THE PERIOD OF GESTATION

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RECENT advances in the physiology of human reproduction suggest that the duration of pregnancy is intimately associated with the individual type of the menstrual cycle. As the viability of the ovum, which is shed into the Fallopian tube at ovulation, is limited to only few hours, pregnancy starts almost simultaneously with the time of ovulation. It follows that the accurate timing of ovulation determines the very beginning of gestation.

We know that ovulation occurs under physiological conditions 14 days prior to the onset of menstruation. It is also known that the corpus luteum of the menstrual cycle ceases to secrete 14 days after ovulation This means in practice that in a 28-days cycle ovulation takes place on the 14th day, in a 30-days cycle on the 16th day, and in a 32-days cycle on the 18th day after the beginning of the last menstrual period. It has also been established quite definitely that an absolute regularity of the menstrual cycle does not exist. Consequently, to determine the time of ovulation in any particular woman we must first know the degree of irregularity of her cycle. The obstetrical significance of the knowledge of the precise type of the menstrual cycle can best be demonstrated by the following 2 examples.

CASE 1. A tall and healthy-looking woman, the wife of a forester, born in 1906, whose menstrual cycle was very irregular, had her last menstruation on 7th February, 1932. She lived in the Bohemian Forest and was under the care of an obstetrician in Prague, who advised her to come into the city at the beginning of November and to be delivered by him in a nursing-home. The expected date of delivery was calculated to be the 14th November, 1932. Pregnancy proceeded for more than 2 weeks after the calculated date. The obstetrician regarded the case as one of post-maturity. He ruptured the membranes and on 3rd December delivered the patient with forceps, the baby presenting as a face. On the third day after delivery, the baby—a girl of 8 pounds 4¼ ounces —died of pneumonia and the mother developed endometritis and thrombophlebitis of both legs. The mother was kept in bed for 4 months and, because of the condition of her heart and circulatory system, she was advised not to have another baby for some time. This pregnancy had a duration of 301 days. It would have continued, if the obstetrician had not lost his patience and had not terminated the pregnancy by artificial means

which turned out to be so bad for both the mother and her baby.

In the summer of 1935 the patient conceived again. The last menstrual period was on 4th August, and I saw her for the first time on 10th October. The expected date of delivery was 11th May, 1936. She was advised to enter my clinic in Prague towards the end of April. She remained in hospital for 4 weeks, and on 22nd May, 11 days after the expected date of delivery, I attempted to induce labour with castor oil, a hot bath and pituitary extract, but without any effect. Attempts were made to induce labour by similar means on 26th and 30th May, and on 4th June, again without success. Although she looked rather overdue and the foetus seemed to be big, the patient was not given further treatment, but on 14th June, after a spontaneous onset of labour, she was delivered of her second child within 9 hours. The baby was a boy, 8 pounds 6 ounces, 21 inches long, and quite normally developed.
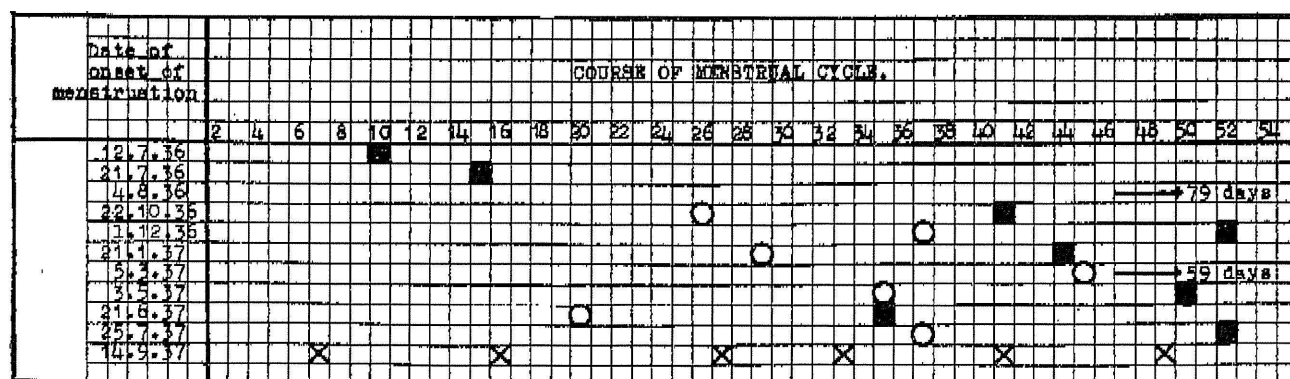
This second pregnancy had a duration of 316 days. The abnormal duration would tend to lead the obstetrician in charge of the case to terminate pregnancy artificially. However, I had the impression that this abnormal duration of pregnancy might have been due to an extraordinary irregularity of her menstrual cycle. The patient was discharged and advised to keep a careful menstrual record so that the periodicity of her cycle could be determined and the timing of conception could be calculated in case of a third pregnancy.

