amount of hepatic tissue to only a small percentage of the normal. By careful dietary measures animals so treated may be maintained in apparently good condition for several years, and after a short time there seems to be but little change in the gross or microscopic appearance of the hepatic tissue. Following the ingestion of 175 gm. of fresh pancreas these animals excrete from 600 to 900 mg. of uric acid, or an average of about 700 mg. The amount of uric acid excreted was quite constant for the individual animals of this series, and increased in proportion to the reduction of hepatic tissue.

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### The prenatal growth and natal involution of the human uterus.

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The human uterus undergoes a marked reduction in length and weight in the first few weeks following birth. This was first described by Lyubetski,[1] and later, independently, by Bayer[2] and by Conte.[3] This reduction takes place through hypoplasia and hypotrophy of the uterine muscle, together with a disappearance of the marked natal hyperemia of the organ. It is supposed to be caused by the withdrawal at birth of a hormone produced by the placenta, the ovary or the tissues of both of these structures, (Aschner,[4] Herrmann,[5] Fellner,[6,7] Frank,[8,9] and

[1] Lyubetski, N. S., Anatomical changes in the uterus in children. Diss. St. Petersburg, 1900.

[2] Bayer, H., *Deutsch. Arch. klin. Med.*, 1902, lxxiii, 422.

[3] Conte, G., *Atti Soc. Ital. d. Ostet e Ginecol.*, 1903, ix, 670.

[4] Aschner, B., *Arch. f. Gynäkol.*, 1913, xcix, 534.

[5] Herrmann, E., *Monatsschr. f. Geburtsh.*, 1915, xli, 1.

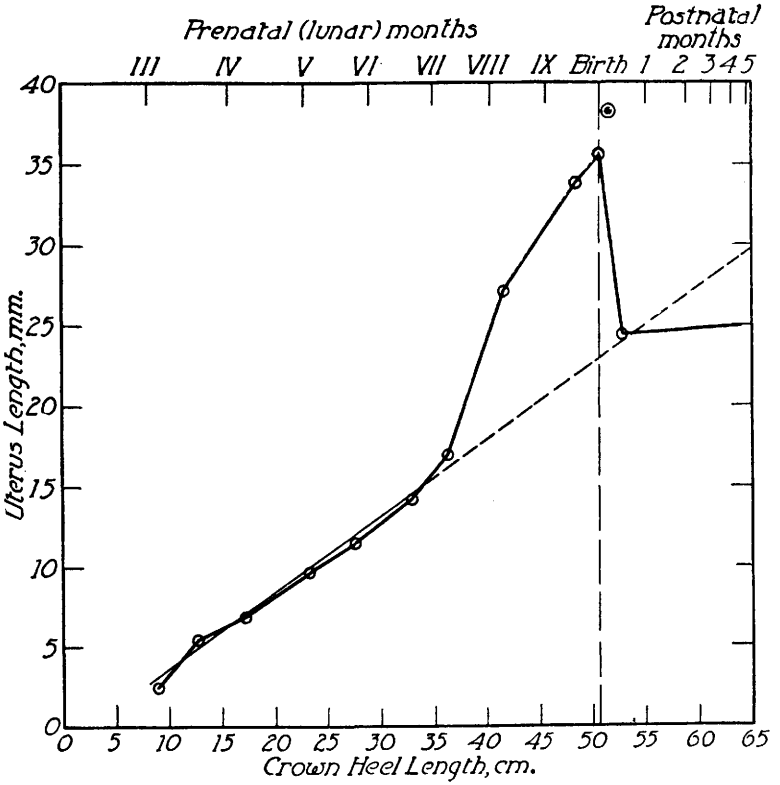
[6] Fellner, O. O. *Zentralbl. f. allg. Path. u. path. Anat.*, 1912, xxiii.

[7] Fellner, O. O., *Arch. f. Gynäkol.*, 1913, c, 641.

[8] Frank, R. T., and Rosenbloom, J., *Surg. Gynecol. and Obstet.*, 1915, xxi, 646.

