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The Problems of Foetal Post-maturity and Prolongation of Pregnancy.

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Post-maturity and Prematurity.

SOME twenty years ago one of the present writers (Ballantyne)¹ contributed to this JOURNAL an article entitled "The Problem of the Post-mature Infant." He had previously dealt elsewhere² with "The Problem of the Premature Infant"; and he endeavoured to show how different the two problems were. The post-mature infant, on account of its prolonged sojourn in the uterus, has in most cases grown so large and has become so ossified in head and shoulders as to make birth alive and uninjured a difficult matter; the problem is to compass safe delivery, and the solution is to induce labour at term and so prevent post-maturity, or, failing this, to perform Cæsarean section when there is reason to believe that the foetal head and shoulders cannot traverse the mother's pelvis without serious damage. The premature infant, on the other hand, is commonly born alive, its small size and ossification making delivery easy; its organs and tissues, however, are not anatomically and physiologically capable of meeting the stress of the post-natal environment, and it is apt to perish soon after birth; the problem in its case is to maintain life in exacting surroundings, and the solution again is to carry on ante-natal life for a few weeks longer, or, failing this, to imitate so far as possible intra-uterine conditions outside the mother's body by providing couveuse accommodation,

by modifying the method of feeding, and by supplying to the "fœtus trying to be an infant" the chemical substances which ought to have been passed over to it in the last weeks of ante-natal life.

The present writers are not concerned here and now with the problem of the premature infant; but before passing from the subject they would point out how great a problem it still remains. Feldman,³ in his *Principles of Ante-natal and Post-natal Child Physiology*, devotes a chapter to the physiology of the premature infant, and has no difficulty in demonstrating the intricacy of the metabolism going on in such a child. Recent investigations have increased rather than lessened the task of the physician who attempts to keep a prematurely born infant alive. There is a lack of unanimity among the plans suggested for rearing such fœtal organisms in ordinary neonatal surroundings. For instance, no decision has been reached regarding the kind of incubator to be recommended; it is not certain whether it is better to place the premature infant in a couveuse in a room or to put it in a room which is itself a couveuse. Little has been done towards solving the difficulty of supplying to the premature infant the chemicals which it would have received *via* the placenta from its mother in the last eight weeks of her pregnancy if it had not been untimely cut off from its ante-natal environment. The problem is no mere academic perplexity; upon its solution depends the reputation of the specifically British operation known as the induction of premature labour; if the babies cannot be kept in life after their birth the induction plan must give way to the Cæsarean section method. As it is, the range of applicability of the induction of premature labour must apparently be narrowed down to dates at or after the thirty-sixth week of gestation. One of the present writers (Browne) has shown,⁴ from the analysis of the results of some two hundred post-mortem examinations of still-births, that the tissues of fœtuses of seven, seven and a half, and eight months are too fragile to pass uninjured through the birth canals, especially if forceps be used to expedite delivery. His conclusion may be repeated here:— "The liability to cerebral hæmorrhage in premature infants is about sixteen times that in infants at term; it is greater from 7 to 7½ months; it becomes less at 8 months, while at 8½ months the liability appears to be no greater than at term."

Acting upon these results, the writers have recently advised and practised the induction of premature labour only when the circumstances of the case allowed it to be postponed till the 35th or 36th week, and they have been gratified by the better results obtained thereby. It has to be remembered that syphilis makes the fœtal tissues still more friable, and when this disease is suspected in the

unborn infant the 35th week will be too early for safe induction. The immediate result of the narrowing of inductions down to dates later than the 35th week has been to increase the frequency of Cæsarean section; this is not by any means the attainment of an ideal, but it must commend itself as the best competitive procedure until more satisfactory methods of preserving premature babies during their transit through the birth canals and after have been devised.

Fœtal Post-maturity.

In his discussion of the problem of the post-mature infant Ballantyne pointed out the great difficulty of framing a satisfactory definition of post-maturity. Nutritional processes may apparently be accelerated *in utero* and thus a baby weighing more than the average number of pounds may be born at the usual time; size and weight are not certain criteria of post-maturity. Ossification and development similarly may be further advanced than is common without the infant being necessarily post-mature. The date of delivery after the last menstrual period or even after the last inseminational opportunity is not a safe guide, for there is uncertainty as to which ovum has been impregnated (the pre- or post-menstrual one). Yet again, residence in the uterus over the usual time is not sufficient to calculate from; the infant must remain alive. The writer, therefore, was forced to endeavour to find other signs of post-maturity in the structure of the tissues of the fœtus and the placenta and cord and to incorporate them in the definition. The result was the grouping together of a number of criteria and the formation of a compound definition. He regarded the infant as post-mature who was born after a pregnancy which could be reasonably believed to have lasted for ten calendar months or longer, who had a weight and size greater than what was normal for the mature infant, who had been alive *in utero* for some days at least after the full time of gestation had been passed, and whose organs and tissues and placenta exhibited some at least of the characters of post-maturity. It is hardly necessary to point out that such a definition is incomplete and unsatisfactory. Is it possible now, after some twenty years, to form a better one? Is there any certain sign of post-maturity now known? Is there any group of signs and circumstances which is pathognomonic?

Anatomical Criteria of Post-maturity.

In Ballantyne's paper, already referred to, *anatomical criteria of post-maturity* were looked for in

- (a) Weight and size.
- (b) Skin and its appendages.
- (c) Ossification.

- (d) Placenta, cord, membranes, liquor amnii, etc.
- (e) Relations and characters of internal organs, etc.
 - (i) Cervical structures.
 - (ii) Liver.
 - (iii) Intestines.
 - (iv) Heart and vessels.
 - (v) Brain.

It will be noted that all these criteria save those under (e) may be inquired into during the life of the infant who is believed or suspected to have been post-maturely born : the weight and size of the child and the state of the skin and its glands can be easily determined, the use of X-rays will reveal the degree of ossification, and the placenta, cord, etc., can be submitted to microscopical examination. To discover accurately the relation of the internal organs and their structure a post-mortem examination will be necessary. It follows, therefore, that there are anatomical criteria which can be elicited *intra vitam* and others only discoverable after death. The question at once arises whether any one of these criteria is reliable as a guide to the determination of post-maturity, and, if so, whether it is one which can be recognized during the life of the infant or which requires a necropsy. It will be well, with this object in view to scrutinise the various characters and see whether in the light of the added knowledge of the past twenty years more or less reliance is to be placed upon any or all of them.

Fœtal Weight.

One expects that the infant post-maturely born will have a weight, a length, and head measurements above the average, and this is generally found to be the case ; but it is not invariably so, and none of these characters can by itself or even in combination be used as a certain indication of prolonged life in the uterus. Babies of nine, ten, and even of eleven pounds (4 to 5 kilograms) occur in cases in which no suspicion of post-maturity exists, for other factors enter in, such a great bulk and breadth (rather than height of the father, and account for the increased foetal size and weight. One of the writers, some years ago, had to perform Cæsarean section on a woman with no pelvic contraction in order to bring a living child into the world ; on two previous occasions her baby had perished in the birth by reason of its great bulk (in one labour it was said to have weighed fourteen pounds) ; there was no indication in the clinical history that the full time had been exceeded in any of the pregnancies, but the father was a professional wrestler of extraordinary weight and breadth of shoulders. There is good reason to suppose that paternal heredity is one of the factors determining the weight of the infant at birth ; but there are others

of which little is definitely known, and they produce variations which ought to be allowed for, and yet cannot be. If they were known their influence in increasing or in lessening the birth weight could to a certain extent be taken into account, and the weight could still be used as a means of estimating the length of time spent alive in the uterus; but in the present state of knowledge of antenatal physiology they are non-cognoscible. Weight may not, therefore, be safely used as a solitary criterion of the length of antenatal life; at the same time, the common sense of the matter must not be neglected, and the absence of any marked increase in the birth weight over the normal must be taken as a strong argument against the existence of post-maturity in the particular case under observation.

Instances of weight variation in Browne's series of over 500 post-mortems upon still-births and early neonatal deaths were numerous and striking. In five cases of large fœtus there was no clinical evidence of post-maturity. In No. 231, for instance, the mother had previously given birth to an eleven pounds (4,990 grams) living baby; in her second labour the head of the child was delivered by forceps, but before the shoulders could be extracted cleidotomy had to be done; the weight was 5,250 grams, and the sex female. In No. 132, a fourth child, the weight was 4,120 grams, the sex was male, and yet there was nothing in the history to suggest post-maturity. In both these cases the mother was not young; she was 38 in No. 231 and 37 in No. 132. Again, in No. 138, the mother, a large phlegmatic woman, had given birth (with the help in four of forceps) to five infants, all large, and the fourth and fifth weighing 12 lbs. each; in the sixth pregnancy, the woman being now 38 years of age, the child, a male, weighed 5,329 grams at birth, and was still-born; in this case also there was no clinical suggestion of post-maturity. In No. 114, again, the mother was likewise a large phlegmatic woman of 41 years of age; she had had eight previous labours, all normal; in her ninth, the child, a male, was delivered with great difficulty by forceps, and was still-born; the weight was 6,160 grams; in this instance the father was 6 ft. 1½ in. in height, but was not very broad. In No. 214, a woman, 26 years of age, had as her second child a male still-born, who was delivered with great difficulty with forceps; the weight was 4,800 grams; the first labour had been easy. In all these five cases the labour was like that associated with post-maturity, and the weight was high, and yet, according to the menstrual history there was no evidence that pregnancy had been unduly prolonged.

On the other hand, in No. 491, there was a history of post-maturity, and yet the fœtus only weighed 3,670 grams. This case is so important that the full details are given.

Mrs. X, a primipara, aged 36 years, had been ten years married before becoming pregnant. There was no family history of post-maturity. She had always been healthy and had had menstrual periods of the 30 day type. The last day of her last menstruation was January 30th, 1921, and she had quickening on June 16th. On 22nd June her doctor felt foetal movements. Pregnancy pursued a normal course till 30th November, when the foetal movements ceased entirely. It is a matter of interest that on the morning of the 29th October (near to the expected date of delivery) she was awakened by pains which she regarded as labour pains; but they passed off in two hours. As there were no signs of labour on the 3rd December her doctor gave her quinine tablets for two days; but as labour still did not begin, chloroform was administered, the os was manually dilated, and the child, which was dead, was delivered with great difficulty with forceps, and sent to Dr. Browne for examination.

The foetus, a male, was macerated, and seemed as if it had been dead for about five days. Its weight was 3,670 grams, and its length 56 cms. It was also malformed, the right hand having a supernumerary thumb and the anus being absent; in this respect the case fell into line with many other instances in which post-maturity has been associated with foetal deformity. There was no evidence of syphilis, and the organs were spirochæte-negative. In consequence of the absence of the anus the colon and rectum were enormously distended, the former, at the brim of the pelvis, being 15 cms. in circumference, and also much increased in length. The rectum and pelvic colon were firmly adherent to the bladder, and they could not be separated below the pelvic brim. The distended colon had so blocked the internal abdominal rings that the testes were unable to descend into the scrotum. It was impossible, on account of the maceration, to determine the degree of adhesion of the dura mater to the skull. The placenta weighed 390 grams; to the naked eye it appeared normal, and showed a fair degree of vascularity. The microscopical characters are described under "Placenta, Cord, Membranes, etc., on p. 192.

The ossification was not greater than is frequently found in the mature foetus; the centre in the lower end of the femur measured 6×5 mms., that in the os calcis 11×7 mms., that in the talus 6×4 mms., and that in the cuboid 4×4 mms. There was one centre in the manubrium sterni, and four (two large and two small) in the body of the bone (see Plate I, No. 491).

The duration of the pregnancy in this case, as determined by the menstrual dates was 308 days, and yet the weight was not excessive. It has, of course, to be remembered that the foetus had been dead for some five days before birth, but these days would not account for

the comparatively small weight. Possibly the intestinal malformation might explain it to some degree. It has to be noted that the length was rather great, viz., 56 cms.

The general conclusion as to the small value of weight already reached is therefore maintained by the examination of this long series of necropsies on still-born infants: the presence of excessive weight is not a proof of post-maturity, for it may be due to other things than long duration of residence alive in the uterus, but its absence is *prima facie* evidence against the occurrence of prolonged pregnancy unless that prolongation is supported by many other signs and by a clinical history of value.

Foetal Length.

It will be unnecessary to examine the question of *excessive length* with so much detail, for the general conclusion is the same. It may be noted here that L. M. Bossi⁵ regards the weight of the foetus as of no importance in the diagnosis of post-maturity; he places great reliance on its length taken in association with the development of the bones and the hardness of the skull. In No. 231, in which the weight was 5,250 grams, the length was 58.5 cms.; in No. 132, in which the weight was 4,120 grams, the length was again 58.5 cms.; in No. 138, with a weight of 5,320 grams, the length was once more 58.5 cms.; in No. 114, with a weight of 6,160 grams, the length was only 56 cms.; and in No. 214, with a weight of 4,800 grams, the length was the highest of the group, viz. 60 cms. In all these foetuses there was no suggestion from the clinical standpoint of post-maturity, and yet in every one the length was above the average, the smallest measurement being 56 cms., and the largest 60 cms. Further, the length did not advance *pari passu* with the weight: as between Nos. 132 and 138 there was a difference of 1,200 grams in weight, and yet the length was the same, viz., 58.5 cms. It has to be noted, however, that in the case (No. 491) of clinical prolongation of pregnancy, the foetal length was above the average, being 56 cms., although, as has been noted, the weight gave no suggestion of post-maturity. Reference may here be made to another instance of marked foetal length, No. 241, in which there was a clinical presumption in favour of post-maturity. The mother, a primigravida, was 23 years of age; she last menstruated on January 11, and her confinement took place on November 12, so that from the last day of the last period to delivery was 306 days; the child presented by the breech, and was dead-born, having been asphyxiated during expulsion; it was a male, weighed 5,000 grams, and had a length of 60 cms. The dura mater was adherent to the inner table of the skull. The head measurements and the ossification (*vide infra*) were rather above the normal

on the whole. In this case, therefore, there was some support for the statement that great length and weight accompany post-maturity; but the matter will be returned to under the heading of ossification (*vide infra*).

Head and body measurements are probably of comparatively little value as independent indications of post-maturity. In the two possible cases of prolongation of pregnancy referred to above, viz., Nos. 491 and 241, the cranial measurements were of no importance in the former, because of maceration, and in the latter they were suggestively large, but not decisively so. For comparison they may be put alongside of the measurements in No. 138 (a large child, but without any clinical indications of post-maturity).

	241 (probably post-mature)	138 (not post- mature)
Occipito-frontal diameter of head ...	13.5 cms.	10 cms.
Sub-mento-bregmatic do. ...	12.5 "	10.5 "
Bi-temporal do. ...	10 "	9 "
Occipito-frontal circumference of head	40 "	37.5 "
Bis-acromial diameter of shoulders ...	15.5 "	17 "
Chest circumference at nipple line ...	35.5 "	39 "

The excess of the body measurements in 138 over those in 241 was due to the large amount of subcutaneous fat in the former.

Ballantyne, in his paper of twenty years ago, was of opinion that anatomical indications of post-maturity were visible in *the skin and its glands*; and he referred specially to absence of lanugo and vernix caseosa, to length of the nails and abundance of scalp hair, to the presence of desquamation, to the thickness of the subcutaneous fat, and to the absence of the red colour of the skin which is characteristic of prematurity. These characters possess some diagnostic importance, but show a large degree of variability.

Ossification as an Index of Fœtal Age.

Considerable emphasis has been laid upon the value of ossification as an index of the age of the fœtus and the infant, and Ballantyne looked hopefully to it as a means of recognizing post-maturity in the child at birth, although he had to admit that in one or two of his specimens the ossification exhibited a disconcerting mixture of excess and defect. It will consequently be of great importance to endeavour to determine as far as possible its value. The use of the X-rays enables the discovery of the degree of ossification to be made in the living child, and extends the employment of this test of age. A question, however, at once arises as to the reliability of ossification as a means of recognizing not only post-maturity but also maturity and prematurity. This question demands an immediate answer before further progress in this

direction can be made. The matter, therefore, calls for careful scrutiny.

Making use of the material available in the 500 still-born foetuses and young infants who died soon after birth, examined by Browne, the writers are able to come to some conclusions. It will be remembered that ossific centres are usually described in works on anatomy as appearing in the following bones at the following dates : in the lower end of the femur at the latter end of the ninth month of foetal life; in the upper end of the tibia at birth; in the calcaneus about the sixth month of foetal life; in the talus in the later weeks of gestation; and in the cuboid either shortly before or shortly after birth. With regard to the sternum, it is confessed that there is some irregularity; but it is generally agreed that the centre for the manubrium appears at the sixth month, is sometimes represented by two centres vertically placed, and is well developed at birth; and that the four pieces of the body of the bone show one or two centres in each, of which that for the top piece can be seen at the sixth month, that for the lowest at term, and those for the second and third segments between these dates. The conclusions reached by the present writers differ considerably from the above statements, and reveal a marked degree of variability in ossification at and about the time of birth.

The ossification will be looked at in the following order :— First, the number and size of the ossific centres in four presumably post-mature foetuses will be given; second, the ossification will be described in mature foetuses under the three headings of (*a*) typical, (*b*) excessive, and (*c*) defective; third, it will be described in premature foetuses under the same headings, (*a*) typical, (*b*) excessive, and (*c*) defective. In each case the centres referred to will be (i) that in the lower end of the femur, (ii) that in the upper end of the tibia, (iii) that in the calcaneus, (iv) that in the talus, (v) that in the cuboid, and (vi) those in the sternum.

First in order, therefore, come the four presumably post-mature infants. It may be noted, in passing, that whilst these were the only foetuses in Browne's series of over 500 post-mortems* in which post-maturity on the clinical data was reasonably probable, there were other instances in which these data were not available, and in which therefore post-maturity was a possibility. The fact that four cases were met with in over 500 dead foetuses and young infants does not, of course, imply the occurrence of a little less than one per cent. of cases of post-maturity in obstetric hospital practice, for there may have been other cases among the infants (several thousands) who survived their birth. The numbers, in fact, are of little value for statistical purposes.

* This list includes the 200 published (4), and 300 not yet published.

The history of two of the presumably post-mature infants (viz. Nos. 491 and 241) has already been given (*vide supra*, pp. 182, 183). No. 119 was an instance in which the exact menstrual dates were not procurable. The mother was a primigravida, and forceps had been applied several times without accomplishing the birth of the infant. She was then brought into the hospital (Edinburgh Royal Maternity), where the foetal head was found still lying above the pelvic brim. Cæsarean section was performed, and the child was delivered alive, and lived for several hours, succumbing, however, from cerebral hæmorrhage. The mother also died. The child, a female, weighed 3,800 grams, and measured 55 cms. in length. When the skull was opened it was noticed, in addition to the cerebral hæmorrhage (the cause of death), that the dura mater on the right side in great measure separated from the inner table of the cranial bones and remained *in situ over* the brain. This peculiarity is practically never met with in premature or mature foetuses, and is believed by the writers to point to post-maturity. The liver weighed 160 grams (1/23 of the body weight). The bones of the skull were very thick and hard, and the anterior fontanelle was almost closed. The ossific centres in the various bones will be given in the table (*vide infra*); they were large, and those in the sternum were fused (a quite exceptional occurrence in infants at birth). The anterior fontanelle was so small as to be almost closed. The fourth presumably post-mature infant was No. 388. The pregnancy lasted from 17th September to 7th July, or 293 days (calculating from the menstrual date). The mother suffered from eclampsia. The infant, a male, weighed 3,762 grams, and had a length of 56.5 cms. The ossification was well advanced, the sternum showing one centre in the manubrium and seven in the body.