In November 1937, she thought that she was pregnant again, and a positive Friedman test was obtained on 17th November. The patient had kept an accurate menstrual record since July 1936, and the record showed a menstrual cycle of exceptional irregularity, which is illustrated in Table I.

The intervals between the first 2 periods after the delivery were very short, and were characteristic of the anovulatory cycles which are found so frequently during the period of lactation. The succeeding menstrual cycles were very long, giving ovulation times from the 20th and 65th days of the cycles. The patient kept an accurate record of the dates of intercourse. The dates particularly significant for this conception were the 10th, 16th and 24th October, 1938, after the last menstruation on 14th September. In view of the irregularity of the menstrual cycle it was felt that the calculated date of delivery could not be obtained by the routine method of Naegele, but that it could be more accurately computed from the time of conception. It was therefore calculated, on the basis that conception was dated between the 10th and 25th October, that the delivery should be between the 10th and 25th July, 1938. The patient was therefore advised to enter hospital at the beginning of July. Labour started spontaneously on 25th July, 1938, and the patient was delivered of a boy, weighing 8 pounds 13 ounces, and 20¼ inches long.

In this third pregnancy, calculation from the date of the last menstrual period gave a fictitious duration of 315 days, whereas the actual duration of 273 to 288 days is obtained if the calculation is made from the possible time of conception. Clearly, the case would have been regarded as one of post-maturity but for the record of the menstrual cycle, and there would have been a tendency to induce labour prematurely.
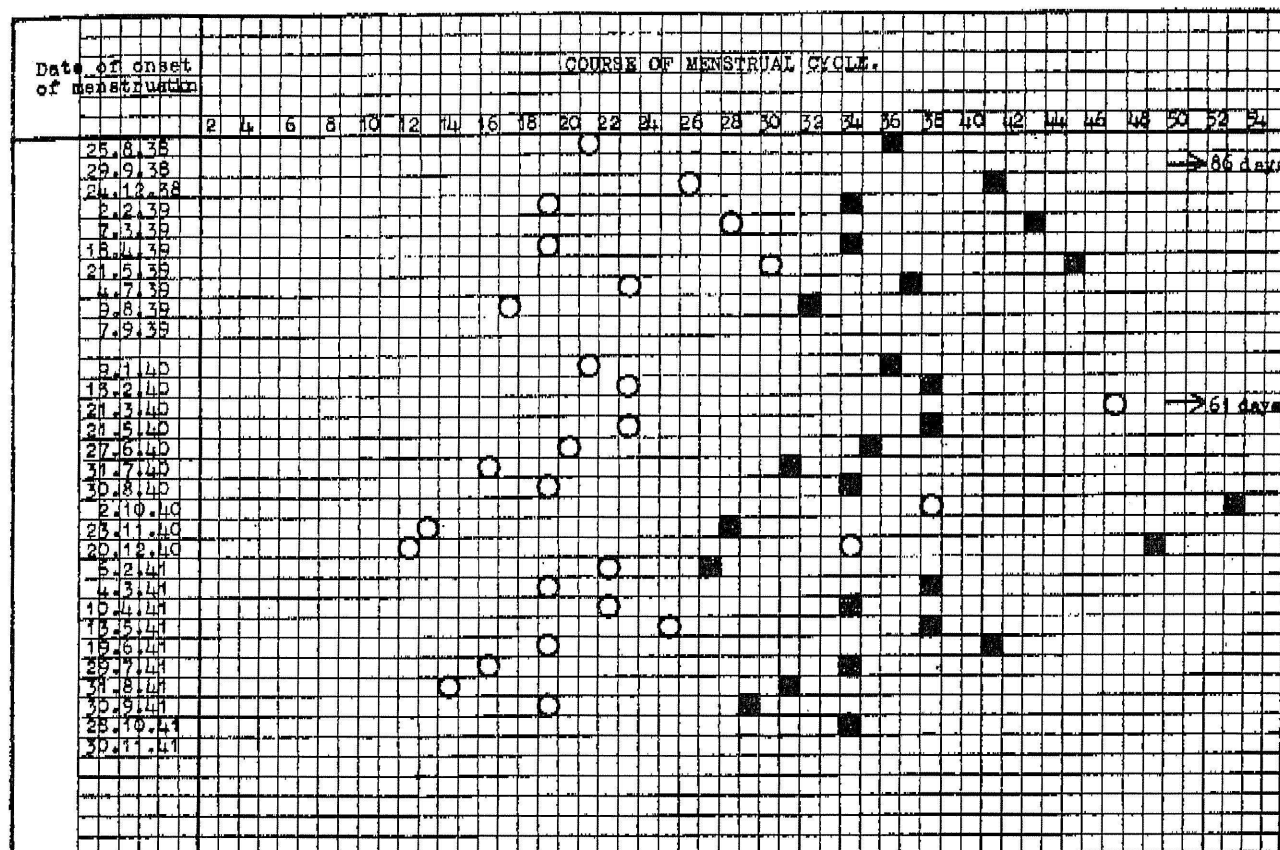

■ = Onset of Menstruation.   O = Ovulation.   × = Coitus.