[9] Frank, R. T., *ibid.*, 1917, xxv, 329.

others.) Little is known of the fetal growth of the uterus which precedes this natal reduction. The present study is based upon a total of 207 observations on the length of the uterus, 89




Graph illustrating lineal growth of human uterus in prenatal life and infancy. The uterus length (in mm.) is plotted against the total body-length (in cm.) and the computed age (in lunar months). The body-length is indicated on the base line and the computed age on the upper line of the graph. Age is computed according to the empirical formulae of Calkins and Scammon[10] and of Scammon.[11] Birth is represented by the vertical broken line of the graph. The circles, in the fetal period, represent the mean values for 5 cm. intervals of body-length. That at birth is the mean value for all newborn material. That at 15 postnatal days is the mean for 15 infants (of this average age) ranging from 3 to 27 days in age. The circled dot represents the mean value for 13 "postmature" newborn infants. The heavy solid line is the point-to-point curve of observed values. The light solid line is the computed curve for growth in uterus length, with respect to total body-length, up to 35 cm. crown-heel length. Its projection is represented by the oblique broken line extended from it.

[10] Scammon, R. E., and Calkins, L. A., PROC. SOC. EXP. BIOL. AND MED., 1923, xx, 353.

[11] Scammon, R. E., *ibid.*, 1921, xix, 133.

of fetal uteri, 62 of uteri of infants stillborn or dying within 48 hours after birth, and 56 uteri of children over 2 days and under 1 year of age.

A graphic analysis of this material is shown in the accompanying figure, in which the mean uterus length for 5 cm. intervals of total or crown-heel body-length, is plotted against the total body-length (as indicated on the base-line scale), and the computed age, (as indicated on the upper scale of the graph). Starting with an average length of about 2.5 mm. in the 5 to 10 cm. interval of crown-heel length, the viscus grows at a slow and fairly constant absolute rate, with respect to the total body-length, until approximately 7 lunar months (about 35 cm. crown-heel length). At this stage the average length of the uterus is approximately 17 mm. The organ then enters a second phase, characterized by rapid lineal growth, and reaches a mean length of approximately 35 mm. at birth, or 10 lunar months.

Between birth and the third postnatal week the length of the uterus declines to 24.3 mm. This figure is based on the average of 15 cases, ranging in age from 3 to 27 days, with a mean age of 15 days. This is a loss of about 11 mm., or about one-third of the natal length. Thereafter there seems to be a slight increase in uterine length for the remainder of the first year, although this gain is so small that it is questionable.

The relation of uterus length to crown-heel length in the early part of prenatal life is approximately rectilinear. An empirical formula has been fitted to these data by the method of least squares, the expression being:

$$U.L = 0.4738\ C.H. - 1.106 \quad (1)$$

where "U.L." is the total length of the uterus in millimeters and "C.H" is the total or crown-heel length of the body in centimeters. The calculated values by this formula show a weighted mean deviation (without regard to sign of deviations) of 0.40 mm. from the corresponding observed mean values.

A straight line has also been fitted for the uterus length in the fetal period and may be represented by the expression:

$$U.L. = 1.3546\ C.H. - 31.045 \quad (2)$$

where the symbols are as in (1). The calculated values obtained by this formula show a weighted mean deviation, taken without

regard to sign, of 0.84 mm. from the corresponding observed mean values.

An estimate of the natal length of the uterus which would obtain if the structure continued to grow at the rate characteristic of the early part of prenatal life, may be made by projecting the line represented by formula (1) to 50.2 cm., which is the computed body-length at birth. This value is approximately 22.7 mm., whereas the observed value at birth is approximately 35 mm. Thus the uterus reaches the length at birth which is approximately one-third greater than that to be expected if the earlier growth-rate of the organ, with respect to body-length, were maintained in the latter part of the fetal period. If this line of early fetal growth is projected to approximately 53 mm., which is a computed mean length of the specimens representing the full post-natal involution of the uterus, it is seen that the length of the uterus, after its postnatal decrement, approximates the length of the organ, which might be predicted from its early prenatal growth. In other words, the uterus in the neonatal period declines in length to approximately the dimension which it would have attained had its early fetal growth rate remained until this time.

These figures indicate that there are two definite phases in lineal growth of the uterus in prenatal life. Until 7 months the organ shows a lineal increase, with respect to body-length, which is comparable to that of most lineal dimensions of the body and particularly to that of the pelvic dimensions. At about 7 lunar months it enters on a phase of augmented lineal growth. After birth the organ loses length until it assumes essentially the dimensions which it would have obtained had the early fetal growth rate remained unchanged. This suggests that the growth of the uterus in the latter fetal months consists of a substrate of typical fetal growth plus a secondary growth increment, which, presumably, is due to an extra stimulus furnished by a hormone of placental or possibly ovarian origin. After birth the organ loses this secondary increment but retains that resulting from the early fetal growth rate.