it when it is available; moreover, the proportion of accurate records could undoubtedly be increased if the information were considered important.)

No doubt it would be agreed that when the risk of foetal death is high the mother should be admitted to hospital before the birth of the child, not only because the labour can be conducted under more favourable circumstances but also because the infant can be protected more effectively if born alive. The importance of the evidence in Table V is that it enables us, once labour has begun, to anticipate with some confidence the probability of stillbirth or neonatal death, and so can be used as the basis of administrative procedure. The procedure we suggest for consideration is as follows:

(1) That mothers in whom the onset of labour occurs more than four weeks before the expected date should be admitted to hospital.

(2) That live-born infants born at home should be admitted to hospital if they weigh less than 4 lb. (1.8 kg.) at birth.

We can illustrate the effect of these proposals on births in Birmingham during 1947.

Table VI gives the number of births delivered prior to each week of gestation, at home, in hospital, or in nursing-home. Two hundred mothers in whom labour began more than four weeks before the expected date were confined at home (just over 1% of the total of

TABLE VI.—Numbers of Births Delivered Prior to Each Week of Gestation

Weeks Before Expected Date	Duration of Gestation (Week)	Domiciliary	Hospital	Nursing-Home	Total
12	29	4 (0.02)	12	—	16
11	30	7 (0.04)	23	2	32
10	31	17 (0.10)	36	2	55
9	32	32 (0.19)	71	2	105
8	33	43 (0.26)	102	4	149
7	34	64 (0.38)	153	8	225
6	35	98 (0.58)	226	12	336
5	36	200 (1.19)	378	24	602
4	37	377 (2.25)	619	41	1,037
3	38	681 (4.06)	1,045	73	1,799
2	39	1,331 (7.95)	1,783	170	3,284
1	40	2,909 (17.37)	3,373	396	6,678
0	41	5,191 (31.00)	5,497	774	11,462
	42 and over	7,535 (44.99)	8,128	1,086	16,749

Figures in parentheses express births delivered at home as a percentage of all births (16,749).

16,749 births), which measures the additional burden on hospitals if the scheme were implemented.* When we recall, however, that roughly half of all deliveries were in hospital, and that the combined risk of stillbirth and neonatal death for all hospital births was only about 5%, it seems reasonable to suggest that these vulnerable births should have a high priority for institutional delivery. Approximately one in three of them was still-born or died in the first month, and (as shown in Table V) even in the week with the lowest death rate (the 36th) the percentage of deaths was 15%.

Table VII compares weight distributions of all domiciliary births and of domiciliary births delivered after the end of the 36th week. The implementation of the first proposal would have reduced the number of births

TABLE VII.—Weight Distributions of Domiciliary Births

Birth Weight lb. kg.	All Domiciliary Births		Domiciliary Births Delivered After the End of 36th Week	
	No.	%	No.	%
1- 0.45-	3	0.04	—	—
2- 0.91-	6	0.08	—	—
2½- 1.13-	11	0.15	4	0.05
3- 1.36-	13	0.17	1	0.01
3½- 1.59-	14	0.18	7	0.10
4- 1.81-	31	0.41	18	0.25
4½- 2.04-	46	0.61	24	0.33
5- 2.27-	148	1.96	114	1.55
5½- 2.49-	222	2.95	202	2.75
6- 2.72-	591	7.84	569	7.76
6½- 2.95-	849	11.27	828	11.29
7- 3.18-	1,489	19.76	1,478	20.15
7½- 3.40-	1,193	15.83	1,178	16.06
8+ 3.63+	2,919	38.74	2,912	39.70
Total	7,535	100	7,335	100

under 4 lb. (1.8 kg.) delivered at home from 47 to 12. Nine of the 12 were live-born, and would have been admitted to hospital as a result of the second proposal.

*The percentage of domiciliary deliveries is actually a little higher, since, as has been stated, the proportion in which the duration of gestation was unknown was greater than in the case of hospital births.

2. "Premature Birth" as a Subject for Research

The issues so far discussed are related to administrative procedure, and have their main application in countries where many deliveries occur at home. Of even wider significance is the identification of birth weight with maturity for the purposes of investigation, which has resulted in an extensive literature ostensibly devoted to the subject of "prematurity."

From the point of view of effective research any convention is unfortunate which obscures differences by dealing collectively with problems which are different in origin. No doubt at an earlier stage in our knowledge it was worth recording certain observations on all stillbirths, or on all congenital malformations; but the day is past when anything useful can be added by investigations which fail to distinguish the separate issues which these terms embrace. The same considerations apply, *mutatis mutandis*, to the subject of "premature birth."