TABLE I. 21.6.38. Expected date of delivery.   25.7.38. Spontaneous delivery.

Date of onset of menstruation | COURSE OF MENSTRUAL CYCLE.

| | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 |

Dates in left column:
25.8.38
29.9.38 → 86 days
24.12.38
2.2.39
7.3.39
18.4.39
21.5.39
4.7.39
9.8.39
7.9.39

9.1.40
13.2.40
21.3.40 → 61 days
21.5.40
27.6.40
31.7.40
30.8.40
2.10.40
25.11.40
20.12.40
5.2.41
4.3.41
10.4.41
13.5.41
19.6.41
29.7.41
31.8.41
30.9.41
28.10.41
30.11.41

TABLE II. 7.9.42. Expected date of delivery. 10.9.42. Spontaneous delivery.

The patient kept careful records for the next 2 years and then conceived for the fourth time. Her menstrual cycle had become shorter and less irregular and showed a variation between 26 and 61 days, with an average variation of between 26 and 37 days. Table II illustrates the variation in the time of ovulation, which in the majority of these cycles occurred from the 12th to the 23rd day after the onset of the menstruation.

The last menstrual period started on 30th November, 1941. The Naegele calculation gave, therefore, the expected date of delivery to be 7th September, 1942. The patient was delivered spontaneously on 10th September, 1942, only 3 days later than the expected time. The baby was a boy, weighing 8 pounds 4¼ ounces, 20½ inches long. The duration of this pregnancy, calculated from the date of the last menstrual period, was 285 days whereas, if the calculation is made from the time between 11th and 22nd December, 1941, the period of gestation is between 261 and 273 days.

These records demonstrate clearly that the real duration of pregnancy showed no great variation in the 4 consecutive pregnancies. On the other hand, there was a remarkable change in the length of the menstrual cycle following upon the third delivery. This analysis of data carefully calculated over a long period of time shows, quite obviously, that the date of delivery depends upon the time of ovulation.