The ossification in these four foetuses is given in the following table:—

Nos.	491.	241.	119.	388.
Femur,				
lower end	6 × 5 mms.	7 × 5 mms.	7 × 5 mms.	7 × 5 mms.
Tibia, head of	?	5 × 5 mms.	5 × 5 mms.	4 × 3 mms.
Calcaneus	11 × 7 mms.	10 × 8 mms.	15 × 8 mms.	13 × 10 mms.
Talus	6 × 4 mms.	6 × 5 mms.	10 × 6 mms.	8 × 5 mms.
Cuboid	4 × 4 mms.	none	?	?
Sternum,				
manubrium	1 centre	1 centre	1 centre	1 centre.
body	4 centres	7 centres	2 centres (fused)	7 centres.
Probable age in days	308	306	300 (?)	293

In order to appreciate the value of these signs of ossification it is necessary to look at the conditions which may be found in mature and premature fœtuses.

A great deal of importance has been attached to the presence and size of the *ossific centre in the lower end of the femur* in connexion more especially with medico-legal investigations involving the question of maturity. For instance, it is held by Glaister (*Medical Jurisprudence*, 3rd Edit., 1915, p. 477) that "the best evidence of maturity is the presence of an ossific centre of 5 mm. in diameter in the lower femoral epiphysis, and of another in the cuboid bone of the tarsus."

Browne took 100 fœtuses (believed to be mature) and measured the femoral epiphyseal centres. He found that in no less than 17 the ossific nucleus was absent, and that in the other cases it varied in size within wide limits, as may be seen from the following table :

OSSIFIC CENTRES IN LOWER END OF FEMUR AT FULL TERM IN 100 CASES.

Absent	...	...	...	...	in 17 ^o / ₁₀₀
1 × 1 mm.	...	...	...	...	1 ^o / ₁₀₀
2 × 2 "	...	...	...	...	11 ^o / ₁₀₀
3 × 2 "	...	...	...	...	7 ^o / ₁₀₀
3 × 3 "	...	...	...	...	13 ^o / ₁₀₀
4 × 3 "	...	...	...	...	12 ^o / ₁₀₀
4 × 4 "	...	...	...	...	6 ^o / ₁₀₀
5 × 3 "	...	...	...	...	3 ^o / ₁₀₀
5 × 4 "	...	...	...	...	14 ^o / ₁₀₀
6 × 4 "	...	...	...	...	4 ^o / ₁₀₀
6 × 5 "	...	...	...	...	5 ^o / ₁₀₀
7 × 4 "	...	...	...	...	1 ^o / ₁₀₀
7 × 5 "	...	...	...	...	5 ^o / ₁₀₀
8 × 6 "	...	...	...	...	1 ^o / ₁₀₀

100^o/₁₀₀

Looking next at the premature fœtuses in his series of 500 post-mortems, Browne found no fewer than 17 had an ossific nucleus in the lower end of the femur. The largest one found measured 3 × 5 mms.; this was in a fœtus which weighed 1,790 grams, and had a length of 41 cms.; the duration of pregnancy, counting from the last day of the last period, was 246 days. In another case in which the duration was 221 days, the fœtus weighed 1,720 grams, the length was 43 cms., and the ossific nucleus was 2 × 2 cms. In the four post-mature fœtuses it will be noted that the centre measured 7 × 5 mms. in three cases and 6 × 5 mms. in one. It is

evident, therefore, that the presence of an ossific nucleus in the lower end of the femur does not necessarily indicate maturity (for it was absent in 17%); neither does its absence necessarily mean prematurity, for it was found in 17 foetuses in which prematurity was established by other clinical and anatomical data. It is to be noted that whilst a measurement of 7×5 mms. was met with in three out of the four post-mature foetuses, there was actually one mature foetus which had a larger measurement (viz., 8×6 mms.), and there were five which were of the same size (7×5 mms.). Excessive size of this nucleus, therefore, is not a certain criterion of post-maturity. At the same time, its value when associated with other indications is considerable.

It may, however, be asked whether this degree of variability in the ossification of the lower end of the femur is not an exceptional thing. In the following tables the ossification of several other bones is given, and it will be seen that it is almost, if not quite, as irregular. In the first table are placed details of foetuses whose clinical history indicated maturity, and in the second details of premature foetuses. In both tables the cases are arranged according to length. The measurements are in grams and centimetres for weight and length, and in millimetres for the ossific nuclei; and the figures in the last column indicate the number of centres in the sternum, in the manubrium and the body respectively.

MATURE FŒTUSES.

No.	Sex	Length	Weight	Lower end Femur	Upper end Tibia	Calcaneus	Talus	Cuboid	Sternum
214	M	60·0	4800	3 x 2	0	7 x 6	6 x 5	0	1 and 5
138	M	58·5	5320	5 x 4	2 x 1	12 x 10	10 x 5	0	—
231	F	58·5	5250	3 x 3	0	13 x 10	9 x 6	1 x 1	1 and 5
132	M	58·5	4120	7 x 5	5 x 3	10 x 6	5 x 3	?	1 and 5
525	M	57·2	3950	5 x 3	0	10 x 6	7 x 5	0	1 and 3
502	F	57·0	4720	4 x 4	2 x 1	10 x 8	7 x 5	0	1 and 6
114	F	56·0	6160	5 x 4	2 x 2	8 x 5	4 x 3	0	1 and 2
457	M	56·0	3950	8 x 6	6 x 4	14 x 8	8 x 6	4 x 3	1 and 5
444	M	54·5	3000	6 x 4	2 x 1	7 x 5	5 x 4	0	1 and 4
498	M	54·5	3256	0	0	9 x 5	6 x 5	0	1 and 4
499	M	54·0	3220	3 x 3	0	9 x 7	4 x 3	0	1 and 6
524	F	53·5	3000	4 x 3	?	9 x 6	7 x 5	0	1 and 2
463	F	53·0	3850	7 x 5	4 x 3	10 x 8	8 x 6	0	1 and 3
156	F	53·0	3200	6 x 4	4 x 3	12 x 9	9 x 4	2 x 2	1 and 2
448	F	53·0	3964	7 x 4	3 x 2	11 x 8	11 x 5	?	1 and 5
479	F	53·0	3155	4 x 3	0	9 x 8	6 x 5	0	3 and 3
389	F	52·0	2350	2 x 2	?	10 x 7	7 x 5	0	0 and 4
414	M	52·0	3050	3 x 3	?	10 x 8	5 x 4	0	1 and 2
406	M	52·0	2760	0	?	8 x 6	4 x 3	?	1 and 3
478	M	52·0	3300	4 x 3	0	11 x 9	6 x 5	1 x 1	1 and 3
541	M	52·0	3000	0	?	9 x 7	7 x 5	0	1 and 5
400	M	51·0	2590	0	0	9 x 5	8 x 4	?	1 and 1
503	M	51·0	2810	2 x 2	?	12 x 7	7 x 7	1·5 x 1·5	1 and 6
534	M	51·0	3185	7 x 5	?	14 x 9	8 x 6	5 x 4	2 and 3
385	F	50·0	2540	4 x 3	?	11 x 7	8 x 5	1 x 1	2 and 3
311	M	49·0	2290	0	0	0	0	0	1 and 4

PREMATURE FŒTUSES.

No.	Sex	Length	Weight	Age in Days	Lower end Femur	Upper end Tibia	Calcaneus	Talus	Sternum
482	M	50·0	2530	260	4 x 4	3 x 2	6 x 6	5 x 5	1 and 3
352	F	45·0	1800	240	0	0	7 x 5	1 x 1	1 and 4
157	M	44·0	1570	226	0	0	6 x 4	2 x 2	1 and 3
505	M	44·0	1411	?	0	0	4 x 3	·5x ·5	1 and 2
546	F	44·0	1750	240	2·5x 2	0	6 x 5	4 x 3	1 and 3
200	M	41·0	1790	247	3 x 5	8 x 5	3 x 3	0	1 and 5
393	F	38·0	1210	214	0	0	7 x 5	3 x 3	1 and 2
392	F	38·0	982	155	0	0	7 x 5	2 x 2	0 and 2
396	F	38·0	945	214	0	0	4 x 3	2 x 2	1 and 4

These tables fully bear out for the other centres of ossification the conclusion come to in respect of that in the lower end of the femur ; there is great variability.

The *cuboid centre* has always had great importance attached to it as a means of determining age ; and to some extent this is borne out by the present investigation. In no case of prematurity was a centre in the cuboid detected. On the other hand, it was by no means always found in foetuses born at term. Among the 26 foetuses at term (analyzed above) a centre in the cuboid was lacking in 15, and in 4 others it was not looked for. Again, the centre in the cuboid may be very large without there being any history of post-maturity ; this was the case in Nos. 534 and 457. It is a striking fact that the cuboid centre in one of these full-time foetuses was actually larger than the one found in the post-mature foetus No. 491. Unfortunately, the cuboid centre was not looked for in two of the four presumably post-mature foetuses ; but it is important to note that it was absent in the other case (No. 241). The presence of such large cuboid centres in full-time foetuses would seem to indicate that ossification in this tarsal bone must occasionally begin some days before birth, perhaps as early as the beginning of the ninth month. The size of the centre in the cuboid cannot be used as a guide to the degree of ossification in the other bones. Thus the centre in the lower end of the femur was of good size in Nos. 138, 525, and 114, yet there was no centre in the cuboid in these cases ; in some of the cases, however, in which the femoral centre was large (as in Nos. 457, 156, and 534) the cuboid one was of good size. A curious instance of defective ossification of the cuboid was found in No. 182, a baby, who died from syphilis at the age of seven weeks after birth (having been born about ten days prematurely) ; there were only two small centres in the cuboid, one being 2 mms. and the other 1 mm. in size. In this case the ossification of the sternum was also defective, although that in the other bones was fair, e.g., 4 x 3 mms. in the femur, 2 x 2 mms. in the tibia, 10 x 8 mms. in the calcaneus, and 6 x 4 mms. in the talus. The conclusion, therefore, which seems inevitable is that the centre in the cuboid cannot be used as a sure sign of maturity, neither can its size be regarded as a test of post-maturity.

The ossification of the other *test bones* (excluding meanwhile the sternum) is seen (from the tables) to be as variable as that of the femur and cuboid. If one takes the list of the mature foetuses, it is easy to recognize what may be termed a typical case of ossification and to pick out those showing excess and defect. For instance, No. 503, a full-time foetus, measuring 51 cms. in length and weighing 2,810 grams, showed ossific nuclei in all the usual bones (unfortunately that in the tibia was not taken); that in the femur was below the average, but the others were about the usual, and so were the centres in the sternum. A variation in the direction of excess was found in No. 534, a full-time foetus of 51 cms. and 3,185 grams; the centres in the calcaneus, talus, and cuboid were all very large and there were two centres in the manubrium sterni. A somewhat similar state of things was found in No. 457, but then in this case the foetus measured 56 cms. in length and had a weight of 3,950 grams. Speaking generally, the long, heavy foetuses, such as Nos 138, 231, 132, 525, and 502 had well-marked ossification in some of the bones, but this was often accompanied by defect in others, so that mixed types were got. For instance, in Nos. 231 and 525 there was no tibial nucleus, and in Nos. 138 and 502 there was none in the cuboid. A variation in the direction of defect was found conspicuously in No. 311, mature foetus of 49 cms., and 2,290 grams; in this case there was no centre in femur, tibia, calcaneus, talus, or cuboid. Other defective cases were Nos. 406 and 498.

Similarly among the premature foetuses it was easy to discover marked variations, even amongst those of approximately the same length and age. No. 505 might be regarded as a typical case, whilst Nos. 200 and 482 would stand for excess and 392 for defect, and mixed types could easily be found.

It is in the *sternum*, however, that indications are most clearly found of the fallaciousness of ossification as a test or an index of foetal age, and therefore also of foetal post maturity. In the Plates I, II, III will be seen the ossification of the sternum in a large number of the cases already referred to. While the presumably post-mature foetuses (Nos. 491, 241, 119, and 388 in Plate I) show a high degree of sternal ossification it is to be noted that in many of the mature infants (*e.g.*, 214, 231, 132, 525, 502, 457, 444, 498, 499, 479, 478, 503, 534, and 385 in Plates I, II, III) this degree is reached if not actually overpassed.

No. 119, however, shows perhaps the most suggestive indication of post-maturity in the fact that the ossific centres of the two parts of the sternum are in process of fusion; in no other case is this so well marked. It may be claimed that in such a high degree of ossification there is a test of post-maturity, but it has to be borne in mind that in none of the other three cases in which prolongation

of pregnancy seemed clinically to be definitely established was there any approach to this fusing of the centres. Amongst the premature fœtuses (Pl. IV) there was also a disconcerting amount of variation in sternal ossification. No. 157, for instance, showed the process well advanced, whilst No. 506, a fœtus of the same length and of almost the same weight, exhibited very slight beginnings of the deposition of bone. No. 200 was most anomalous, for while the sternum showed a good degree of ossification, the calcaneus showed very little; the talus-centre was absent altogether, and then, in marked contrast, there was a fair-sized centre in the lower end of the femur, and a very large one (8×5 mms.) in the upper end of the tibia. The centre for the manubrium sterni is sometimes absent in the premature fœtus; but so is it occasionally in the mature. The degree of ossification of the sternum, therefore, unless it be very high, is no safe means of determining pre-maturity.

The same conclusion may be come to with regard to *the size of the anterior fontanelle*. Ballantyne (*loc. cit.*) looked hopefully to this anatomical character as a test of post-maturity. His hope was supported in No. 119, in which, along with many other signs of prolonged residence in the uterus, it was found that the cranial bones were very hard and thick, and that the anterior fontanelle was almost closed (its actual size was 6×7 mms.). In No. 88, however, a premature fœtus ($7\frac{1}{2}$ months), weighing 1,990 grams and measuring 42 cms. in length, the fontanelle was nearly as small (7×10 mms.). Further, the variations among full-time fœtuses were considerable; in No. 86, a mature infant of 50 cms. in length, the fontanelle measured 3×1.5 cms.; in No. 88, also full-time, it measured 1.5×1 cm., and in No. 80, another full-time fœtus of 50 cms. length, it had a measurement of no less than 9×3 cms. In No. 214, a very large but not a post-mature fœtus (length 60 cms.), the anterior fontanelle measured 2.5×3 cms.; in Nos. 78 and 79, premature fœtuses of $8\frac{1}{2}$ and 8 months, and lengths of 48 and 46 cms., the fontanelle measured in each case about 1.5×1 cm.; and then in No. 58, a full-time infant of 52.5 cms. length, the anterior fontanelle reached the large size of 10×3 cms. There is obviously great variability even among mature fœtuses, the fontanelle in premature fœtuses is often very small, and in post-mature fœtuses it is not always small. The measurements were always made after the removal of the scalp, for it was found that no reliability could be placed on those obtained without this precaution.

The presence of twins in the uterus must affect in some measure the ossification of each, just as it does their weight; but in this respect also the possibility of considerable variability has to be accepted. In Cases 486 and 487, for instance, although the twins, both males, were seven months' fœtuses, the ossification was far

advanced in the sternum. The one had a length of 42.5 cms., and a weight of 1,030 grams, and the other one a length of 39.5 cms., and a weight of 1,214 grams; the former had two ossific centres in the manubrium of the sternum and three in the body, whilst the latter had *four* centres in the manubrium and three in the body. In another pair of twins (males) born at term (Nos. 443 and 455), one was a still-birth, and the other died of purulent meningitis when 18 days old, yet the ossification was almost the same. The former weighed 2,855 grams and had a length of 51 cms., and the latter had a weight of 2,190 grams and a length of 52 cms. In the sternum in the one there was one centre in the manubrium and five in the body, whilst in the other there was again one centre in the manubrium and four in the body. In both the centre in the lower end of the femur was the same (3×3 mms.); that in the calcaneus was 10×5 mms. and 10×9 mms. respectively; and that in the talus was 5×4 mms. and 7×5 mms. respectively.

The general conclusion reached by the writers after a survey of ossification in the long series of fœtuses dealt with is that as a test of fœtal age it is unreliable. *It is impossible to tell an infant's age within one month by the ossification alone.* The presence of high ossification does not necessarily prove post-maturity, neither does its absence disprove it; but its presence, if associated with other characters, greatly increases its probability, whilst its absence is a serious impediment to the formation of the diagnosis of post-maturity in any case.

Placenta, Cord, Membranes, Liquor Amnii, etc.

When the fœtus has remained longer than is usual in the uterus alive one would expect to find in the placenta, membranes, etc., the signs of post-maturity. Ballentyne, in one of his ten cases (*loc. cit.*, p. 542), was able to examine the placenta and cord microscopically; he found both were non-vascular, and that the former showed very little syncytium on the villi combined with fibrous patches in the organ and thickening of the walls of the blood-vessels, while in the latter the mucoid tissue was beginning to exhibit fibrous tissue formation and the vessels were almost closed by reason of thickening of the intima. The liquor amnii was not excessive in amount. Unfortunately few examinations have been made of the fœtal annexa in cases of prolonged pregnancy; but in one of Browne's series of 500 post-mortems (No. 491), in which post-maturity was established clinically, the placenta was available and was found to have the following characters. It weighed 390 grams, and its volume was increased; to the naked eye it appeared fairly vascular. Under the microscope, however, it was seen to be less vascular than normal; many of the small villi had no vessels, and all of them possessed fewer than is normal for the full time. The larger stems were

markedly non-vascular; the lumen of most of the vessels was almost entirely obliterated by endarteritis, and in a considerable number it was entirely so. Here and there the section showed areas of calcification. The changes were not pathognomonic, but revealed in higher degree what is normally found in the mature placenta; it was a matter of degree. There was no enlargement of the villi such as is found in syphilis, and therefore the placenta as a whole was not enlarged. While scarcely so marked as in Ballantyne's case, the changes were of the same nature. The umbilical cord contained only one artery, and its lumen was smaller than usual from thickening of the wall; the vein was similarly but less affected. There were fibres in the jelly of Wharton.

The Viscera of the Post-mature Fœtus.

The signs of post-maturity as exhibited by the internal organs of the fœtus were found by Ballantyne (*loc. cit.*, p. 541) to consist of a comparatively low level for the organs in the neck (as determined in frozen sections), of distension of the lower bowel with meconium, and of the bladder with urine, of constriction of the foramen ovale in the heart, and of loss of patency of the ductus arteriosus, of higher development of the cerebral convolutions and sulci, of smaller relative size of the liver, etc. In the present investigation little can be added to this part of the subject. Marked variability was found in the weight of the various organs in relation to the body weight, a circumstance which calls for caution in the attempt to determine fœtal age from the relative size of any viscus. A series of 85 full-time non-syphilitic fœtuses was taken: it was found that whilst the average weight of the liver was $1/21.1$ of the body weight, there was a variation from $1/38$ to $1/13$. In a series of 35 premature (8 months) fœtuses the average ratio of liver to body weight was $1/22.5$, with variations from $1/41$ to $1/14$. One would, therefore, expect the weight of the liver in post-mature fœtuses to be less than $1/21$ of the body weight, if the approximation towards adult characters is to be postulated; but, in view of the variations found in full-time and in premature fœtuses it will be necessary to employ caution in applying this criterion.