As an administrative device the use of weight as an index of maturity has the advantages and disadvantages to which we have referred; as a means of identifying an entity suitable for inquiry it could hardly be less satisfactory. From the point of view of the investigator interested in the aetiology of stillbirths and infant deaths, it is hard to see that any useful purpose is served by a convention which brings together such completely different subjects as congenital malformations, multiple births, toxæmia of pregnancy, trauma, induction of labour, and early onset of labour of unexplained origin. For it is deceiving oneself to suppose that progress can be made in prevention of "premature birth" due to congenital malformations, except through prevention of congenital malformations. This possibility is not yet in sight, but it can be delayed only by a practice which groups malformations with other causes of death. Similarly the early onset of labour in multiple pregnancies is an observation of considerable biological interest which will not be advanced without separate study of multiple births. Moreover, the confusion of these problems has diverted attention from cases in which the early onset of labour is unexplained, and is hence still the matter of primary interest.

What has been explored in the literature as "premature birth" is the subject of low birth weight; it is hardly surprising that investigation has not been particularly fruitful. If the administrative proposals made above, or some modification of them, commend themselves to clinicians, the research worker need have no regrets if the present conception of "premature birth" were abandoned. He could then return to the study of late foetal development and its relation to the duration of gestation. On this important issue we have as yet very little worth-while evidence.

Summary

Birth weight, duration of gestation, and the history of survival are recorded for 16,749 single births in Birmingham during 1947. The data are used to give: (1) The distribution of "premature births" by duration of gestation. More than half were delivered later than the end of the 37th week and about one-third later than the end of the 39th week. (2) The proportion of births "premature" in different weeks of gestation. (3) The percentage of births stillborn or dead within one month of birth related (a) to birth weight, and (b) to duration of gestation. It is shown that mortality is so closely associated with both birth weight and duration of

gestation that there is little to choose between them as indices of the probability of survival.

The conception of "premature birth" is discussed in the light of these observations, which are used to suggest for consideration a possible modification of administrative procedure as follows. (1) Mothers in whom the onset of labour occurs more than four weeks before the expected date should be admitted to hospital. (2) Live-born infants born at home should be admitted to hospital if they weigh less than 4 lb. (1.8 kg.) at birth.

The effect of these proposals is exhibited on the Birmingham data. The first would have resulted in the admission of an additional 200 mothers (just over 1% of 16,749), whose confinements were in weeks in which the risk of stillbirth or foetal death is about one in three. It is suggested that these vulnerable births should have a high priority for institutional delivery, as nearly half of all deliveries in the city were in hospital, and the incidence of death (stillbirth or neonatal) in all hospital births was only one in twenty.

The operation of the first proposal would have reduced the number of births under 4 lb. (1.8 kg.) delivered at home by about three-quarters.

We are greatly indebted to Dr. Jean Mackintosh and her colleagues in the City of Birmingham Maternity and Child Welfare Department for the facilities which they have placed at our disposal.

REFERENCES

- Hosemann, H. A. (1948). *Arch. Gynäk.*, **176**, 109.
McKeown, T., and Gibson, J. R. (1951). *Brit. J. soc. Med.*, **5**, 98.
Ministry of Health (1949). Report for the year ended March 31, 1949. London.
Ylppö, A. (1920). *Z. Kinderheilk.*, **24**, 1.

THE NATURAL HISTORY OF VENOUS THROMBOSIS

BY

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[WITH SPECIAL PLATE]

In 1856 Virchow described the mechanical effects of embolism; in 1889 Cohnheim showed that injury to vascular endothelium was favourable, if not essential, to thrombosis; and in 1909 Aschoff discussed the possible influence of eddies in the blood stream. Belt, in 1934, ruled out inflammation as a frequent cause of thrombosis and put pulmonary embolus into its correct category as a medical rather than a surgical complication. These are the milestones of a century in which the accumulated knowledge on the subject might be summarized as: if the venous endothelium is damaged then thrombosis and embolism may occur. It is a philosophical aphorism that when a problem is accurately stated the solution is near to hand. The purpose of this paper is to analyse the natural history of thrombosis so far as is possible by the histological method—a most neglected field—and so to endeavour to close, if only in a minute degree, the vast chasm between our knowledge and our control of a complication which so often kills those who might otherwise recover.

When a student I was taught that thrombosis and embolism were usually surgical complications, but very little observation was required to show that this conception was false and that they were in most cases associated with medical conditions such as congestive heart failure.