More than a year after her fourth delivery, this patient conceived for the fifth time. Her cycles had become less irregular, but still showed a variation from 22 to 46 days. However, the majority of these cycles were varying between 32 and 37 days, with the bulk of the dates of ovulation covering the time from the 18th to the 23rd day of the cycle.

The last menstrual period started on 12th December, 1943. Consequently, the patient was due to be delivered on 19th September, 1944, but the delivery was delayed and the baby was not born until 27th September, 1944. The baby was a boy, 6 pounds 10 ounces in weight and 20 inches in length. The duration of this pregnancy, calculated from the date of the last period, was 291 days, but as conception must have taken place some time between 29th December and 3rd January, the duration of pregnancy was between 268 and 273 days.

these figures is the reappearance of the period of 273 days in the appropriate calculation of the duration of all 3 pregnancies which seems to represent the normal length of the real period of human gestation.

CASE 2. A princess of an old aristocratic family of Bohemia was the last of her line. She was born in 1905 and married in 1932, and she was anxious to produce an heir for the vast estates of her family. She failed to conceive during the first 3 years of her marriage. She was treated by several gynaecologists. Plastic operations were performed on the cervix of the uterus and the vaginal introitus by Professor Weibel in Vienna. She consulted me
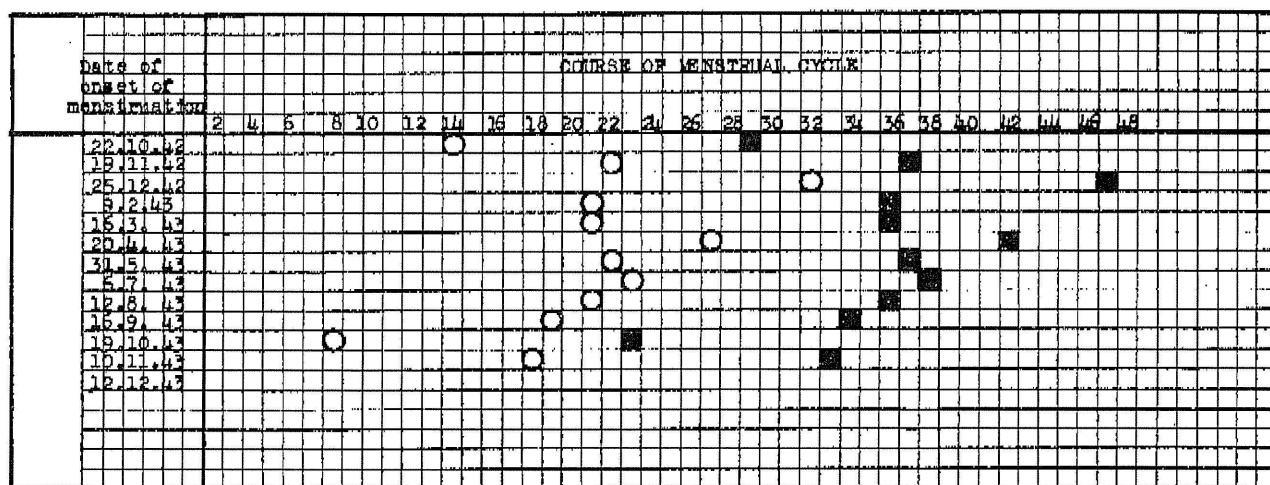

TABLE III. 19.9.44. Expected date of delivery. 27.9.44. Spontaneous delivery.

The abnormal length of the first 2 pregnancies of this patient could never have been reasonably explained if this woman had not been advised to collect the menstrual dates during the subsequent years. When all these dates preceding the subsequent 3 pregnancies were made available the reason why there had been such a striking fictitious variation in the duration of gestation could be easily detected. Although the last 3 pregnancies appeared to have a duration of 315, 285 and 291 days, respectively, they could be proved to show a real period of gestation of 273–288, 261–273 and 268–273 days respectively. And the most remarkable fact amongst

on 22nd July, 1935. The pelvic organs were normal except for a slight cervicitis and colpitis. She was able to produce the dates of 8 menstrual periods from which the times of ovulation could be calculated. She was advised to use the 11th, 12th, 13th, 14th, and 15th days of the cycle for sexual intercourse with the result that she conceived at once.