An anatomical indication of post-maturity which is of considerable importance is found in the ease of separation of the dura mater from the inner surface of the cranial bones during the performance of a necropsy. Usually it is noticed that when the cranium is opened into in the case of mature fœtuses the dura mater adheres to the skull and is not easily detached from it; in post-mortems upon the adult the dura mater falls away at once when the head is opened. When the latter condition is found in an infant at birth it is a very strong indication of post-maturity. Its absence, however, cannot be safely

regarded as disproof of post maturity. In the four cases of prolonged pregnancy met with in Browne's series of 500 post-mortems there was only one (No. 119) in which the dura mater was found largely separated from the inner table of the skull and remaining *in situ* over the brain, and, as this fact was associated with a high degree of ossification in the cranium, sternum, and other bones, and with almost complete closure of the anterior fontanelle, the presence of post-maturity may be said to have been established on a strong anatomical foundation. As an instance of the almost inevitable presence of a contradictory detail, one had, however, to admit that in this foetus the weight (160 grams) of the liver was $1/23.7$ of the total body weight. It was unfortunate that in No. 491 the macerated state of the tissues interfered with the determination of the relation of the dura mater to the skull. In No. 241 (another post-mature case) the dura mater was adherent to the inner table of the cranial bones. The conclusion is that whilst the presence of this adult character of the relationship between the dura mater and the skull is strong evidence in favour of post-maturity, its absence cannot be affirmed to demonstrate the contrary. It is noteworthy that in no case of maturity or prematurity was this adult character detected.

Value of Anatomical Criteria in the Determination of Post-maturity.

In the survey of the anatomical criteria of post-maturity which has been made in the preceding pages it will have become increasingly clear that no single criterion can be safely trusted as a certain proof of a longer residence *in utero* than usual. The only one which comes reasonably near to having such a discriminating importance is easy separability of the dura mater from the cranial bones, and, as has been seen, it may be absent in well-authenticated cases of prolongation of pregnancy. One is driven, therefore, to the conclusion that reliance must be placed upon the presence of a group of anatomical characters for the purpose of diagnosis. When, for instance, unusually great weight and length and an abnormally advanced degree of ossification (especially of the cranium and of such test bones as femur, tibia, cuboid, and sternum) are found under clinical circumstances which suggest, or at any rate do not exclude, post-maturity, there will be a reasonable proof that the foetus has been carried beyond term; when these are associated with easy separability of the dura mater certainty will be practically reached. In other cases in which the clinical evidence is strong but in which great length, weight, and ossification, and easy dural separability are absent, sufficient evidence may yet be found in a non-vascular state of the placenta, in endarteritic changes in the vessels of the cord and the appearance of fibrous tissue in the jelly of Wharton, and in the presence of mature characters in the skin and its appendages (especially in length of the nail). Proof

of post-maturity, therefore, while not at all impossible from the examination of the infant alone, must be built up from an association of characters and not decided upon one standing by itself. It is of particular importance to keep this restriction in mind in dealing with medico-legal cases in which clinical data have to be sharply scrutinized. The definition of post-maturity given on p. 179 must, therefore, be maintained meanwhile, notwithstanding its awkwardness.

If an explanation be sought for the failure to find in any given case a complete anatomical picture of post-maturity it must be admitted that no fully satisfactory one can be yet given. One falls back of course upon variability, but that is in itself no explanation, for it, in its turn, must depend upon causes. The absence of unusually great length and weight is not, however, inexplicable. The infant who is born after thirty days longer stay in the uterus and who yet weighs only seven pounds may be explained on the supposition that his mature weight was only six pounds, and that, therefore, seven pounds for him is excessive. Some support for such a supposition is found in the recent work of Brailsford Robertson on the Pre- and Post-natal Growth of Infants.⁶ He has discovered that for South Australian (British stock) infants there is a growth cycle represented by a single sigmoid curve which begins nearly with the commencement of development and lasts until almost the end of the first year of post-natal life. A part of the curve, therefore, is ante-natal and a part post-natal. Robertson was able to determine the post-natal part of the curve, and he then found, from the examination of mature and premature infants, that it was continued smoothly backward into the pre-natal curve. With the help of algebraical formulæ he could calculate what the weight should be at any given age. He extended his observations to infants born after term, and he found that the weights at birth of children which are born after the normal time are identical within very narrow limits with the weights which they would have attained at that time had they been born at the normal period. His tables for males and females are reproduced here :—

Period of Gestation in days.	MALES.	
	Observed.	Calculated.
260	111	110
270	117	117
280	127	126
282.5	127	127
290	137	134
300	145	142
310	146	151

Period of Gestation in days.	FEMALES.	
	Observed.	Calculated.
250	97	99
260	105	106
270	108	112
280	120	118
284.5	121	121
290	130	125
300	133	132
310	138	139

It is to be noted that Robertson found the mean period of gestation in South Australian infants to be 282.5 for males and 284.5 for females, the calculation being founded on the time which elapsed from the onset of the last menstruation. When, therefore, one finds that a post-mature infant weighs less than one would expect, it is fair to draw the inference that this infant has had a smaller weight throughout the pre-natal part of its growth cycle. It must not be forgotten, however, that in order to accept this conclusion in its entirety one must regard weight as a character already existing in the zygote, and little, if at all, influenced by environment either ante-natal or post-natal; and yet clinical observations founded on the effect of rest during the last weeks of pregnancy upon the weight of the infant at birth seem to run contrary to this view. It must be admitted that the causation of variability of weight, both at term and in post-mature infants, presents a problem as yet insoluble, and the same may be said of the other anatomical criteria, such as ossification and placental and visceral conditions.

Possible Fœtal Causes of Prolongation of Pregnancy.

The question whether prolongation of pregnancy and consequently post-maturity are due to a condition of the foetus, or to one of the mother, or possibly to one of the father, constitutes another problem for which no satisfactory solution can yet be discovered. At this stage it may be noted that some investigators have been inclined to look to a state of the foetus for the cause of prolonged gestation. Von Winckel,⁷ for instance, thought that the male sex of the child had some influence; and Taussig⁸ was of opinion that the presence of the foetal head in the lower part of the uterus played a part, prolongation of pregnancy being proportionately less common in breech cases. On the other hand, absence of the hard head from the lower uterine segment has been regarded as a cause of post-maturity, and attention has been drawn to the remarkable frequency with which anencephalus has been met with in these cases. According to this view the cause of labour is pressure by

the head of the fœtus upon the cervix; but here once more one must admit ignorance, the actual determining cause of the onset of uterine contractions being unknown. The frequency of the association of fœtal anencephaly with prolongation of pregnancy may have quite another explanation: one may argue that in anencephaly the fœtal pituitary gland is commonly absent; that the secretion of that gland may determine the onset of contractions in the uterus of the mother; and that consequently the absence of that secretion may retard the beginning of labour. It is an attractive theory, but it is no more. It is, perhaps, just as likely that the anencephaly of the fœtus and the prolongation of the pregnancy may both be due to something else, for example, a fault in maternal metabolism. If one knew all these things, why then "how happily the years of Thalaba" might "go by": *felix qui potuit rerum cognoscere causas.*

Clinical Evidence of the Prolongation of Pregnancy.

Fœtal and infantile characters are, as will have been gathered, of high importance in coming to any conclusion regarding the prolongation of pregnancy, although it has to be admitted that they are not infallible; but, of course, in every case it is necessary to look also at the clinical evidence.

A search throughout literature reveals the fact that a belief in the possibility of the prolongation of pregnancy far beyond the usual period was held even in early times. Gellius Aulus, for instance, in his "collection of incongruous matter," called *Noctes Atticæ*,⁹ stated that the Emperor Hadrian, having consulted with the physicians and wise men, decreed that in cases in which the woman was of chaste manners and irreproachable conduct the child born eleven months after the death of the husband was legitimate. Gellius lived about 130 A.D. To come to more recent times, the Supreme Court of Friedland in 1634 decided that a child born 333 days after the decease of the husband was legitimate.

In modern literature many examples of alleged prolongation of pregnancy are found reported more or less fully. Merriman,¹⁰ from a study of 114 mature children in whom the last day of the last menstrual period of the mothers was known with certainty, discovered four, or 3.5%, born from the 302nd to the 306th day. The results are in the following table:—

3 were born from the 255th to the 259th day or in the 37th week.							
13	„	„	262nd	„	266th	„	„ 38th
14	„	„	267th	„	273rd	„	„ 39th
33	„	„	274th	„	280th	„	„ 40th
22	„	„	281st	„	287th	„	„ 41st
15	„	„	288th	„	293rd	„	„ 42nd
10	„	„	295th	„	301st	„	„ 43rd
4	„	„	303rd	„	306th	„	„ 44th

Reid¹¹ gave the result of 500 cases in which the number of days from the last menstruation to the delivery was known :—

23	were born from the	252nd	to the	259th	day	(37th	week)
48	„	„	260th	„	266th	„	(38th „)
81	„	„	267th	„	273rd	„	(39th „)
131	„	„	274th	„	280th	„	(40th „)
112	„	„	281st	„	287th	„	(41st „)
63	„	„	288th	„	294th	„	(42nd „)
28	„	„	295th	„	301st	„	(43rd „)
8	„	„	302nd	„	308th	„	(44th „)
6	„	„	309th	„	316th	„	(45th „)

There was one case on the 310th day, and one each on the 311th, the 314th, the 315th, and the 316th days.

Von Winckel,¹² in a study of 30,500 labours, stated that of 566 cases in which the fœtus weighed 400 grams or more, there were 31 cases (11%) in which pregnancy calculated from the first day of the last menstrual period had lasted from 302 to 322 days. In 281 of the 566 cases accurate information was available: in 245 the first day of the last menstrual period could be given; in 36 the day of cohabitation; and in 51 both data were available.

When, however, the evidence for the prolongation of pregnancy is critically looked at in the reported cases it is often found to be of an unsatisfactory nature; the data on which it is based are frequently very unreliable. Reid (*loc. cit.*) wrote: “ In the case which occurred 314 days after the cessation of the catamenia I find it noted that quickening did not happen until the sixth month, proving, in my opinion, that conception had taken place later than had been thought.” Reid also referred to reports of extraordinarily long pregnancies from literature, and was clearly sceptical about several of them.

The following are the clinical data which are usually provided; and they very seldom are all present in any case.

1. Date of last menstrual period.
2. Date of last coitus.
3. Date of onset of morning sickness.
4. Date of quickening.
5. Size of uterus at different periods.
6. Difficulty in delivery of the child.
7. Evidence of post-maturity in the child.

(1) The date of the last menstrual period is often unreliable. The woman's past menstrual history may have been irregular; she may, for instance, have missed one or two periods before conception occurred. There may have been a very short period of, say, half

a day, and the question will at once arise whether the calculation of pregnancy should be made from this incomplete menstruation or from the last full period. Again, the date may be given indefinitely, and yet again the date may be badly remembered. It has, however, to be borne in mind that a history of a thirty day type of menstruation has a value in the building up of proof of prolongation of pregnancy, it having been not infrequently noticed that this type of menstruation is likely to be associated with a longer duration of gestation.

(2) Evidence founded upon the data of the last coitus is seldom available, save under such exceptional circumstances as existed during the War when husbands were at home for short stays of a few days, or in connexion with certain groups of persons such as sea captains. Further, statements regarding the last time of cohabitation may be satisfactory enough to the patient's own medical attendant and yet be received with scepticism by the medical profession generally. Statements made by single women will necessarily be received with caution.

The date of the onset of morning sickness is variable and consequently unreliable. If it correspond with the date of the last menstrual period or of alleged insemination, it is supporting evidence; but it is well known that a woman who suspects or who fears the existence of pregnancy may suffer from this symptom without conception having occurred.

(4) Quickening, also, when its period of detection corresponds with the date of the last period or of coitus or of morning sickness, is corroborative evidence. It may, however, be simulated in a non-pregnant woman; or the patient may fancy it occurred earlier than it really did; or its onset may be delayed till the sixth or seventh month instead of taking place at four and a half months.

(5) The size of the uterus ascertained at various periods is the most reliable clinical evidence which can be got, more especially if the examination has been the bimanual one, if it has been carried out at the 2nd or 3rd month, and if it has been done by a competent clinician. These data were present in Hayes' case and in the first of Simpson's four. The presence, however, of a fibroid tumour in the wall of the pregnant uterus may cause confusion, as in Oliver's case. After the fifth month the size of the uterus will be less convincing, for hydramnios, large size of the child, twins, unusual relation of the fœtus to the pelvis of the mother, and other circumstances may conspire to make the uterus appear larger than the presumed age of the gestation (as in Hendry's case). In only a very few of the reported cases had early observations on the size of the uterus been taken.

The importance of a carefully made examination of the uterus

was clearly shown in the case of *Doherty v. Doherty*, in which one of the writers (Browne) appeared as a witness for the pursuer. Mr. D. sued for divorce on the ground that a child born 348 days after he had left the country with his ship could not possibly be his child. The last possible date of access was 9th May, and the infant was born on 22nd April following. In the beginning of June there was a period of apparently ordinary duration and amount. On 12th August Mrs. D. consulted a doctor, who gave evidence for the defence. She then stated that sickness had been going on for some considerable time. The doctor formed the opinion then and at a subsequent examination on 18th August, that the woman was three months pregnant. He had not, however, carried out a bimanual examination, but had based his opinion entirely upon the duration of sickness (from the beginning of July), upon the history of amenorrhœa, and upon there being milk in the breasts (although the woman had had a child about a year before). A bimanual examination on 18th August resulting in the finding of a uterus of size corresponding to a three months' pregnancy would almost certainly have gained the case for the defence, and would have added to the literature of the subject, an instance almost unique both as regards prolongation and authentication, for the doctor was a most competent observer.

(6) In the older reported cases of alleged prolongation of pregnancy a history of difficulty in labour was rarely given. When it is available it forms corroborative evidence; but it is not necessary that a labour should be difficult in order to prove post-maturity; for example, the pelvis may be unusually roomy and so permit the passage of a large infant, or the child may not be large although there was prolonged pregnancy.

(7) Evidence founded upon the presence of characters of post-maturity in the infant at birth, although of considerable value, is not infallible. This, however, has been fully shown in the earlier part of this article and need not be referred to again.

The Duration of Pregnancy.

Before, however, one can rightly judge the value of the clinical evidence in support of the prolongation of gestation, it is necessary to know how far the determination of the duration of pregnancy can be accurately known.

By the term "duration of pregnancy" is meant the interval between conception and the actual birth of the child, or rather the birth of the placenta, for the latter is a part of the ovum, at least in its greater part. The "duration of pregnancy," therefore, means the interval between conception and the termination of the third stage of labour.

Its average duration in the human subject is difficult to estimate for reasons which will presently appear; but for clinical purposes it is customary to count it from the beginning or end of the last menstrual period as 280 or 275 days respectively. It is to be observed that this is not the average duration of *pregnancy*, but only of the interval between the last menstrual period and the completion of labour; we do not know, and we have no means of knowing, the "duration of pregnancy." Occasionally it is possible to substitute for the last menstrual date that of the last coitus; then the duration generally is found to average 275 days. Thus, in 46 cases in which the date of a single coitus was known, Matthews Duncan found the average duration of what may be termed the "insemination-labour" interval to be 275 days; but Ahlfeld, studying 425 cases, found it to be 271 days; Hecker, from 108 cases, found it 273.52 days; and Veit, from 43 cases, found it to be 276.42 days. Recently Nürnbergger, studying 206 war cases in which the date of a single coitus was known, found the duration to be anywhere between 253 and 297 days, there being therefore a "spread" of 44 days.

More accurate estimates can be founded upon observations on animals in whom the date of insemination can be exactly known. Earl Spencer, for instance, examined the gestation period of 764 cows, using the "insemination-delivery" time as his guide, and got the following results:—

Length in days.		Cows.	Length in days.		Cows.	Length in days.		Cows.
days.	Cows.		days.	Cows.		days.	Cows.	
220	1	.....	263	2	.....	285	74
226	1	.....	266	1	.....	286	60
233	1	.....	268	2	.....	287	52
234	1	.....	269	2	.....	288	42
235	1	.....	270	5	.....	289	45
239	1	.....	271	6	.....	290	23
242	1	.....	272	3	.....	291	31
245	2	.....	273	3	.....	292	16
246	2	.....	274	5	.....	293	10
248	1	.....	275	5	.....	294	8
250	1	.....	276	15	.....	295	7
252	2	.....	277	14	.....	296	6
253	1	.....	278	18	.....	297	2
254	1	.....	279	32	.....	299	1
255	2	.....	280	35	.....	304	1
257	2	.....	281	39	.....	305	1
258	3	.....	282	47	.....	306	1
259	1	.....	283	54	.....	307	1
262	1	.....	284	66	.....	313	1

It will be seen that whilst most calves were born on the 285th day, as many as five went over 300 days and one 313 days, and the shortest time was 220 days. There was thus a "spread" of 93 days. The observer stated that he had never been able to rear any calf born at an earlier period than 242 days; any calf born at an earlier period than 260 days had to be considered as decidedly premature. Any period exceeding 300 days had to be regarded as irregular, but in the cases of prolongation the health of the produce was not affected. Spencer's conclusion was that the probable duration of gestation in the cow should be regarded as 284 or 285 days. In other words, it is not dissimilar from that in the human subject, and may, therefore, be used in comparison with it.

Tessier¹⁴ has given results from a similar study of 446 cows, and these have been reproduced by Berry Hart¹⁵ in his article on the "Duration of the Interval between Insemination and Parturition in certain Mammals as studied in Biometric Curves." It is sufficient here to state that in the series of 446 cows there were 10 in which pregnancy exceeded 300 days and there was one in which it went on for 321 days.

Krahmer gave statistics regarding eight cows who had all several parturitions each. The figures in the table indicate the length of the gestations in days:—

Cow No. 1 :	282, 277, 279, 281, 286, 281, 277.
" 2 :	282, 283, 283, 280, 276, 277, 281.
" 3 :	283, 281, 284, 281, 283, 280, 250, 277.
" 4 :	284, 280, 289, 284, 292, 290.
" 5 :	301, 304, 299, 303.
" 6 :	276, 286, 291, 295.
" 7 :	275, 294, 283, 303, 284, 275.
" 8 :	303, 284, 280, 321, 278, 288, 275.

The tendency to a prolonged gestation was marked in Nos. 5, 7, and 8.

Berry Hart (*loc. cit.*) endeavoured to explain the apparent prolongation of gestation in these animals by the suggestion that as a cow may sometimes come into heat about three weeks after insemination two ova may be shed at intervals of three weeks, the second one being fertilized by a spermatozoon from the insemination which failed to fertilize the first ovum; thus the delay caused a later date of labour but not a longer pregnancy. Hart's theory, however, demands the supposition that spermatozoa can live in the genital tract for three weeks and be capable of fertilizing an ovum at the end of that time; and, as will be shown immediately, there is small warrant for this assumption.

Observations on animals so far as they go support the conclusion that the period of insemination-parturition gestation varies within fairly wide limits; and the fact that so many cases of definite prolongation beyond the 300 days were met with in the small number of cows examined is striking. It would seem reasonable to use such occurrences as *prima facie* evidence in favour of the occasional prolongation of gestation to a corresponding degree in the human subject.

From what has been stated it will be clear that difficulties exist in the calculation of the duration of pregnancy founded on the ordinary data, and that fallacies may easily creep in; but there is another hindrance to which attention has not yet been drawn, the estimation of the insemination-conception interval. There are also two or three other problems to which reference must be made.

The actual duration of pregnancy, it must be remembered, is not the interval between menstruation and delivery or even between insemination and delivery, but between conception (*i.e.*, impregnation) and delivery. Insemination necessarily precedes conception, but it is not known by how much time, for whilst the moment of insemination may be arrived at, that of conception cannot be recognized. There is no knowledge of the length of the insemination-conception interval; it is necessary to speak in probables.

Whilst it is probable that conception usually occurs from three to four days after insemination yet it may be delayed so long as the sperm cell remains alive and retains the power of fertilizing. It is said that a spermatozoon has been found alive (with fertilizing power?) in the Fallopian tube 21 days after the last insemination. On this assumption the insemination-conception interval may, therefore, be almost as long as the inter-menstrual period; that is, if insemination occurred on the day after the last menstrual period, conception might still be delayed (so far as the male element had to do with it) until just before the next (the first missed) period. Whilst ovulation probably occurs between the eighth and fourteenth day of the inter-menstrual cycle (Ruge, C.¹⁶), it may be occasionally delayed till the third week of the cycle, and thus, even at the end of the inter-menstrual period there would be a fresh ovum available for impregnation provided the sperm was capable of fertilizing it.

This prolonged vitality of spermatozoa rests for its proof upon a single observation. It will be wiser to rely upon more numerous and more moderate estimates. Marion Sims,¹⁷ from his observations, was able to state: "I have examined the semen many times with the view of determining this point and I think I can safely say that spermatozoa never live more than 12 hours in the vaginal mucus, but in the mucus of the cervix they live much longer. At the end of twelve hours when all are dead in the vagina there are

but few dead ones to be found in the cervix. When the cervical mucus is examined from 36 to 40 hours after coitus we shall ordinarily find as many spermatozoa dead as alive. But my observations on this point could not be accepted as the rule for they were all made upon those who were, or had been, the subjects of uterine disease in some form or other." In one case which he personally observed, insemination occurred at 11 p.m. on Saturday and microscopic examination of the secretions was carried out at 3 p.m. on Monday, *i.e.*, 40 hours afterwards: the vaginal mucus contained a few dead spermatozoa, none alive; the cervical mucus contained great numbers very active, and a few dead. Marion Sims saw no reason why many of these active spermatozoa should not have lived for a still longer time; many of them lived for six hours after removal. Percy¹⁸ found "living spermatozoa and many dead ones issuing from the os uteri $8\frac{1}{2}$ days after sexual connection"; during the interval the woman's husband had been from home. Ruge,¹⁹ however, believes that all the available evidence points to the conclusion that the life of both the human ovum and spermatozoon is limited to a few days. He is of opinion also that ovulation usually occurs from the 8th to the 14th day of the intermenstrual period, and that the optimum of fertilization exists when a fresh ovum meets a fresh spermatozoon. Pryll²⁰ thought from the analysis of 713 pregnancies following a single coitus that spermatozoa might live for from six to ten days. Siegel²¹ and Nürnberger,²² from observations during the war, reached conclusions resembling those of C. Ruge. Thus Siegel found that of 300 one-time cohabitations which resulted in pregnancy there were 159 (53 per cent.) in which coitus was performed on the sixth day following the beginning of the last menstrual period; and Nürnbergberger noted that in 215 personal war observations, in 41.3 per cent., cohabitation happened in the early post-menstrual time, in only 9.3 per cent. in the pre-menstrual time, and in the remaining 49.4 per cent. in the interval. Grosser's²³ investigations have a high importance. He believes that in all mammals ovulation, impregnation, and insemination practically coincide. If this be so then the various observations on cows would demonstrate the variability of the length of gestation and establish prolongation. Grosser believes, further, that very similar conditions exist in the human subject. If this be so, it will be permissible to draw conclusions with regard to the prolongation of pregnancy from cows and other mammals; but if not, then it may be fallacious to do this. Grosser thought that neither the ovum nor the spermatozoon remained very long fit for their biological function.

A consideration of all the evidence leads to the conclusion that only a comparatively short term of life and functional fitness can

be allowed to the spermatozoon in the genital tract, even under the most favourable circumstances. It seems almost certain that it does not exceed ten days. Since it is probable that ovulation may occur at almost any time in the intermenstrual cycle after the 8th day, the length of the insemination-impregnation interval will depend essentially upon the length of the life of the spermatozoon. In endeavouring, therefore, to assign a time value to the insemination-impregnation interval it will probably never be necessary to allow more than 10 days. If then pregnancy has resulted from a single coitus on a known date it will not be necessary to deduct more than ten days (representing the length of the insemination-impregnation interval) from the total in order to get the length of the true gestation time (impregnation-parturition period). Anything over this number will fairly be termed prolongation of pregnancy. For instance, if 310 days have elapsed since coitus and before delivery then one is warranted in regarding the pregnancy as having had an extent of at least 300 days.

Another question which may arise in connection with the alleged prolongation of pregnancy is whether impregnation can occur after a menstrual period from a spermatozoon belonging to an insemination which took place before that period. The matter may be of importance in medico-legal cases involving the consideration of post-maturity and prolongation of gestation. If the possibility of such a conception be admitted then not only may a woman have a normal menstrual period after her husband's departure without the child being necessarily illegitimate, but the alleged prolongation of pregnancy may also be reduced in extent. The matter was discussed in the case of *Doherty v. Doherty*. Such a post-menstrual impregnation by means of a premenstrual spermatozoon would permit of the shortening of the insemination-delivery interval by the number of days during which the male element may live in the genital tract. Of course the answer to this question will depend upon that which can be given to the other question whether a spermatozoon can live in the genital tract during a menstruation. One must beware of preconceived notions regarding such a question; the possibility of a spermatozoon living through a menstrual period ought not to be put aside as absurd. Theoretically there is no reason why the sperm should not, if in the Fallopian tube, pass through the period uninjured. The tube takes no active part in menstruation, although it doubtless becomes congested at the time, and, since it contains no glands, there should be no increase in secretion to interfere with the sperm. But even if it be admitted that the sperm may remain intact in the tube till the menstrual period is over, another question will at once arise—will there be an ovum there to be fertilized? Now opinion is

practically unanimous in believing that an ovum cannot exist in the genital tract during a menstruation; further, it has been seen that it is probable that ovulation does not occur till the eighth day of the intermenstrual cycle. The spermatozoon, therefore, which has weathered the storms of the menstrual period would still have to continue to live for about eight days after the end of the period before an ovum became available for fertilization. If the period last four or five days and if the duration of life of the spermatozoon in the genital tract be limited to ten days, then the answer to the question of the possibility of impregnation must be in the negative.

There has always been speculation upon the greatest possible prolongation of pregnancy, and it is not uncommon for the Bar in medico-legal cases to demand that obstetrical experts shall place an upward limit. It would be of little use to quote the various opinions which have been held. National legislation and individual views differ widely as to the greatest prolongation of pregnancy which may nevertheless be considered as legitimate; and discussions thereon have been veritable battlefields in some *causes célèbres* in which the question of paternity arose. Among experts opinions seem to have varied with the experience of each. Thus Berry Hart (*loc. cit.*) believed that there was no such thing as protracted pregnancy or a post-mature foetus, whilst Schlichting²⁴ stated that gestation might be prolonged to 334 days, fixing that as the extreme limit. Schlichting carried out a series of observations at Munich on a total of 456 cases; he found that 14, or 3%, had a duration of more than 302 days, estimated according to the method of Naegele. Runge, again, fixed the upward limit at 320 days, and others specified other numbers. All these estimates are open to the question—why fix 320 days exactly? Why not fix it at 321 or 322? And, in Schlichting's estimate, why not 335 or even 336?

The great conclusion would seem to be that one is unable to fix any upward limit to the time of gestation, and that one must consider every case on its individual merits; but one has also to bear in mind that the greater the departure from the normal the more completely established must the evidence be. Further, when the last possible date of insemination is known, it is necessary that the period of days between that date and delivery (or what may be called the insemination-delivery interval) should be reduced to the conception-delivery interval by subtracting a certain number of days not greater than that during which the spermatozoon may live in the genital tract or by subtracting the number of days between insemination and the first missed menstrual period. It is possible, however, that the first missed period may have been so missed on account of some cause other than pregnancy; if this can be proved, even then the full number of days during which a spermatozoon

can live in the genital tract may clearly be deducted. If the date of insemination be not known, and the reckoning be made from the last menstrual period, the apparent duration may always be reduced by 23 days provided there was opportunity for insemination during the whole of the intermenstrual interval, because conception might have occurred just before the first missed period. In this way an apparent duration of 300 days (dating from the last menstruation) may be reduced to 277 days, and may thus not be a case of prolongation at all.

Etiology of Prolongation of Pregnancy.

It is hardly necessary to consider in detail the causes which have been invoked to explain the prolongation of pregnancy, for the sufficient reason that the determining factors which bring on labour at the normal time of delivery are unknown. Until one knows what it is which throws the uterus into action about the 280th day after the last menstruation it may be doubted whether it is profitable to spend much time discussing what it is which in a small number of instances delays the incidence of this influence till the 300th day or till some still later date.

Something has been said already about the possible causes of prolongation of pregnancy which may exist in the fœtus (*vide p. 196*); and the male sex, the vertex presentation, and the existence of anencephaly have been spoken of as etiological influences. With regard to such generally acting influences as sex and presentation it is probable that the possession of a sufficiently large number of cases would smooth out any curve of exceptional frequency. The co-existence of anencephaly and prolongation is more impressive, but it also may be mere coincidence.

Maternal causes have been sought and found easily enough in various circumstances. Rest during the later weeks of pregnancy has been freely alleged as the explanation of delay in the onset of labour pains; there is some evidence that it increases the average weight of the child, and it may eliminate some of the accidental causes of the supervention of uterine action, but its essential importance has not been demonstrated. The same conclusion may be reached regarding the suggestion that large, phlegmatic and fat women are more likely to carry their babies long. The association of narrow pelvis and prolongation of pregnancy is only occasional; if it were more constant it might be explained as due to the absence of the stimulus of the fœtal head in the upper part of the cervical canal. There can be no doubt that prolongation of pregnancy tends to recur in the same patient. Dewees, long ago, wrote: "I have had every evidence this side of absolute proof that pregnancy has been prolonged to ten calendar months as an

habitual arrangement in four females whom I have attended." Montgomery,²⁵ also, stated that he had attended a woman who had been pregnant thirteen times, and had on four or five of these occasions gone from four to six weeks past the expected date. Several further instances of this repeated prolongation of gestation have been reported by Taussig, Puech, and others. Heredity has also been invoked as a cause, and it has been observed that a mother and her two daughters have carried their babies for longer than the usual term (Retzius). Another associated, if not a causal, condition is the thirty day type of menstruation. Some obstetricians have gone so far as to say that in the case of a woman with this menstrual type a 300 day pregnancy ought to be expected. All that can be safely said, however, is that whilst such women have not infrequently been found to have long gestations there are numerous exceptions. The fact that 300 is ten times 30 is, of course, suggestive of an explanation and even of a possible law of the duration of pregnancy; but, if so, it ceases to be of value in the etiology of gestations of 306, 310, or 320 days. Puech's theory that the woman who has a long pregnancy is possessed of an under-excitabile uterus does not carry one far. The over-excitabile uterus has been invoked to explain recurrent premature labours and abortions. In both cases one is left without information as to the cause of the hypo- or hyper-excitability. It will be in keeping with the trend of scientific opinion if one suggest that the onset of labour at the normal time is due to an interaction of the endocrine organs, and that the delay and the acceleration of this onset are both caused by a defect in the smooth working of these glands. Scientific proof, however, is lacking.

The Dangers of Post-maturity and Prolongation of Pregnancy.

Since 1902 when one of the present writers pointed out the extreme gravity to the infant of a prolonged stay in the uterus, numerous observations have confirmed the serious nature of the *prognosis for the child*. In the four cases of post-maturity recorded in the present contribution (Nos. 491, 241, 119, and 388) foetal death occurred in two during delivery, in one before it, and in the fourth a few hours after it. All were difficult confinements and one of them called for Cæsarean section. The difficulty and danger are due in the majority of cases to the large bulk of the infant, a circumstance which has the same effect upon the labour as contraction of the mother's pelvis would exert. There is no proof that if the weight of the post-mature baby is near the average (as it sometimes is) the labour will be more dangerous than usual; in other words post-maturity itself, apart from large dimensions of the foetus, does not appear to be a cause of stillbirth. It has, however, to be borne

in mind that in not a few of the recorded cases the post-mature infant has shown malformations; this was so in one of the four instances recorded in the present article. It will, therefore, be wise to keep this association of teratology in view in forming a prognosis for the infant in cases of prolongation of pregnancy even when there is an absence of excessive foetal weight and size. The actual cause of the stillbirth (apart from non-viability due to teratological states) is commonly cerebral hæmorrhage following upon forceps extraction in the cases in which the child has presented by the head, and intranatal asphyxia from delay in delivery in breech presentations. In No. 119, in which Cæsarean section was performed, there is every reason to think that the child might have been saved had not forceps been applied several times before the section was done. There can be no doubt that from the point of view of the infant post-maturity is an occurrence of evil omen, and, further, that the danger is concentrated in the intranatal period when the child is passing, or rather is being dragged through the genital canals of the mother. The child dies in its birth or soon afterwards on account of injuries received therein.

To the *mother*, prolongation of pregnancy brings danger also. It is difficult to determine whether the pregnancy itself is more dangerous than usual. One should expect albuminuria and toxæmic troubles to be more frequent, and in one of the cases (No. 388) recorded above the mother suffered from eclampsia; but fortunately a prolonged pregnancy does not seem to be necessarily a morbid one. It must not be forgotten, however, that as soon as the calculated date of delivery is passed without the onset of labour the mother begins to worry; and the worry is intensified if, as has been sometimes recorded, there has been a sort of spurious labour with no tangible result. The further fact that her medical attendant seems puzzled to account for the delay does not lessen her anxiety. Even if she escape albuminuria, does not suffer from marked pressure symptoms, and have no special discomfort from the large size of the child and the small amount of liquor amnii, she will yet enter labour with a disturbed mentality and an increased apprehension of suffering and evil happenings.

The labour, as has been indicated already, is commonly delayed and difficult, and special trouble arises from the unexpectedness of the emergent troubles. Even when there has been ante-natal supervision the particular source of risk may have been overlooked, for the ordinary precaution of pelvimetry without a careful comparison of the size of the foetal head and maternal pelvis will not suffice to detect the incompatibility of the passenger and the passages. For this reason it has often happened that the mother has been allowed to enter labour and to reach the second stage with

an imperfect realization of the impending catastrophe. Even then the medical attendant, deceived by the roominess of the mother's pelvis, may apply forceps and discover only after several unsuccessful efforts that no obstetric salvation lies that way. He will then find himself face to face with an obstructed labour in which the time and opportunity for Cæsarean section have been allowed to pass, and craniotomy alone is left, with consequent destruction of the child. The craniotomy also may be a particularly difficult one, and bring real danger of septic troubles and structural injuries to the mother. One of the writers has still painful memories of a consultation case to which he was summoned some ten years ago. The labour was a month post-mature, and in addition the mother's pelvis was contracted; either of the abnormalities would have entailed a difficult labour, the two together contrived the most difficult and exacting craniotomy the writer had ever met with. The bones of the enlarged foetal head were enormously thick, and it was only after perforating in three places that reduction in size sufficient to allow extraction was accomplished. The birth of the shoulders required cleidotomy. The special difficulty in this case was due to the fact that the medical attendant had been lulled into a sense of security by his knowledge that on a previous occasion the labour, although difficult, had been accomplished by forceps; in that instance, however, there had been no post-maturity. There need be no hesitation in reaching the conclusion that a post-mature labour contains in itself all the conditions which go to make up the *bête noir* of modern obstetrics, an unexpected craniotomy. Even when the birth has been accomplished there may be difficulty with the third stage due to adhesion of the placenta; the puerperium may be accompanied by minor septic complications, if, happily, the major ones have been escaped; and the patient may be left crippled in the obstetric sense for the rest of her life. The post-mature foetus and the prolonged pregnancy have no compensating advantages to offer for the many dangers and difficulties which they introduce into the obstetric emergency to which they give origin.

Management of Post-maturity and the Late Labour.

From what has been stated of the prognosis (maternal and foetal) of the post-mature labour, it will be evident that the treatment is prevention. Fortunately, this is a result much more easy to attain nowadays than it was twenty years ago, for, thanks to ante-natal supervision which is now a commonplace of obstetric practice, the medical practitioner is brought into touch with his patient at an earlier date than was customary. He is thus able (1) to make a more accurate estimate of the age of the pregnancy; (2) to exclude

other causes of difficulty, such as the contracted pelvis; (3) to check the relation of the fœtal head to the brim of the mother's pelvis frequently by depressing the one into the other; (4) to note any prolongation of pregnancy past the expected date of delivery; and (5) to detect the first indication of difficulty in the passage of the fœtal head into the mother's pelvis, and to take the appropriate obstetric measures in good time. It is hardly an exaggeration to say that adequate ante-natal supervision provides the means of excluding all the horrors of an enforced craniotomy on a living infant from midwifery practice, including, of course, the cases in which the indication for the same is post-mature labour.

When the probable date of parturition is passed in any case the obstetrician ought carefully to revise the data on which the calculation has been founded and make any deductions for possible errors or readjustments; he ought next to examine for any deviations from the normal in the urine, in the blood pressure, in the nervous system, in the fœtal heart, and in the general symptomatology of the mother; and he ought to begin the daily testing of the depressibility of the fœtal head into the maternal pelvic brim. Any abnormality in the patient's symptoms and signs and any hesitancy in the descent of the head into the pelvis should be the immediate signal for the consideration of the induction of labour. There can be no difference of opinion about this; but the question will arise whether, given the fair certainty that the date of normal parturition is being overpassed, labour ought not to be induced in any case. The writers are convinced that it should. One of them, in his article of twenty years ago, was strongly of opinion that in all cases of prolongation of pregnancy, save in a primipara, induction of labour should be practised, and that the same should be done even in a primipara if albuminuria appeared or if the head of the fœtus began to refuse to pass through the brim. It is doubtful whether, in the light of all the knowledge which is now available, any exception should be made for the primipara. So far as can be judged no advantage accrues either to mother or infant from allowing the pregnancy to continue and the fœtal life to be prolonged; on the contrary, many reasons, including the release of the mother from worrying uncertainty, may be urged for terminating gestation at once. Induction of labour ought, therefore, to be begun. Even if it have been determined that Cæsarean section will be necessary there is no reason for postponing its performance.