Table IV shows that this patient had a cycle of 27 to 29 days. It was expected, therefore, that she would ovulate only between the 13th and 15th days of the cycle, which would be between 30th July and 1st August, 1935. The expected date of delivery, calculated from the last menstrual period starting on 18th July, would be 25th April, 1936. The patient was delivered on 11th April, spontaneously, of a girl, 6 pounds 13¼ ounces in weight, 20 inches in length. The duration of pregnancy
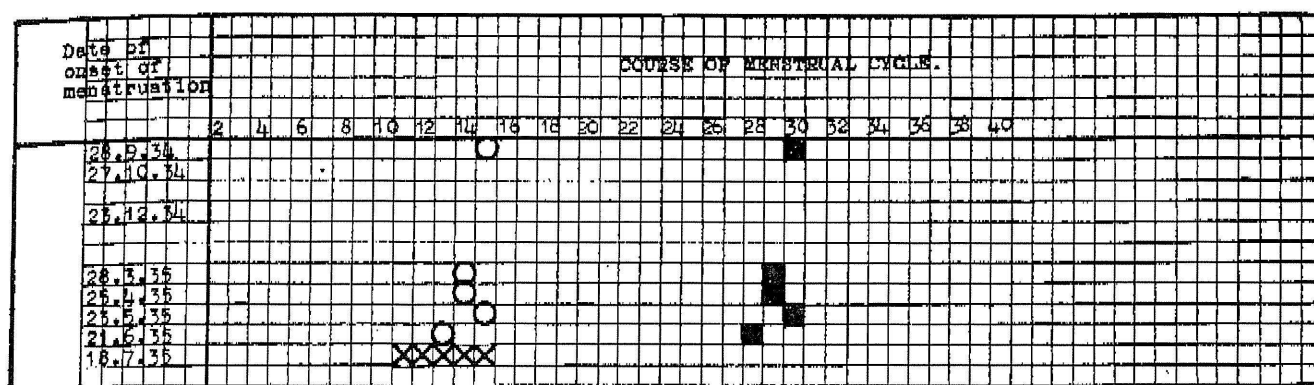
TABLE IV. 25.4.36. Expected date of delivery. 11.4.36. Spontaneous delivery.

calculated from the time of the last period was only 268 days, and the real period, calculated from ovulation, would be between 254 and 256 days, which should be considered as abnormally short.

During the year following upon the first pregnancy, the menstrual cycle became more irregular and fluctuated between 27 and 37 days. The patient was anxious to bear a son. She was advised to have intercourse during the time of ovulation. There was only one sexual union during the menstrual cycle of March 1937, on 20th March, and this led to the desired conception.

The eagerly expected son was born on 18th December, 1937, after a spontaneous delivery. He weighed 6 pounds 11¼ ounces, and a length of 20 inches. The duration of the second pregnancy, calculated from the first day of the last period, was 286 days. Calculated from the date of fertilization it was between 273 and 275 days.

After the second pregnancy the patient's menstrual cycle showed only slight irregularity. In November 1939 she decided to have a third child, and had sexual congress on 25th and 26th November only. Conception followed immediately, and 287 days after the last menstruation the second boy was born on 24th August, 1940. He had a weight of 7 pounds 9½ ounces, and a length of 20 inches. There is ample evidence that the pregnancy commenced in the time between 25th and 27th November, from which it is calculated that the duration of pregnancy was between 271 and 273 days.