It must be remembered that it is not induction of *premature* labour that is being discussed in these cases; uterine action is being brought on not before the proper time, but at the proper time. This fact makes a great difference to the patient; she is not told

that something exceptional has to be done, but that the normal is being sought after and compassed. It may be said here, in passing, that even when one is inducing premature labour it is unwise to speak of it as bringing on pains before the *proper* time; the right way of approaching the subject is to say to the mother that under all the circumstances of her case the *right* time for her baby to be born with safety to herself and the child has now arrived. In this way much difficulty will be avoided. But in the case of the post-mature pregnancy there is no need for even this precaution. The full term has passed and the mother's own reason and common sense appeal to her that her baby ought to be making his appearance. From the attendant's standpoint there can be no doubt; any slight risk he may anticipate in connexion with the induction is as nothing compared to the trouble he will experience at a later date in bringing a large post-mature infant into the world.

How generally this principle of intervention, when the calculated date of delivery has passed, is being adopted may be learned from contemporary obstetrical literature. Thus B. P. Watson,²⁶ in a series of 150 induced labours operated 65 times for pregnancy prolonged beyond the calculated time. His signal for interference is "the first indication of any disproportion," and it is instructive that in 65 cases this was forthcoming. The writers, from their own experience, have come to the same conclusion, and inductions at term have been frequent in the past few years. If these experiences are confirmed by other observers it may come about that the commonest indication for induction of labour shall be prolongation of pregnancy.

With regard to the method of carrying out the induction it has to be noted that it may not be necessary to use such mechanical means as bougies, packing, or hydrostatic bags. In quite a number of his cases Watson (*loc. cit.*) employed the injection of pituitrin, sometimes alone and sometimes along with the giving of quinine; C. Hager,²⁷ in 1911, used pituitrin (two hypodermic injections of 0.6 ccm.) in a case in which pregnancy had gone a fortnight past the full term, with the result that an infant weighing 4,225 gr. was quickly expelled alive; Stolper,²⁸ in the same year, reported two somewhat similar cases in which the probable date of confinement had been exceeded by twelve and fourteen days respectively, and in which three and four separate injections of 1 ccm. of pituitary extract served to bring large infants (4,100 and 4,500 grams respectively) into the world alive. Other cases were soon afterwards reported. It may be that the success obtained in such instances was due to the fact that the full term had arrived, that the musculature of the uterus was complete, and that the organ was, therefore, ready to pass into rhythmical contractions. At the same time, the

present writers have secured action of the uterus not only at and after the full term but also at the eighth month of pregnancy by the use of pituitrin. They, however, preceded the pituitrin by two or three doses of ten grains of quinine (to "sensitize" the uterus), and gave the pituitrin in repeated doses of 0.5 ccm. with half hour intervals. In one instance they had to administer chloroform on account of tetanic action of the uterus; and in this case they believe that if this had not been done the infant would have been stillborn. It is obvious that further knowledge of the action of pituitrin upon the uterus at and before term is needed, but there is good reason to hope that by this means the induction of labour may be secured without any local mechanical measures at all, and therefore without the risk of septic infection following thereupon. If pituitrin can be relied on so much the better; but whether this be so or not, the indication in cases in which pregnancy is being prolonged is to induce labour within a few days of the attainment of the full term and by the safest and most certain means available.

Conclusions.

1. Post-maturity of the fœtus is a condition which has a real existence, although it may not be possible to diagnose it from any one of its several anatomical or physiological characters.
2. It may, however, be recognized from the presence of a group of anatomical characters, such as excessive length, weight, and ossification, and easy separability of the dura mater, especially when these are associated with advanced senile changes in the placenta and cord.
3. It is impossible to state with certainty what are the causes of fœtal post-maturity and the prolongation of pregnancy, although several conditions, both in the mother and in the unborn infant, have been alleged to be of etiological importance; until the cause or causes of the supervention of labour at the normal time have been discovered it will be impossible, or at least unwise, to dogmatize about the cause of prolonged gestation.
4. The clinical evidence upon which the diagnosis of the prolongation of pregnancy is founded consists of a number of data none of which is absolutely free from fallacy; the most reliable is the determination of the size of the uterus made by a competent observer using the bimanual examination on several occasions from the second or third month onwards.
5. Whilst the length of the menstruation-delivery interval and sometimes of the insemination-delivery interval can be ascertained, there is no means of calculating the impregnation-delivery period to within eight or ten days, which represents the maximum

insemination-impregnation period. It is impossible, therefore, to state the exact duration of any pregnancy.

6. At the same time, the establishment of prolongation of pregnancy is a possibility and depends upon analogy with what is known to occur in the lower animals (*e.g.*, the cow), and upon several clinical details in history and symptomatology, which, taken together, are sufficient proof; in medico-legal cases in which the medical evidence is conflicting moral considerations often play a determining part.

7. It is impossible to fix an upward limit to the duration of pregnancy; but the greater the deviation from the normal the stronger must be the direct and collateral evidence.

8. The dangers both to mother and child of a prolonged pregnancy are undoubted; they are chiefly associated with difficulty in the passage of the child, and are greatly increased by reason of the unexpectedness of their emergence.

9. Adequate ante-natal supervision provides a means by which the element of surprise can be eliminated from cases of post-mature labour with immediate improvement in prognosis (maternal and infantile).

10. The treatment is prevention of prolongation of pregnancy by means of induction of labour at or soon after the carefully calculated full term of gestation. The method by means of the administration of quinine followed by pituitrin should be given a trial.

ILLUSTRATIVE CASES, WITH OCCASIONAL COMMENTS.*

ACKER, G. N. *Amer. Journ. Obstet.*, 1889, xxii, 1276.

Mother of 4 children and several abortions; former pregnancies of normal duration and labours easy.

L.M.P. 15—20th May. Coitus for only time for several months on May 20th. She left city afterwards and went to seaside, being thus separated from her husband. In mid-June wrote him that she had morning sickness and thought she was pregnant—"which she much dreaded." Quickened end of September.

Delivery: March 23rd; rapid labour; child did not appear unusually large (no weight given). "Bones of head and sutures in same condition as usually found at full term." Duration from date of coitus (and last day of last period) 305 days.

ALLEN, L. M. *Amer. Journ. Obstet.*, 1907, 55, p. 541.

Case I. E. R., æt. 30, husband æt. 34, primipara. L.M.P. June 1st. Confined April 9th. Head never engaged in pelvis owing to large size.

* Several cases have been rejected in which the details given were indefinite. No case of less than 300 days duration has been included.

Craniotomy. Weight after craniotomy 10 lbs. 3 oz. Duration, 312 days from L.M.P.

Case II. S. M., 1-para, age 23, blind for 10 years. Menstruated last Sept. 7th. Labour began July 19th, continued very slowly and irregularly for several days. Head never engaged. Delivered by internal podalic version. Child lost in delivery which was very difficult. Weight 10 lbs. 2 oz. Head very large and hard. Anterior fontanelle very small. Sutures almost completely ossified. "The mother had been unable to get any exercise and had led this sedentary life since her affliction." Duration 318 days from L.M.P.

Case III. W. H., 1-para, æt. 36; husband æt. 44. Menstruated last, April 1st. Confinement expected January 9th. Palpation latter part of December revealed a well-developed fœtus. Head not engaged. Jan. 12th head not yet engaged and apparently quite large and hard. Induction of labour advised but advice refused. Labour began on January 29th and continued for 24 hours. Head not yet engaged. Forceps applied and a dead child delivered after extremely difficult operation. Weight 9 lbs. 10 oz. Head almost entirely ossified. No moulding possible. Duration from L.M.P. 305 days.

Case IV. E. F., æt 37; husband æt. 40. L.M.P. Dec. 1st. Examination on Sept. 20th revealed large head, not engaged; induction advised but not accepted. Seen again Sept. 29th, labour had then been in progress for 12 hours with no advance. Allowed to continue till signs of exhaustion manifest, when cervix was artificially dilated and delivery effected with much difficulty. Child asphyxiated but was revived. Death occurred 36 hours later from melæna neonatorum. Weight 10 lbs. 11 oz. Head very large and extremely hard. Bi. p. 10.3 cm. Bi-T. 9 cm. S.O.B. 10 cm. O.F. 12.75 cm. O.M. 15 cm. Duration 303 days from L.M.P.

ANNAN, ROBERT. *Edin. Med. Journ.*, 1856-7, N.S., p. 712.

Case I. Mrs. —, æt. 34, mother of several children. Uniformly regular in her periods except when nursing or pregnant. Considered herself close on the end of 7th month of her 6th pregnancy and that she would be confined about 5th June, 1851. Delivery 20th July, fully six weeks after expected date. Tedious labour, 24 hours' duration; delivery with forceps; female child, weight 10 lbs. 4 oz. The placenta corresponded in size to the child. Of her former children one was much under average weight and size, the other about 7½ lbs. or a little more, and she has since given birth to another child, a female, 7 lbs. 10 oz. in weight.

Case II. Mrs. —, æt. 44. Married June, 1839. Ceased menstruating at end of December, 1839, and calculated on confinement end of September or beginning of October, 1840. Small stature, well made, and had every appearance of having attained the period referred to. Delivery November 21st. Duration of labour 24 hours; forceps delivery; female still born, 9 lbs. 8 oz. Duration from 1st Jan. 1840=326 days.

Case III. Mrs. —, æt. 26. Four miscarriages in 5 years. L.M.P. April 1st, 1836. Delivery 15th Feb., 1837; male 10 lbs. 14 oz. Duration of labour 24 hours. Duration from L.M.P. 321 days.

ATLEE, WASHINGTON I. *Amer. Journ. Med. Sci.*, N.S., xii, p. 535.

Letter to Isaac Hays, M.D., dated July 29th, 1846. "In reference to the

case of fornication and bastardy I will give you memoranda of two cases occurring in my practice several years ago, viz. :—

Case I. The wife of Valentine Shaeffer, Rapho Township, Lancaster County, lost her catamenia March 22nd, 1832, quickened August 5th, 1832, was delivered March 22nd, 1833, with forceps, of a female child. First presentation, fourth child. (Duration 365 days from L.M.P.)

Case II. The wife of Samuel Henry, same township, lost her catamenia August 6th, 1832, quickened Dec. 25th, 1832, was delivered August 13th, 1833, of a female child. First presentation, third child. (Duration 372 days from L.M.P.)

Both the above children were living, healthy, and unusually large, and the mothers enjoyed excellent health. In these cases there was no possible motive for deception, nor is it probable that the women were deceived. They experienced the same symptoms as in previous pregnancies, and made their calculations as before, engaging my services for a period long before the time they were actually required. From the moment of quickening, they continued to feel the motions of the children daily until the time of parturition. I have not the least doubt of the truthfulness of the evidence in the above cases. The circumstances were so extraordinary to me at the time that I closely investigated them so as to satisfy myself on this point. If these are not cases of protracted gestation how are they to be explained?"

BAKETEL. *New York Med. Record*, lii, 159.

Mrs. E., æt. 27. Expected date March 27th. L.M.P. June 20th, 1896. "Shortly after its cessation she went away on a visit and was absent from her husband nearly 2 months." Her pregnancy had been uneventful. March 25th pains started, sent for nurse. Continued several days and stopped suddenly, leaving her very lame in right leg.

Previous history : 4-para.

Ch. 1. Full time, lived 12 days.

Ch. 2. Twenty-five days after expected date—died soon after birth.

Ch. 3. Difficult labour lasting 78 hours; 28 days later than expected.

Present labour.—Vertex L.O.A. Labour very long and difficult : secondary inertia; duration of labour 5 days, low forceps. Male, weight 11 lbs. 10 oz. Complete closure of posterior fontanelle, anterior "exceedingly small."

The sutures were very firm and could not be felt. Occ. mental dia. $6\frac{3}{8}$ in., biparietal $4\frac{1}{4}$ in., fronto mental $4\frac{1}{8}$, S.O.B. $4\frac{7}{8}$. Duration from L.M.P. 316 days.

N.B.—This case seems well supported, though we do not know exactly when she left home—only "shortly after" cessation of L.M.P. If she became pregnant on her return two months later the duration from insemination would be 256 days, very short considering large size of the child.

BALLANTYNE, J. W. *Journ. Obstet. and Gynec. Brit. Emp.*, 1902, ii, 521.

Case I. Mrs. D. Duration from L.M.P. 320 days : 6 months after quickening, anencephalic, foetus died during delivery. Its finger and toe nails had grown much beyond the tips of the digits; weight 10 lbs.

Case II. Miss E., æt. 30, healthy periods, somewhat irregular, going 6 weeks at one time and 3 weeks at another. L.M.P. mid-June, 1899, last coitus June 21st and July 21st, and not again until October. Foetal move-

ments felt early in December. Birth expected beginning of April but did not occur until June 13th. Fœtus anencephalic male but weighed 4490 grm., length 55 cm. Forceps delivery and great delay owing to enormous shoulders. Circumference of shoulders 42 cm., abdomen at level of umbilicus 34 cm., thigh 21 cm., leg 13 cm. Subcutaneous adipose tissue of thigh measured nearly 2 cm. deep. Duration from coitus of July 21st—328 days.

Case III. Miss F., unmarried, 1-para, æt. 19. Menstruation of 30 days' type. L.M.P. not stated. Quickened in July, 1901. Very difficult, high forceps failed. Craniotomy, cephalotripsy, and cleidotomy on Jan. 4th, 1902. Weight nearly 8 lbs. without brain and cranial vault bones. Length without vault 21 inches. "The patient according to her dates was five weeks past the full term."

BALLARD. *Brit. Med. Journ.*, 1884, i, p. 56.

"I have just attended a girl, æt. 16½ years, the duration of whose pregnancy was 306 days. I have been very careful to guard myself from error with regard to this case, and I believe it may be accepted with every confidence as a reliable contribution to the statistics on this subject. The pregnancy was the result of a single intercourse. The labour was short and easy for a primipara and the child quite within the average as to size."

BARAN, J. *New York Med. Record*, 1900, lviii, p. 194.

Married at 38 years in 1892. Two years later had miscarriages (2½ months). L.M.P. June 11th, 1899, had symptoms of pregnancy at least one week before July 9th at which time her menses should have reappeared. But as expected there was no show. Quickening felt Nov. 1st, P.D. March 18th. But no sign of commencing labour existed even on April 19th, "on which day I decided to force labour and gave a large dose of castor oil." After oil had acted labour pains developed; 1st stage 60 hours. 2nd and 3rd stages short. Delivered on April 22nd. The child was large, bony but not fat; it had considerably elongated nails, but no unusual growth of hair. Duration 316 days from beginning of last period.

BENSINGER, MAX. *Centrbl. f. Gynäk.*, 1893, p. 816.

Healthy woman, two previous pregnancies 6 and 2 years before; normal labours at full term and normal puerperia; infants of normal weight, alive and well. Abortion in May, 1892, at 2-3 months.

Now (July 23rd) is 27 years old, well nourished and intelligent, worried because of her long pregnancy, some abdominal pain but no other troubles.

L.M.P. 10-15th August in every way as usual. She felt symptoms of pregnancy at beginning of September, and saw a doctor who diagnosed pregnancy with certainty: expected her baby from 17th May onwards; at present (July 3rd) her abdomen is greatly distended, uterine fundus under the heart, back of child to the left and small parts to the right and front; head in brim and slightly movable. Fœtal heart to the left a hand-breadth from umbilicus, loud and clearly heard 130—140. Per vaginam. Slightly movable, large head felt in brim; cervix taken up, very strong bones, no sutures to be felt. Spontaneous labour on 12th July after 12 hours of pains; head born easily because of former perineal tear, but the very broad shoulders caused the midwife difficulty: placenta very large and very thick. Liquor amnii very little. Weight 6,000 grms.: length 58 cm. Occ. frontal dia. 12.75 cm.; Bi.p. dia. 10.25 cm.; Bi-temporal dia. 8.75 cm.; O.M.

15.00 cm.; S.O.B. 10.5 cm.; Circumf. of head 37.5 cm.; Diam. of shoulders 18 cm.; Diam. of thorax 12 cm.; Diam. of hips 12.5 cm.; Circumf. of shoulders 43 cm.; Circumf. of thorax 36 cm.; Circumf. of hips 36 cm.

Normal puerperium. Rose on 9th day. Happily married but her husband died during the first two months of this pregnancy, but she was an "honourable woman." Duration from last day of L.M.P.=331 days.

N.B.—This is one of the best substantiated cases in the literature.

BLAKE, C. P. *Edin. Med. Journ.*, 1893-4, xxxix, p. 180.

A.R., æt. 25, periods always regular, married 2 years. Two abortions (3rd month). L.M.P. Sept. 22-25. During the period husband left home on business, not returning till Oct. 15th. Next period was missed, and very soon had morning sickness, date calculated July 22nd. Strong regular pains set in on August 3rd, and everything pointed to a speedy delivery but pains gradually diminished, and on Aug. 6th ceased entirely. Child born Sept. 5th. An unusually large one (no weight given); "labour perfectly natural." Duration 323 days from date of coitus of Oct. 16th, or 345 days from L.M.P.

CAREY, R. J. *Lancet*, 1873, i, p. 293.

Mrs. B., 1-para, æt. 32. Always regular, had morning sickness for the first time during the last week of February, 1872; quickened in July and expected to be confined in last week of November. At this date the breasts were full and for 2 or 3 days she had irregular pains which then went off. The first week in January she again was out of sorts for 2 days but nothing came of it. On February 8th she was delivered of a large male child 23 inches long, with the head well ossified. Diameter: biparietal, 4½ in.; occip. frontal, 5½ in.; occipito mental 6½ in. Hands and legs were large, but body not.

"Now though morning sickness commenced in February, and from the development of the child conception must have taken place then, yet it is to be noted that the catamenia occurred three times subsequently in normal quantity and at the usual intervals. The last was in the last week of April. . . . If we reckon from Feb. 24th, 1872, pregnancy has lasted 350 days, but it may have existed a few days before sickness commenced. The lady's illness in November, January and *now*, seems to support the opinion that throughout pregnancy at every menstrual period a tendency to discharge the foetus exists, but is resisted."

N.B.—Reckoned from L.M.P., viz. 30th April, duration=285 days. It is probable that pregnancy started only then and that the sickness in February was not due to pregnancy and that she was deceived regarding foetal movements in July.

CHAMBERLAIN, W. M. *Amer. Journ. Obstet.*, 1879, xii, p. 750.

A young woman had a child in March, 1877, which she nursed till June 3rd, 1878. She was quite healthy and her periods regular and of 28 day type. On June 3rd, 1878, had vaginal hæmorrhage lasting two hours, and which she regarded as an indication for weaning her child, which she began to do. Very early in July she was troubled with nausea. Felt life on Oct. 1st. Delivery on May 6th following, viz., 340 days after L.M.P. There was a "certain co-ordination of movement" in the child which Chamberlain had never seen in a child at term. No weight given nor

history of delivery. The posterior fontanelle was very closed, "the anterior to a considerable extent."

N.B.—Particulars are all too indefinite. There is no evidence that the hæmorrhage on June 3rd, and from which the duration is dated, was a period at all. The absence of periods after that date may have been due to other causes than pregnancy, *e.g.*, prolonged lactation. The only confirmatory evidence is the "nausea very early in July" and quickening on Oct. 1st.

COLLINS, J. *Edin. Med. and Surg. Journ.*, 1826, xxv, 245—261.

Act. 24. Multipara, stout and well made. Confinement expected end of October, 1824. In beginning of October Collins examined her. Fundus then to epigastric region and "gave to the abdomen the form and appearance it assumes at end of 8th month." Per vaginam the fœtus felt like an 8 months' one. She had felt quickening in the 6th month from cessation of menses. Two months after expected time labour set in and lasted two hours. "Fine and active boy." Child screamed loudly before birth after rupture of membranes, and when head was on the perineum. As soon as born "the little urchin, rolled in the usual covering, placed one of his fingers in his mouth and began to suck it with as much eagerness as if it had been the nipple of his mother." "In size he seemed to exceed the ordinary standard of children at birth, and his mother assured me that in strength and bulk he was much superior to her other children at the same period."

FANCON (de Lille). *Semaine Médicale*, 1892, xii, p. 386.

"I have observed a case of prolongation of pregnancy of at least three weeks, with a fœtus weighing 11½ lbs. As it occurred in a woman with a rickety pelvis and in whom there was a transverse presentation, the delivery after version was extremely difficult."

(This is the entire report.) Duration 301 days.

GASKILL v. GASKILL. *Times Law Reports*, Aug. 12th, 1921, p. 977.

The petitioner, Mr. Gaskill, a soldier at the time was granted leave of absence from Sept. 29th to Oct. 3rd, 1918. He overstayed his leave by one day and returned to duty on October 4th. He gave evidence that on Oct. 4th he had sexual intercourse with his wife for the last time. He left for Salonika on Oct. 12th and did not return to this country until Sept. 1919. On Sept. 1st, 1919, his wife gave birth to a child, the lapse of time since the husband's departure being 331 days. Mrs. Gaskill had consulted Dr. Munroe on May 9th, 1919. From the facts stated by her he drew the inference that the birth of the child would take place in July—an inference which must have been founded upon the fact that the last menstrual period occurred in October.

Dr. Munroe said that the child was exceptionally large and the labour was prolonged. He did not weigh the child at birth, but he judged that it weighed about 11 lbs.

The only evidence of adultery was the abnormal length of pregnancy. "No other fact or circumstance has been adduced which in the slightest degree casts any reflection upon the chastity or modesty of the respondent who has on oath denied adultery. I can only find her guilty if I come to the conclusion that it is impossible, having regard to the present state of

medical knowledge and belief, that the petitioner can be the father of the child. The expert evidence renders it manifest that there is no such impossibility. In these circumstances I accept the evidence of the respondent and find that she has not committed adultery and accordingly I dismiss the petition."—(Extract from the Judgment of the Lord Chancellor.)

HAGER, G. *Zentralbl. f. Gynäk.*, 1912, xxxvi, p. 304.

iii-para, æt. 39. First child born 34 days after the expected date of delivery, spontaneously after a long labour; it was stillborn, weighed 5,500 grams, and had a length of 58 cms. The second pregnancy ended in an abortion at the third month. The third labour was due on Nov. 1st, 1911, when the abdomen was found to be enormously distended; on Nov. 15th labour had not begun so three injections of pituitrin (0.6 cm.) were given and the child, a male weighing 4,225 grams, was spontaneously born alive. The placenta was expelled easily.

HAYES, H. L. *Amer. Journ. Obstet.*, 1893, xxviii, p. 794.

Mrs. E. B., æt. 25. Mother of two children both born after normal pregnancies. L.M.P. April 30th—6th May. "Soon after this felt morning sickness and other symptoms with which she was familiar through her previous pregnancies, which convinced her she was again enceinte." On August 26th (3 months after L.M.P.) she visited a Dr. J. Morgan Barber wanting him to procure abortion. This he of course refused to do, "but confirmed her in her belief that she had been pregnant about 3 months." (Dr. Barber, on being afterwards questioned, confirmed these facts from his books.) Fœtal movements were first felt in mid-November, viz., at mid-term of the pregnancy, and $6\frac{1}{2}$ months after L.M.P. The pregnancy was normal except that in the last three months she had a feeling of oppression or smothering.

On May 28th, 1893, the husband came to see Dr. Hayes, complaining that his wife had gone over time. On examination he found the abdomen enormously distended and fœtus presenting by the vertex. He prescribed gr. x. quinine once daily and on 30th May a 9 lb. female child was born naturally, labour having lasted 24 hours; no further particulars given regarding child. Duration=389 days after L.M.P.

N.B.—There is no absolute proof of there being a 3 months' pregnancy on August 26th, e.g., it is not stated that a bimanual examination was made on that date and if it was made to omit saying so is an important omission.

Hayes evidently believes that Barber made a vaginal examination on August 26th, as he says: "this visit is the keystone of the whole structure." It is then a pity that he did not specifically state that a vaginal examination was made and the size of the uterus!

Quickening occurred at $6\frac{1}{2}$ months, viz. mid-November. It is more likely that there were two missed periods, viz. May and June, before pregnancy commenced, and that on August 26th her pregnancy had not advanced more than one month at most. Note that Hayes only saw her for the first time on May 28th, 1893. Details given are too indefinite to admit this case as reliable.

HENDERSON. *Amer. Journ. Obstet.*, 1879, xii, p. 393.

Multipara, æt. 35. First seen in January, 1860. L.M.P. early part of previous November. In January when first seen had slight hæmorrhage from uterus and pains in back and abdomen. Uterus enlarged to "about

size we would expect to find it at $2\frac{1}{2}$ months." Morphia and rest ordered because of diagnosis of threatened abortion. "She continued to develop until about the proper time when she quickened, which led her to suppose that she would be delivered about mid-August." He saw the patient frequently from the time he had been called and "believed from her appearance that she would be confined about the anticipated time." She, however, continued for a month or more over the expected period, and becoming uneasy, again sent for him. He found "the uterus to all appearance at the full period of gestation, but the os was not in the least dilated." About Nov. 1st he made another examination and found the uterus apparently larger but in every other respect about the same as previously. He now left the patient in charge of another physician as he expected to be absent a few months. On 15th February he was sent for again as patient and physician were becoming uneasy. He found her in good health, the abdomen enormously dilated; no labour pains had so far set in. Os considerably dilated and dilatable. Labour came on in a day or two, was tedious and painful, ending in forceps. Child weighed $16\frac{1}{2}$ lbs. (7,500 grms.), was stillborn, and had evidently died during labour as movements were felt up till 3 hours before delivery. Duration from L.M.P. 444 days! (counting from beginning of December).

N.B.—The most obvious criticism is that an abortion took place in January and that pregnancy again occurred before menstruation was established. The date of quickening is not definitely stated. It is remarkable, however, that when seen in September the uterus was about the size of a nine months' pregnancy (this might be accounted for by the great size of the fœtus), also that she had been under observation from January until then, and Henderson "believed from her appearance that she would be confined about the anticipated time."

It should, however, be noted that the case was not reported until about 20 years after it occurred!!

HENDRY, R. A. *Proc. Roy. Soc. Med.*, Dec., 1921.

Mrs. B., æt. 41, 4 children, youngest 18 years, and three abortions scattered between the live births. Seen first at Ante-Natal Clinic on Nov. 20th, 1917. Her husband went to Australia in 1913. He returned with his regiment and while in Liverpool on leave spent night of May 14-15, 1917, with his wife and then returned to his unit. On Nov. 20th, six months later, Mrs. B. came to A.N. Clinic and said she had menstruated regularly until April 12th and that her periods had been absent since then, except for flooding in June—exact date not remembered, and that she was getting stouter and could feel fœtal movements. It was noted on abdominal and vaginal examination that uterus was size of six months' pregnancy, *i.e.*, corresponding with presumptive period of gestation, and fœtal heart not heard. Her next visit was on Dec. 18th when uterus was size of seven months; fœtal movements present, fœtal heart not heard. She again attended on January 15th and February 19th, but was not examined again till March 19th, 1918, when a month overdue; uterus noted to be at term. F. H. heard. Movements felt and head in pelvic cavity. On April 2nd abdominal examination as on March 19th, cervical canal not taken up, internal os admitted one finger.

Patient delivered April 8th—female—328 days after coitus and 361 days after L.M.P.

“The midwife informed me that the labour was quite straightforward, that there was no excess of liquor amnii, and that the baby was of average size.” On the 17th day it was weighed at an Infant Welfare Centre and its weight was then 7 lbs. 4 oz.

JAMES, W. S. *New York Med. Journ.*, 1894, vol. lx, p. 343.

Mrs. S., German, æt. 27, 5th pregnancy, other labours normal. L.M.P. April 22nd, 1893. On February 3rd, 287 days after L.M.P., she was taken with supposed labour pains; a midwife was called who said it was not true labour and returned home; the pains subsided. Dr. James was called on Feb. 24th and found first stage of labour was over, but there had been no pains since Feb. 3rd. He thought that by mechanical irritation of the os he might be able to induce a contraction, but failed. Quinine also had no effect. Ergot seemed to induce a slight painless contraction of uterus. Membranes were now ruptured artificially and forceps applied to head above brim. “She was delivered quite easily of a 10 lb. baby girl alive but weak.” Both did well: no other details given. Duration, 308 days from L.M.P.

JOYNT, C. *Dublin Quart. Journ. Med. Sci.*, 1866, xliii, p. 377.

Æt. 30. Six previous pregnancies including two miscarriages. Came under his care in November, 1863, for frequent and excessive menstruation, and ovarian pain. No evidence of any organic lesion found on examination. She menstruated in December, 1863, from 28th Dec. till 2nd Jan., 1864. Morning sickness mid-January. Its characteristic nature made him attribute it to pregnancy, “especially as it had been an early and troublesome complaint in all previous pregnancies, and this opinion was confirmed by the non-occurrence of the menses at the expected period.” Sickness continued till last week of March; on 28th March she “first distinctly felt foetal movements.” Pregnancy was normal till May 12th when she was threatened with a miscarriage—severe pains and hæmorrhage which passed off on treatment. On the evening of 3rd October (expected date of confinement) labour pains started, which increased in force until the following morning, when they abated and disappeared during the day. Pains recurred and died down daily for the next five days. “During an intermission I examined her and found the os soft and patulous and the cervix obliterated.” Pains continued to recur at uncertain intervals till 21st Nov. at 12 midnight when he found os size of one shilling. Labour went on favourably and a mature male child was born on 22nd Nov. at 5 a.m. “The only thing at all noteworthy about the child was that it was born with a tolerably good head of hair.”

The patient had been separated from her husband in order that she might be under Joynt's care, being only visited by him occasionally. He was absent from 26th Dec., 1863, till 6th or 7th January, 1864, when he returned and remained with her till the 10th. This fixes 10th January as the latest possible date of insemination.

Duration from date of last possible insemination=317 days.

KELLY, A. L. *Glasgow Med. Journ.*, 1869—1870, New Series, ii, p. 512.

M. A., æt. 25, single, strong, healthy and well developed, “was spending a few days with her sister in a country farmhouse when on 9th May, 1869, a young man just returned from America, who had formerly been a lover

called, found her alone, her sister and husband having gone a short distance to a neighbouring farm, commenced to tease and jostle her, subsequently to violate her which he succeeded in accomplishing after an obstinate struggle; indeed so severe and lengthened, that she became exhausted and unconscious, and knew not what had occurred for a long time afterwards. Such is this young person's statement, which I have no cause to distrust because previous to this misfortune her conversation and actions were irreproachable."

"Fully three weeks had elapsed since her last menstruation: she therefore expected another change in a few days which did take place but was small in amount and only continued part of one day." Between two and three months after this Kelly was consulted regarding her: she complained of sickness, loss of appetite, vertigo and general weakness, and had had painless sudden profuse loss of blood that morning per vaginam. She then made the above confession. She had two similar hæmorrhages on subsequent occasions, with pain and uterine contraction, put down to violent exertion. Pregnancy continued normally thereafter. Labour set in on March 8th; forceps delivery. March 10th, female, large and living. Duration from coitus 305 days.

LAMB, J. A. *Journ. Amer. Med. Assoc.*, 1905, xlv, p. 1000.

Mrs. T., æt. 46, 5 ft. 5 in., weight 155 lbs. Always healthy, nine previous normal confinements. Eldest child æt. 23, youngest 5, all alive and well. Had always vomited in first three months of pregnancy, never at any other time and had never been more than one week out in estimating her probable date. Since birth of her last child had occasionally missed one or two periods which she thought was due to change of life.

History of pregnancy: June 29th, 1904, began vomiting, and a few days later menstruation failed to appear. L.M.P. June 5th—9th, 1904. Vomiting lasted till March 1st, 1905. On July 1st her husband, whose work called him to Idaho, left home and did not return till after birth. Before leaving both he and his wife considered her pregnant. Fœtal movements first felt on October 15th, 1904. On May 9th she was given quinine sulphate gr. v. in capsules, every 4 hours, and after taking four, pains started. Delivery March 10th, labour lasted four hours, and was natural: male anencephalic, 22½ inches long. Weight 10 lbs., bisacromial circumference 16 in., bitrochanteric 14 inches, dead born.

Duration from L.M.P.=339 days. Duration from last possible coitus, 313 days.

LUTZ, C. *Aerztl. Int.-Bl. (München)*, 1879, xxvi, 475.

V-para, called in on account of transverse presentation and prolapse of cord; pains entirely ceased during extraction of fœtus; difficult extraction, child dead born=4,500 grms. Length 58.5 cm. According to her recollection pregnancy had lasted 44 weeks=308 days.

LYNCH. *Brit. Med. Journ.*, 1886, ii, p. 859.

Married. L.M.P. August 6th, 1885. Delivery July 6th, 1886. Three or four days after L.M.P. "had an idea that she was pregnant as she was sick every evening." About Sept. 25th she noticed a slight discharge which continued for 3-4 days and only in the mornings. She quickened on Dec. 8th. On May 8th (*i.e.*, 273 days after L.M.P.) had "regular labour

pains " which " at first came on once a week or fortnight but latterly every 2 or 3 days." Labour natural and of rather short duration. Female, large and about the average weight. Duration from August 6th—July 6th=334 days.

MANLEY (reported by T. R. BECK). *Amer. Journ. Med. Sci.*, 1841, N.S., i, 59.

Mrs. G., Polish. In Feb. 1840, Manley was requested to attend Mrs. G. in confinement, expected 10th or 15th April following. She had previously been his patient, having treated her for hæmoptysis. On 7th April another attack of hæmoptysis (due to consumption). Delivery 29th May. Both she and her husband were " Polish exiles of excellent education and morals, and highly esteemed among their acquaintances." " Her husband had left her on business on 13th July, 1839. He did not return till the last of November. During the first three months of her pregnancy she was twice unwell or menstruated, but as she was 39 years old and had borne six children and the amount was trifling she, in place of thinking herself pregnant, thought it furnished evidence of the approaching cessation of the function, and particularly as the ordinary accompaniments of pregnancy such as sick stomach, toothache, etc., were altogether wanting. On the 30th Nov. she felt quickening, which allowing $4\frac{1}{2}$ months for the mean time of the appearance of that sign made her reckoning for the 15th April correct."

Brow presentation, nothing else peculiar in delivery: weight $9\frac{3}{4}$ lbs. (male). Child remarkably strong: posterior fontanelle obliterated; anterior very small, " not exceeding the size of a 5-cent. piece": duration 321 days from coitus.

MAIDLOW. *Lancet*, ii, 1902, p. 990.

I-para, æt. 25, married April 25th, 1901; L.M.P. (last day) April 25th. Fœtal movements early in July. Delivery March 18th, 1902. Male anencephalic, 14 inches long, 11 lbs. weight; bisacromial diameter 8 inches; slow difficult vertex delivery; great difficulty in delivery of shoulders; duration 325 days from L.M.P.

MILLER. *Practitioner*, 1918, Vol. 100, p. 94.

" Mrs. N—, ii-para, æt. 28. Consulted me as to her condition on May 6th, 1916, when I found she was suffering from persistent leucorrhœa, sickness and cessation of menses since February 12th, 1916. No marital relations had taken place since before the last menstrual period. On examination and questioning I found that she was distinctly pregnant for the second time and that such pregnancy had advanced three months. I calculated that delivery should take place about November 19th, 1916. . . . I attended her for some time for the local discharge, and as her husband had been called up to the Forces no marital relations took place during this period.

On November 19th, 1916, I was sent for, as labour pains had begun fairly strongly, and a discharge of liquor amnii had taken place. On examination I found the os dilated to the size of a shilling, and the vertex presenting. Pains were very slow—15 minutes interval, and of short duration. These continued for just over 24 hours and then entirely ceased. The case dragged on slowly, and to my great surprise and anxiety, until at last on Feb. 11th, 1917, labour definitely set in, and she was delivered of a healthy

female child on Feb. 12th, 1917, after a very tedious labour, which was terminated by forceps, and after twelve months cessation of menses, and undoubted pregnancy, for no marital relations had taken place since just previous to Feb. 12th, 1916."

Recovery was slow but good. "Fœtal movements during the last three months were very feeble." Duration from L.M.P.=365 days.

McFARLANE, W. *Glasgow Med. Journ.*, 1899, lii, p. 181.

Mrs. S. Abortion at third month, Feb., 1887. Menstruated in following March. L.M.P. (last day) 3rd May, 1897. Quickening in September. During last two months of pregnancy could not sleep at night owing to oppression and want of breath, and in mornings felt helpless and exhausted. Delivery March 29th, 1898, viz., 330 days from L.M.P. Very large anencephalic (size and weight not given). The labour was difficult and there was great difficulty with the shoulders. The mother is stout, of middle height, pelvis just minor. At last confinement she went 10 days over her time. Child weighed 8½ lbs. and was alive.

INGLEBY—MACKENZIE. *Brit. Gynec. Journ.*, 1889, v, p. 427.

E. C., æt. 32. i-para, married 10 years. Always menstruated regularly to the day, viz., 28th and 29th of the month. L.M.P. April 28th, 1888. Fœtal movements first felt September. Had false pains and sent for McKenzie Jan. 1st, 1889. Had a "show" March 5th, was in labour till March 8th., viz., 66 hours. Duration from L.M.P. 314 days. No further details given.

MCTAVISH, D. A. *New York Med. Journ.*, 1889, xlix, p. 413.

Mrs. B., æt. 26, healthy, always regular. Married 28th March, 1888. L.M.P. March 28th—April 2nd. "On 14th April she consulted me about her condition, relating her symptoms as dizziness, faintness and squeamishness of the stomach, especially on first rising in the morning, but she did not vomit till the latter part of June. I diagnosed the case as pregnancy. She did not menstruate again."

F.M. August 22nd. Delivery 18th February, 1889. Female, 12½ lbs.

"Reckoning her period of gestation from advent of symptoms—April 7th to February 18th," the duration=318 days. From L.M.P.=323 days.

MACDONALD, K. N. *Brit. Med. Journ.*, 1883, ii, p. 13.

II-para, æt. 28. L.M.P. August 16th, 1882. Quickened a few days after Christmas. Delivery June 21st. Prolonged second stage; head on perineum two hours though pains were strong: natural delivery of head, but difficulty in extracting body. Weight 12 lbs.; length 22 inches. Duration from L.M.P. 308 days.

MAUS, L. M. *New York Med. Journ.*, 1889, xlix, p. 519.