In the course of the following 5 years this patient had a menstrual cycle which varied between 26 and 31 days. Only twice during this period of time was this periodicity disturbed; the cause for the delay of the onset of these 2 menstruations remained, unfortunately, unknown. In the autumn of 1945 the patient conceived for the fourth time. Her last menstrual period started on 19th October, and the timing of ovulation was between 30th October and 4th November.
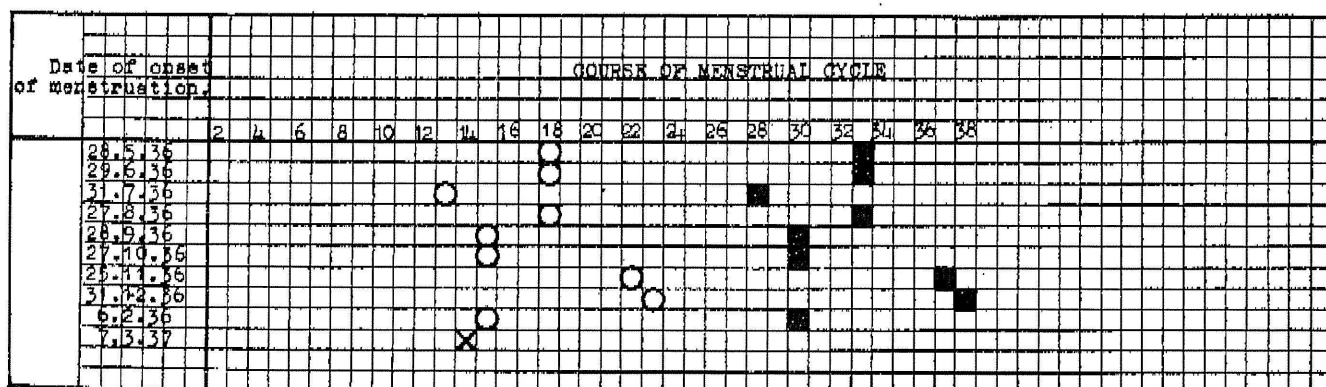
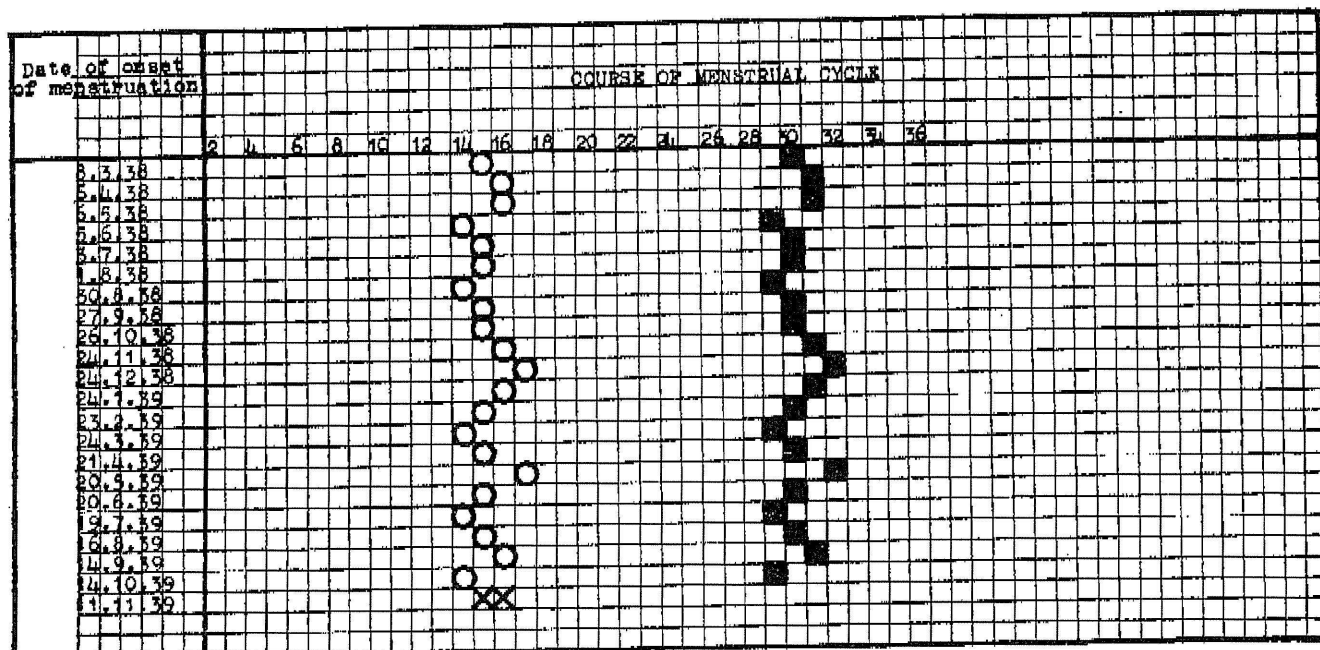TABLE V. 14.12.37. Expected date of delivery. 18.12.37. Spontaneous delivery.