Mrs. M., æt. 29. L.M.P. May 13th—17th. Early in June following, complained of intense nausea or morning sickness, and distaste for food, with inability to retain it. "These early developments, together with absence of future periods, were sufficient for an opinion of impregnation." Fœtal movements Sept. 17th and frequently after Sept. 24th. Expected date of labour last week of February. Became very large during March. April 14th, child born, healthy male, 9 lbs. No mention of difficult delivery. Duration from L.M.P. 334 days.

MARTIN, A. *Zeitschr. für Geburts. u. Gynäk.*, i, 44.

II-para, æt. 38. Two years ago bore a strongly developed child, forceps delivery: after a long convalescence, menses started 12th June, 1874, for last time. "Became pregnant after by the father of her child, a strongly built young landed proprietor." Pains started 19th April, 1875, one month after expected date. Vertex third position, pelvis normal, head low in pelvis, forceps delivery failed. Woman much exhausted, pulse hardly felt, pains few and useless, no fetal heart sounds. Vagina much swollen also vulva. Craniotomy and cephalotripsy, and even then great difficulty in delivering head. Podalic version done. Placenta adherent; manual removal: weight of child without brain=7,470 grms.; breadth of shoulders 16 cm.; circumference of shoulders 47 cm.; intertroch. diam. 15 cm.; hair of head strongly developed; bones of head firm and large, fontanelles small. "On the navel ring was lacking the red stripe usually found in new born children. Placenta large but showed nothing abnormal. Mother died six days after from peritonitis. There was a rent in lower uterine segment stretching into left parametrium."

Duration 311 days from L.M.P. (1st day of).

MERRIMAN, SAMUEL. *Medico-Chir. Trans.*, London, 1827, xiii, p. 339.

Case I. Mrs. I. had in 10 pregnancies borne 11 children. She had on all of these occasions become pregnant almost immediately after the monthly intermission. She was regular in March, 1813, and had no appearance after the 7th inst. She was led to believe that she conceived on the 8th and made preparation for confinement in early part of following December. Delivery 11th Jan., 1814, viz., 309 days, not including the day of supposed conception. "The child, a boy, when born was larger than most if not all of her former children, and her labour was of several hours longer duration. She was once pregnant afterwards, but this pregnancy presented nothing unusual."

Case II. "Mrs. N., had lain in of one child and the number of days which elapsed on that occasion between the catamenial intermission and the labour was 303. Mrs. N. was unwell in November, 1822; she recovered on the 15th and had not the slightest appearance afterwards. Her labour took place on 5th October, 1823, 323 days from the day of intermission."

Mrs. N. has a "very nervous temperament, and has always been irregular in her periods of menstruation. The child was large, but not larger than might be expected from a mother who is herself above the usual size of females." He thinks that this case, therefore, cannot be "adduced as satisfactory evidence of protracted gestation."

MUNDE. *Amer. Journ. Obstet.*, 1879, p. 751.

Mrs. B., æt. 34, mother of four children. L.M.P. 28th August, 1875. Coitus August 30th; symptoms of pregnancy, including morning sickness, indicating themselves within 10 days. She had no doubt that she was pregnant. Quickened at $4\frac{1}{2}$ months; delivery August 8th; labour lasting six hours and natural: head firmly ossified—"the fontanelle being firmly closed though the head was small." No other appearance of an over-developed fœtus existed. Duration from L.M.P. 345 days. Duration from coitus 343 days.

No data given as to weight or length of child, but was probably of average size as "no other appearance of an over-developed fœtus existed."

OLIVER, J. *Brit. Med. Journ.*, 1902, ii, p. 1950.

Æt. 36. Consulted him on February 19th, 1902, on account of general abdominal discomfort. Had missed her period in January and the December period, which occurred about the correct date (20th), was less prolonged (2 days) and more scanty than usual. She wished to know if pregnant.

Uterus enlarged to three inches above pubes, and a fibroid, size of a tangerine orange, in right half. "Breasts were in appearance characteristic of pregnancy, and after taking the fibroid into consideration I informed her she was about two months advanced in pregnancy, and that the confinement would in the ordinary course take place about Sept. 24th."

Movements first felt "towards end of April." Delivery Oct. 21st. Duration from L.M.P. 305 days.

"The child, a female, is living; in this case there can be no doubt about the facts as they were recorded by me as early as February 19th."

No note of nature of labour or of size of child.

PARK, R. *Glasg. Med. Journ.*, 1873, N.S., v, p. 470.

Was called to see Mrs. C. on July 7th, 1873. Had expected confinement one month previously and about that time had a show and pains and sent for midwife. Pains passed off.

"Her husband had returned home from sea after an absence of ten months and was naturally surprised to see her in the condition in which she was."

Tall, raw-boned, æt. 37, plain looking, narrow forehead and angular features. Seven children and one miscarriage. Two of the children are dead, one during delivery (breech) and other, æt. 4, from hydrocephalus.

Husband, æt. 38, handsome regular features, muscular, 5 ft. 6 in., weight 20 stone.

L.M.P. August, first week, 1872. 13th August=last day of period. Her husband came home to her on 15th and stayed two weeks. Dates commencement of pregnancy from 15th "as felt differently this time from what she did on former occasions." Avers most positively that since her marriage (!!) no man had ever had access to her except her husband and that if "she had been messing about with other men" she knew better than to allow herself to go longer than nine months.

Delivery July 13th: no hydramnios: male, anencephalic, weight 8¾ lbs. Circumference of chest under armpits 16 inches: breadth from shoulder to shoulder 5¾ inches: girth of middle of thigh 8 in. "The features and conformation of the fœtus bore so striking a resemblance to those of the father that no doubt as to the *paternity* was left upon my mind nor on that of anyone who took an interest in the case." Duration from 15th August=331 days.

PHILIPS, J. *Lancet*, 1900, i, p. 94.

Primipara, single. Intercourse declared to have taken place on one occasion only, Sept. 6th, 1898, aged then 16⅓ years. Periods regular, duration one week, last day of L.M.P. August 24th, 1898. "In consequence of her missing her next two periods in September and October her aunt, with whom she lived, took her on October 24th to see a medical man in London, to whom the girl confessed that she had had intercourse, and he expressed the opinion that she was most probably pregnant." (N.B.—*It is not definitely stated that a bimanual examination was done.*) In April,

1900, Philips saw her and then calculated the probable date of confinement to be May 29th. The child was born July 14th, 323 days after L.M.P. and 310 after coitus. Philips says "there is not the slightest doubt that no period occurred after August as in addition to the girl's own statement her aunt, who always looked after her linen, declared that there was not a stain subsequent to the August period." Labour was "perfectly normal: presentation the usual cephalic one." The child was not weighed but "though well proportioned and of good size it did not seem at all unusually large."

N.B.—In a girl of 16 there are liable to be periods of amenorrhœa apart from pregnancy, and it is well known that it may be caused through fear of pregnancy. Her own statement as to there being no coitus after Sept. 6th can hardly be accepted: and there is no evidence as to size of uterus at examination on Oct. 24th or even that a bimanual examination was carried out.

PUECH, P. *Bull. Soc. d'obstét. de Paris*, 1907, x, p. 272.

Æt. 40 years. Always healthy. Menstruation 28 days type. Duration 5-6 days. Sixth pregnancy.

Previous pregnancies.

- Ch. 1. F. 3,150 grms.; forceps R.O.P.
- Ch. 2. M. 3,700 grms. Natural—12 hours' duration.
- Ch. 3. F. 4,750 grms. Alive, 14 days after expected date. Breech, prolapsed cord. Manual extraction: post partum hæmorrhage.
- Ch. 4. F. alive, 4,095 grms. Breech—3 weeks over expected date. Alive—manual extraction, profuse post-partum hæmorrhage.
- Ch. 5. Born 15th March. In consequence of previous protraction of pregnancy date had been fixed for February 15th, the date of her 10th period had she not been pregnant. On this date some slight pains appeared which made him think labour was imminent, but proved a false alarm, and pregnancy continued till March 8th "without the least incident." On 8th March the foetal heart ceased to beat. On 15th March a slightly macerated child was born, weight 5,000 grms. Manual removal of placenta 1½ hours after birth; post-partum hæmorrhage.

Sixth Pregnancy (the one in question). L.M.P. Sept. 15--20, 1906. Periods so regular that their absence in October left no doubt in her mind that she was pregnant. The tone of the uterus appeared to be feeble. In the first days of June the foetus was lying transversely: external cephalic version done on June 13th. July 22nd a bougie was introduced into the uterus to induce labour. Two days after, no pains having occurred, the bougie was withdrawn and the lower uterine segment packed with gauze. On 25th at 6 a.m. some pains started but continued feebly. He then ruptured the membranes. The pains ceased at mid-day completely. At 5 p.m. the liquor became tinged with meconium. The uterus was then showing no tendency to contract and the cervix seemed to be closing up again. Under an anæsthetic the cervix was dilated manually and a foot brought down. Extraction of the foetus was carried out very slowly and the child, a girl, began to cry as soon as born. No post-partum hæmorrhage. Weight 4,560 grms. Duration 308 days from L.M.P. and labour induced,

RINGLAND, J. *Dublin Quart. Journ. Med. Sci.*, 1865, xxxix, p. 493.

Multipara, insemination 12th June. Quickening early in October: delivery 10th April, 1865—healthy, full grown mature child; duration from insemination 302 days.

There was no possibility, "owing to a variety of circumstances," of insemination occurring during the year 1864, exceptions on 23rd May, 12th June, or 15th September. The last was precluded by the maturity of the child as well as by the period of quickening.

On 7th February, 1865, she discharged "a large quantity of liquor amnii accompanied by irregular uterine pains which, however, yielded to treatment, and did not recur until 12th March—273 days from 12th June. From that time it frequently returned, at greater or shorter intervals but always accompanied by uterine action, which at first produced only slight dilatation of the cervix uteri. This enlargement of the os continued to increase from day to day during the ensuing fortnight on each recurrence of uterine contraction until it had attained the size of about a half crown piece, when no further enlargement whatever occurred until the morning of her delivery."

RODENSTEIN, L. A. *New York Med. Journ.*, 1882, xxxv, p. 477.

Case I. Mrs. A. R. Ceased to menstruate August 15th, 1875. Felt life at the proper time, and should have been confined May 15th, 1876, but was not delivered until July 7th, 1876, "carrying the child 10 months and 21 days." "I was a number of times asked to examine the patient during this extended period of gestation, to determine whether what she supposed was a child was not really a tumour." Duration from L.M.P. 327 days.

Case II. Mrs. A. R. The same lady mentioned in Case I ceased to menstruate on Dec. 1st, 1880, felt life April 15th. Expected confinement Sept. 1st, 1881. "On that day I was called as she had some slight symptoms of approaching labour. I found the os well contracted; pains were feeble and soon disappeared. I was called again on Nov. 4th and found her in labour which had begun 24 hours before." Instrumental delivery. "The facts as related by the woman were as follows: Coition took place the very day menstruation ceased, and every day thereafter for five days. On December 7th the husband left home and was absent six weeks. Before his return gestation was fully established." Duration from L.M.P. 338 days.

RODRIGUE, A. *Amer. Journ. Med. Sci.*, 1845, N.S., x, p. 338.

Commonwealth v. Jeremiah Wilson Porter. Indictment for fornication and bastardy—January term, 1844, for Cambria County, Pa.

Defendant pleaded not guilty. The ground on which the defence rested was "protracted gestation," extending to 317 days, viz., from coitus on Sept. 27th till delivery on Aug. 7th.

Margaret Shoup deposed "I am a single woman, aged 23. I am the mother of a female child born on 7th August, 1843. Jeremiah Wilson Porter is its father. It was begotten on the night of 24th Sept.; he had connection with me more than once—not more than twice on that night. It was three or four weeks after that I knew I was pregnant. I had connection with no man after that nor before that." Five weeks before the birth she had her courses for two days, and about this time was very sick;

had "*pains which continued for a long time,*" and had the pains frequently after this till birth of the child.

It was proved that the defendant was absent after connection and that he did not return till after the birth. "No evidence was produced to impeach the character or conduct of the female, but on the contrary she invariably bore a good reputation, and it was also proved that under promises of marriage the plaintiff had yielded to the desires of the defendant."—*Verdict Guilty.*

ROSS, E. FAIRFAX. *Australas. Med. Gazette*, 1896, xv, p. 280.

Mrs. —, æt. 31. Third pregnancy. First normal—male, æt. 8. Second premature—7 months, female, lived two weeks, born three years ago. "Felt foetal movements 30th Sept., 1895, but doubting their accuracy appealed to me. I felt the foetal movements distinctly on October 6th and noted it in my diary. I continued to feel them every week till delivery on May 20th," *i.e.*, 227 days after the first foetal movements. Ross asks how soon may foetal movements be felt? "Presuming they may be felt at the end of third month . . . 84 days must be added," making 311 days' duration from *conception*. The date of the L.M.P. in this case was no guide as the "molimina with some discharge continued for three months after date of appearance of foetal movements." False labour pains with blood-stained mucus set in on May 13th but died away. True pains started on May 19th but were weak, and on 20th May os only 2/6; cervix not taken up. Chloroform given; os manually dilated. Membranes found extremely tough, ruptured with finger, forceps applied to head above brim "without undue difficulty," female child delivered. After waiting three-quarters of an hour for placenta it was removed manually; it seemed firmly attached to left corner. It seemed healthy except for great thickness of membranes; posterior fontanelle closed, anterior "very small and firm, and its pulsation not apparent." Child not weighed but "judged her to be between 9 to 10 lbs. There was little vernix caseosa." He is "well assured that she carried her child for 311 days or more."

SIMPSON, J. Y. *Month. Journ. Med. Sci.*, 1853, xvii, p. 50.

Case I. ii-para. L.M.P. 1st week January, 1851—last day 4th or 5th January. On 20th January there was a return of menstrual discharge for six days attributed to the sudden death of a brother. Delivery 336 days after L.M.P. Simpson examined her towards the end of April. "*In consequence of the size and shape of the uterus I had no hesitation in concluding at the time that she was then at least two months advanced in pregnancy.*" No note of size of child or of nature of delivery.

Case II. Periods always regular. L.M.P. Sept. 24th, 1851. Shortly after this she had feverish symptoms and from the catamenia not returning she considered herself pregenant. Delivery 332 days from L.M.P., *i.e.*, Aug. 3rd. No note of size of child or nature of delivery.

Case III. iv-para. L.M.P. March 23rd. Delivery 5th Feb., 1853, 319 days after L.M.P. "*That the patient became pregnant very shortly, if not immediately after her L.M.P. I have every ground for believing, for in May I was asked to see her before she left Edinburgh I found the uterus so enlarged as to leave no doubt whatever that she was then about two months pregnant.*"

No note of size of child or nature of delivery.

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Case IV. Always regular, L.M.P. July 9-14. Sickness towards end of July, and continued so for four months, or till end of November. Fœtal movements felt Nov. 17th; delivery June 3rd, 324 days after L.M.P., and six months and sixteen days after quickening.

No further details supplied.

SPRENKEL, W. F. *Amer. Journ. Obstet.*, 1896, Vol. 34, p. 846.

Case I. M. G., æt. 42. iv-para, last being twins, two miscarriages; previous labours difficult but easily terminated by forceps. L.M.P. Sept. 26th, 1895. Fœtal movements felt February 15th, 1896. Delivery August 3rd, 1896. Labour very difficult. Craniotomy; difficulty with shoulders—male, 5,542 grms. Length 56 cm. Bisacromial diameter 20 cm. Duration from L.M.P. 312 days.

Case II. R. L., Italian, æt. 40; v-para; one miscarriage. Previous labours normal—none but the first being unduly prolonged. On admission, April 27th, 1886, had been in labour 36 hours. L.M.P. June 12th, 1895. Fœtal movements first noticed Nov. 1st. Labour pains began 10 a.m. 26th April and had continued strong and active till three hours prior to admission. Several attempts had been made to deliver with axis traction forceps. Cæsarean section performed. Female child born with "enormously developed head." 5,280 grms.; length 55 cm.; bisacromial diameter 18 cm.; bitemporal 9.5 cm.; biparietal 10 cm.; occipito-frontal 13.5 cm.; occipito-mental 15 cm.; trachelo bregmatic 10 cm. Duration=320 days from L.M.P.

STAHL, F. A. *Amer. Journ. Obstet.*, 1895, xxxi, p. 842.

V-para. L.M.P. March 15th, 1894. Previous labours normal. Weight of mother 140 lbs.; height 5 ft. 1 in.; normal physique, but pelvis contracted. Husband 130 lbs., height 5 ft. 5 in. Delivery Jan. 11th, 1895.

On December 22nd had strong and regular pains resembling labour pains, which passed off after three hours. Internal podalic version was done with great difficulty: much difficulty also in effecting delivery. Weight 12 lbs. 8 oz.; length 22 in. (56 cm.); occ. frontal diameter, 15 cm.; biparietal 13.5 cm.; bitemporal 12 cm.; occ. frontal circumference 41 cm. Duration from L.M.P.=302 days.

TAUSSIG, F. J. *Amer. Journ. Obstet.*, 1901, Vol. 44, p. 516.

Æt. 27. Very obese. 256 lbs. in weight; height 5 ft. $\frac{1}{4}$ inch; phlegmatic; previously had five children and one abortion. No instruments used in any, and labours did not last very long. Nothing known as to weight of these children. Came into hospital for seventh child. "Never helping in wards, but was sitting or lying in bed doing nothing." This (seventh) pregnancy went 277 days after L.M.P. Face; female, 4,550 grms.

Also came into hospital for eighth confinement. L.M.P. Dec. 7th, 1897. P.D. Sept. 14th. Towards the end of September complained occasionally of pains in abdomen and back, but no dilatation of cervix. On Oct. 26th, 323 days after L.M.P. (first day) delivery occurred. L.O.A., head born easily but great difficulty with shoulders. Male, 5,625 grms. Length 57 cm. Child died of pneumonia 16 days later.

In next pregnancy delivery occurred 285 days after L.M.P. Breech, uterine inertia, manual extraction, difficult delivery. Female, 5,110 grms.

Length 55 cm. Mother died of cardiac dilatation from myocarditis one hour after delivery.

N.B.—Taussig considers the menstrual history in this case unusually reliable, but exact date of coitus or of quickening could not be ascertained, so if it were not for weight of child he would not classify it as prolonged gestation.

THOMPSON, W. A. *Trans. Obstet. Soc., London, 1885-6, xxvii, 308.*

Delicate woman, not long married, who had miscarriage short time before, caused by "shock." After this menstruation recurred and the last period ended June, 1884. Her husband left home a week after and returned June 16th for one night only, on which coitus took place. Left home next morning and was away four weeks. Soon after the husband's departure signs of pregnancy appeared. Delivery April 13th, 1885, 317 days after L.M.P. and 301 after coitus. Child was a female and "appeared to be of average size and weight."

VELPEAU. *Traité Complet de l'Art des Accouchemens. Tome I. Paris, 1835.*
p. 383.

A ces témoignages, je puis ajouter un fait qui m'est propre : une femme, enceinte pour la quatrième fois comptait quatre mois de grossesse lorsqu'elle vint à mon amphithéâtre. Je sentis distinctement les mouvemens passifs et les mouvemens actifs du fœtus. Les phénomènes du travail s'annoncèrent à la fin du neuvième mois se suspendirent bientôt, ne revinrent qu'au bout de trente jours, languirent toute une semaine, et dans le fait l'accouchement n'eut lieu que le trois cent dixième jour.