TABLE VI. 18.8.40. Expected date of delivery. 24.8.40 Spontaneous delivery.

It was again a spontaneous onset of labour, and a girl was delivered on 31st July, 1946, with a weight of 7 pounds 4½ ounces, and a length of 20 inches. Calculated from the first day of the last period, the duration of pregnancy was 285 days while, calculated from the time of ovulation, it was between 269 and 274 days.

In this case, for all 4 pregnancies the very beginning of the period of gestation could be determined more or less precisely, and showed an extraordinary shortness of duration of only 254–256 days for the first pregnancy and a rather similar length of 269–275 days for the 3 following pregnancies. These figures reveal again very clearly the actual period of human gestation which should serve as the basis for the determination of the expected date of delivery.

DISCUSSION.

From the data given above, I have endeavoured to emphasize the practical importance of an accurate knowledge of a woman's menstrual cycle for the determination of the real period of gestation as well as of the date of the expected delivery in any particular case. As a regular cycle of 28 days does not exist the still common expression of "Menstruation regularly every 28 days" should no longer be used in the histories of gynaecological and obstetrical cases, but instead we should speak and write of menstrual cycles of a certain range expressed in days. The medical profession should try to persuade all girls and women to keep a menstrual record for their benefit during the child-bearing age. In particular, obstetricians should make every effort to convince their patients of the importance of writing down carefully in a special calendar the date of their menstrual periods. Such a calendar* enables the length and degree of irregularity of the menstrual cycle to be recognized at once. Only by following this line of education shall we succeed in accumulating more reliable evidence of the actual

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*This calendar is distributed by H. K. Lewis & Co., London, W.C.1.
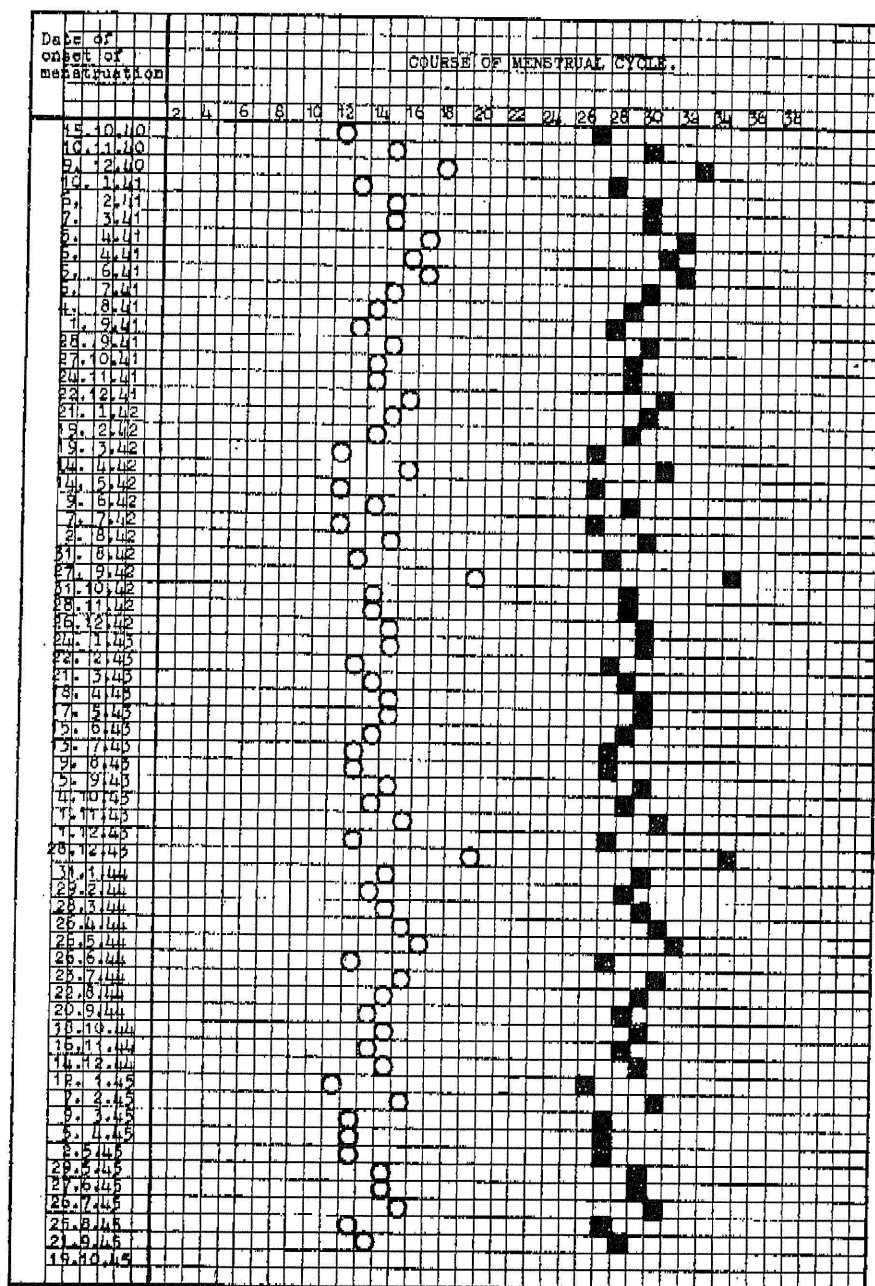
TABLE VII. 26.7.46. Expected date of delivery.
31.7.46. Spontaneous delivery.

duration of human gestation and its physiological range.

In 6 of the 7 pregnancies recorded in this paper, in which the duration of pregnancy could be most accurately determined, the interval between the time of ovulation and the date of delivery was constant at about 273 days. There was no evidence that the duration of pregnancy had any relation to a hypothetical correspondence of the period of gestation to ten multiples of the menstrual cycle, as has been postulated by Harvey, Naegele, Rigby, Berthold, Tyler Smith, John Beard, Jolly and many others. Clearly, if such an association existed the duration of pregnancy in the 2 cases

described would have shown a still wider variation and in the first case, would have led to a grossly abnormal duration for 3 of the pregnancies. Moreover, in spite of the remarkable differences in length of the cycle during the intervals preceding the last 3 pregnancies in the first case, 273 days emerged as the constant figure of the actual period of human gestation.

When I first read in Jolly's paper "On the Period of Human Gestation" the leading sentence of his summary " Evidence is adduced that the period of human gestation is intimately related to the length of the mother's menstrual cycle in any particular case " I expected to find accumulated evidence to support this contention. However, it is most interesting to notice how far one can be led astray by the fundamentally erroneous assumption that there are women with various types of absolutely regular menstrual cycles.

CONCLUSIONS.

The actual span of human gestation has an average duration of 273 days. This duration is entirely independent of the length and irregularity of the menstrual cycle. In order to avoid disastrous miscalculations of the expected date of delivery, the modern obstetrician should not satisfy himself any longer with the date of the last menstruation only, but should base his computation upon the exact figures of the menstrual cycle showing its course for at least one year preceding the pregnancy under consideration.

REFERENCES.

Beard, J. (1897): *The span of Gestation and the Cause of Birth*. Fischer, Jena.

Jolly, W. A. (1928): *J. Obstet. Gynaec.*, 35, 258.