Duration 310 days from L.M.P.

WIGODSKY. *Centrlbl. f. Gynäk., 1897, xxi, p. 144.*

III-para, æt. 28, 11 months gestation. First day of L.M.P. Sept. 7th. Quickening end of January. Delivery August 13th. Pregnancy normal but somewhat delayed on account of big shoulders (18.5 cm.). Living anencephalic; no sex given.

WILSON, T. *Birm. Med. Rev., 1895, xxxvii, 238.*

Mrs. H., tall bony woman, third pregnancy, æt. 39., seen on July 31st, 1893. History of having had labour pains for four days. L.M.P. beginning Sept., 1892. The pains had been fairly frequent for 30 hours, and 7 or 8 hours before his visit the membranes had ruptured and blood-stained liquor amnii came away. Abdomen extremely prominent and overhanging pubes : transverse presentation; cervix dilated to three fingers; right shoulder presenting high up. Fœtal heart not heard. Woman's condition good but complained of fatigue. Pelvis generally contracted; C.V. $3\frac{3}{4}$, foot brought down; difficulty in delivering head. "Fœtus was of large size, above the average at full term, and macerated." The two previous labours had been difficult and prolonged, the first ending in a still-birth (boy), second in a girl, now living and well, aged 8 years. The exact date of L.M.P. in this case was not known, but she was certain it was the beginning of the month. Taking 16th Sept. as the date, duration from L.M.P. = 318 days.

WOOLETT. *Brit. Med. Journ.*, 1886, ii, p. 662.

Girl, æt. 16, last day of L.M.P. June 10th, 1885; last coitus June 12th. Called to visit her on March 19th, 1886, labour pains strong and regular, os one shilling; bag of waters tense and presenting. March 30th, os two shillings, pains feeble; March 21st, pains quite absent and milk had appeared in both breasts. For next 10 days saw her daily, had intense frontal headaches, vomiting, hæmorrhage from bowels and raised temperature; on April 23rd living child born naturally—not weighed; duration from coitus=315 days.

WRIGHT, J. W. *Med. Rec. (N.Y.)*, 1884, xxvi, p. 584.

Mrs. P—, æt. 32, iv-para. Youngest born Nov. 24th, 1882. She menstruated regularly from the time she began after the birth of her third child until Sept. 22nd, 1883, on which date the menstrual flow began and continued until Sept. 25th. This was the last time she menstruated until she was delivered of a healthy living male child—11½ lbs.—on August 21st, 1884. Duration of labour three hours; duration from L.M.P. 330 days.

“The above dates I can vouch for, for the following reason: The woman was desirous of not having more children, and kept on a calendar the dates of her menstruation, and had not passed her period but a few days before she came to me to see if something could not be done.”

YOUNG, JAMES. *Edin. Med. Journ.*, N.S., 1868, xiii, Pt. II, p. 956.

“Mrs. S—, married in Spring of 1848: abortion Jan., 1849. Menstruated in February and every month after till 9th July of same year (1849) and continued till the 14th of the month. At the end of July she complained of sickness which continued for four months. Fœtal movement was distinctly felt on 17th November. Allowing the full time to expire, she expected her confinement about 24th April, 1850, being 9 months and 10 days from the cessation of the last menstruation, or five calendar months and a week from the time of quickening. Mrs. S. was delivered of a large child on 3rd June, 1850, being 326 days from end of L.M.P., or 201 days from the time fœtal movement was first felt.”

“In order that the dates may be more accurately depended on, let me mention that Mrs. O. (sister of Mrs. S.) menstruated on 9th August, 1849, one month after Mrs. S., and calculated on her confinement one month later than her sister; whereas Mrs. O. was confined on 18th May, 1850 (nine months and 9 days from commencement of menstruation), seventeen days before Mrs. S. Both sisters kept particular note of the dates.”

N.B.—No note of kind of labour or size of child.

VON WINCKEL, F. *Volkmann's Sammlung klin. Vorträge; Gynäkologie*, 1900-3, ii, p. 194.

This author in his paper “*Neue Untersuchungen über die Dauer der Menschlichen Schwangerschaft*,” records in tabular form a total of 37 cases of unduly long gestation, with children weighing over 4,000 grms.

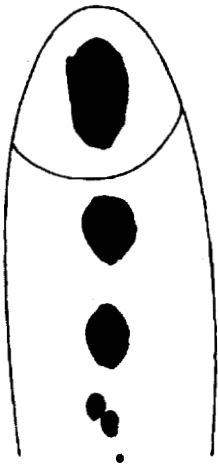
Of these in 21 the duration counted from L.M.P. (1st day) was from 301 to 310 days; 13 from 311 to 320 days; 2 were 322 days; 1 was 334 days.

In four of these the date of insemination was also known; in one case it was 305 days (322 days post-menstrual); in one it was 307 days (315 days post-menstrual); in one it was 315 days (320 days post-menstrual); in one it was 321 days (322 days post-menstrual).

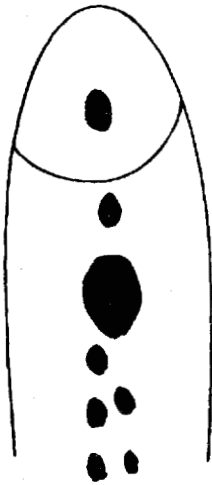
PLATE I.—OSSIFICATION OF THE STERNUM.

POST-MATURE FŒTUSES.

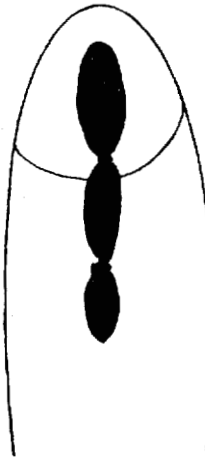
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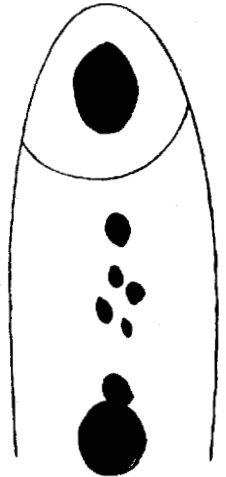
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119

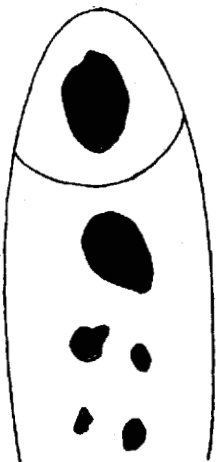


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MATURE FŒTUSES.

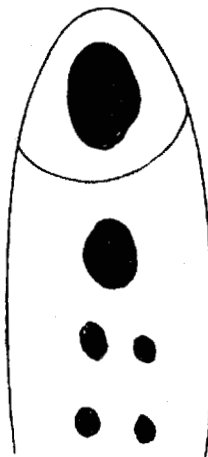
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525

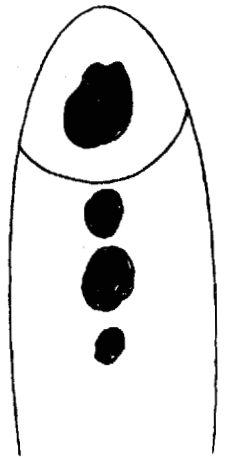


PLATE II.—OSSIFICATION OF THE STERNUM.
MATURE FŒTUSES (Continued).

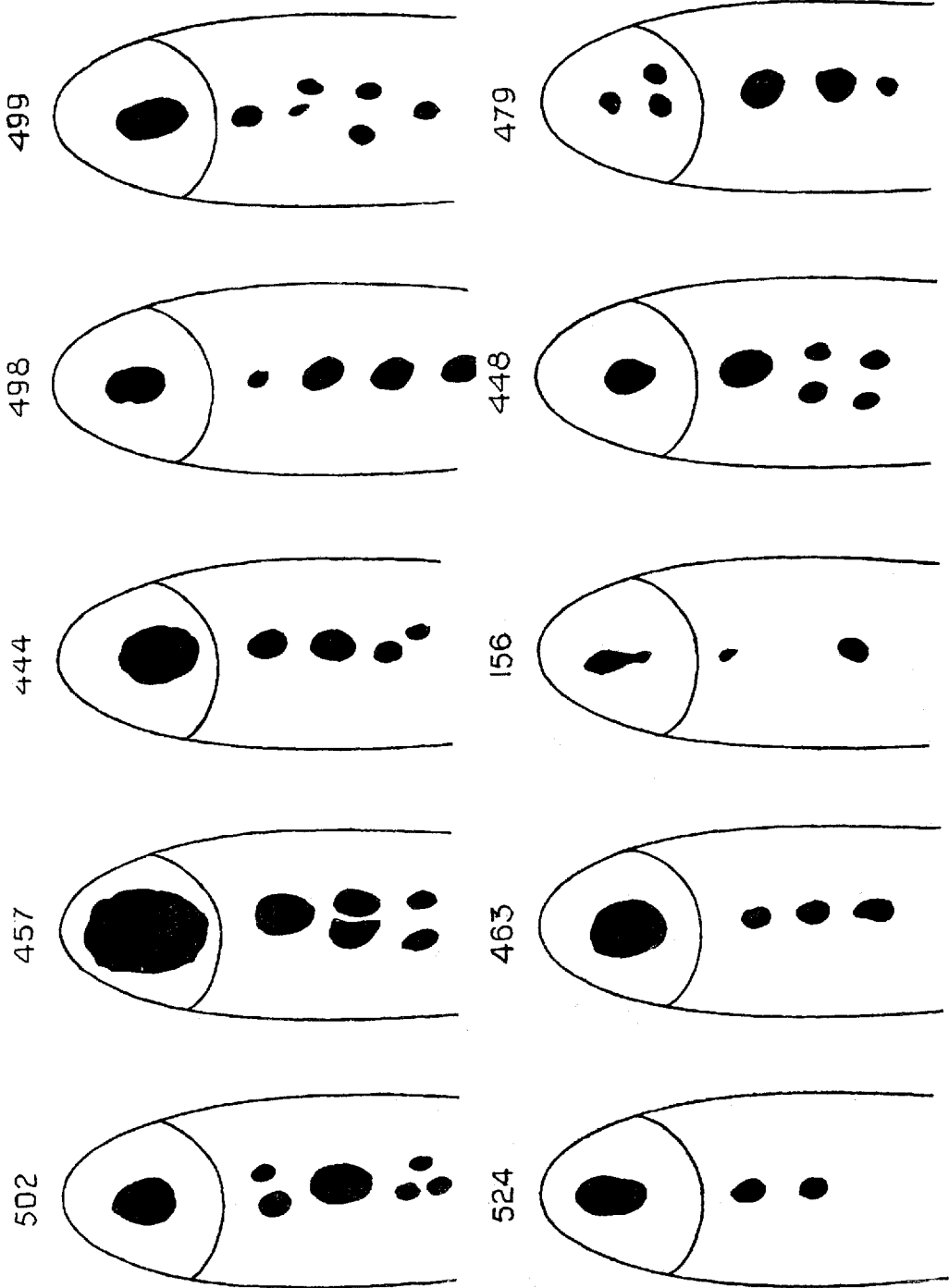
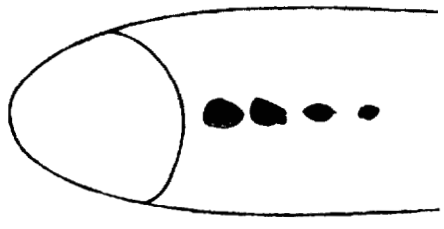


PLATE III.—OSSIFICATION OF THE STERNUM.

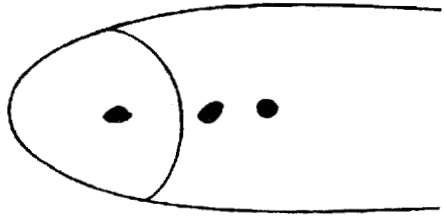
MATURE FETUSES (Continued).

236

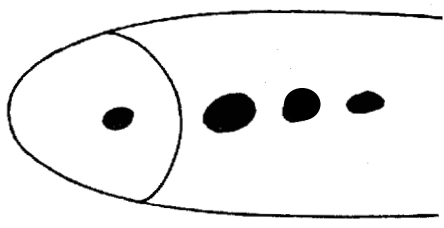
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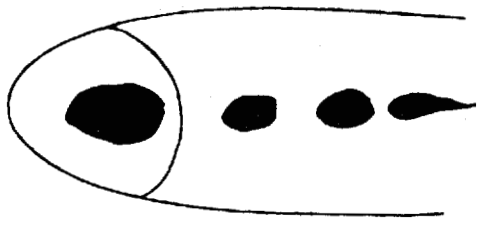
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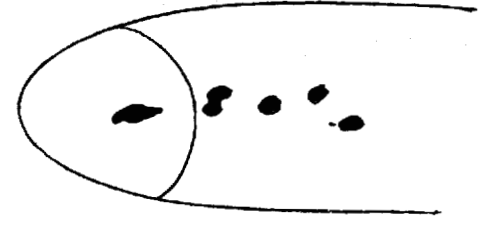
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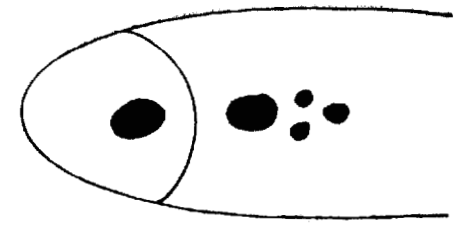
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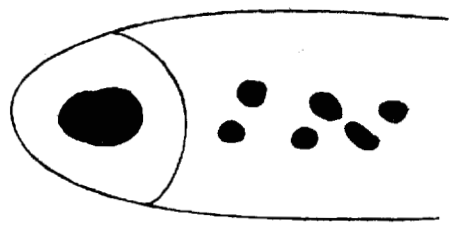


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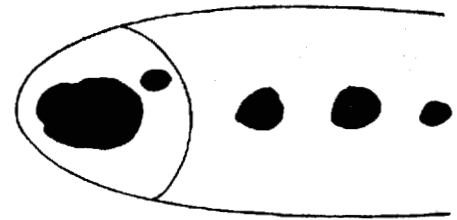


TWINS.

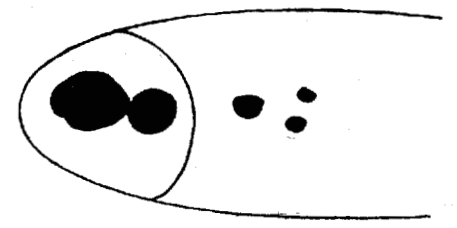
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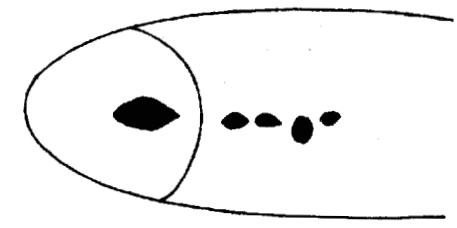
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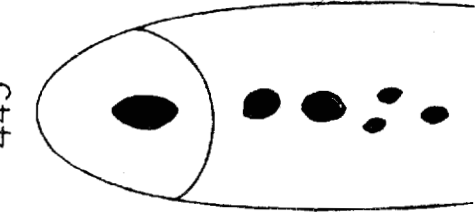
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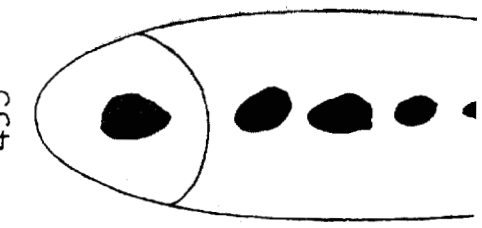
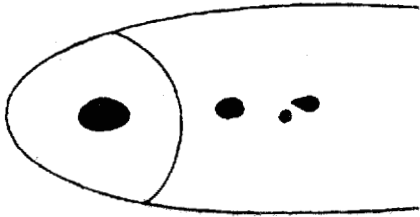


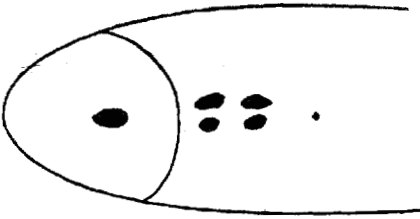
PLATE IV.—OSSIFICATION OF THE STERNUM.

PREMATURE FŒTUSES.

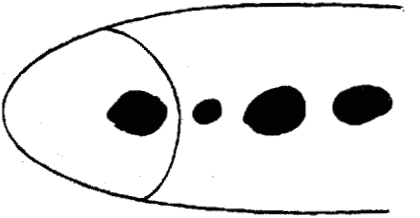
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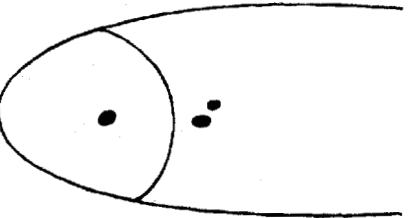
352



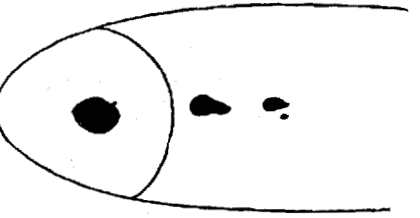
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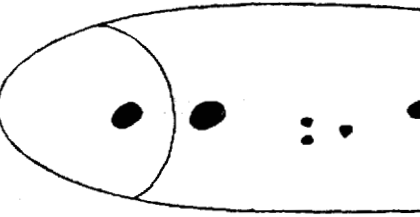
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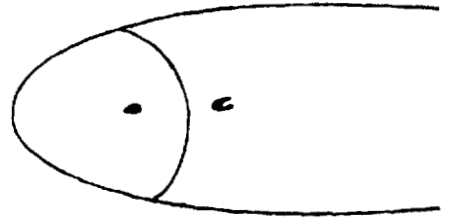
546



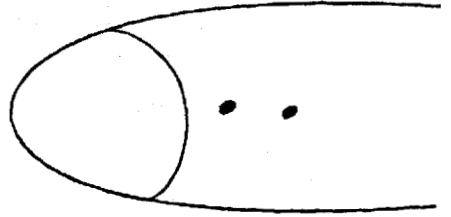
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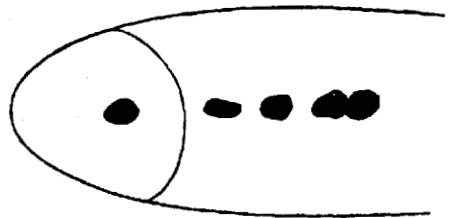
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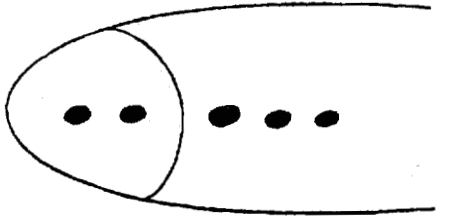
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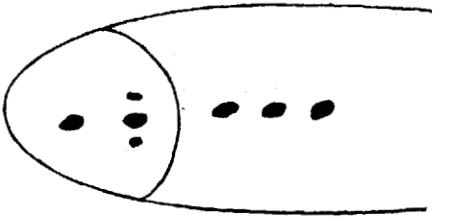
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