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The prenatal growth and natal involution of the human suprarenal gland.

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Two organs of the human body undergo a remarkable reduction in size following birth, these are the uterus and the suprarenal glands. The neonatal loss in mass of the suprarenals seems to have been first noted by Scheel.¹ It is due in great part, if not entirely, to a degeneration of the inner and middle layers of the cortex. This process was first described by Starkel and Wegrzynowski² and, shortly after, independently by Thomas,³ Kern,⁴ and Armour and Elliott.⁵

It has been pointed out that the neonatal loss in size of the uterus is preceded by a period of marked growth of this viscus in the latter part of fetal life, and that this neonatal involution reduces the organ to essentially the dimensions which would have obtained had the early fetal growth rate remained unchanged. Since the suprarenals undergo a neonatal involution which is concomitant with that of the uterus, it seems desirable to determine whether they also show a period of increased growth in the latter part of prenatal life.

The present study is based on observations on the weights of 1087 pairs of suprarenal glands; 425 of fetuses, 338 of newborn infants, stillborn or dying within 2 days after birth, and 324 of children over 2 days and under 1 year of age.

The course of growth of these structures is shown in the accompanying figure in which the suprarenal weight is plotted against the total body weight (as indicated on the base line scale) and the computed prenatal age and observed postnatal age, as indicated on the upper boundary line of the graph. The ob-

¹ Scheel, O., *Arch. f. path. Anat.*, 1908, cxcii, 494.

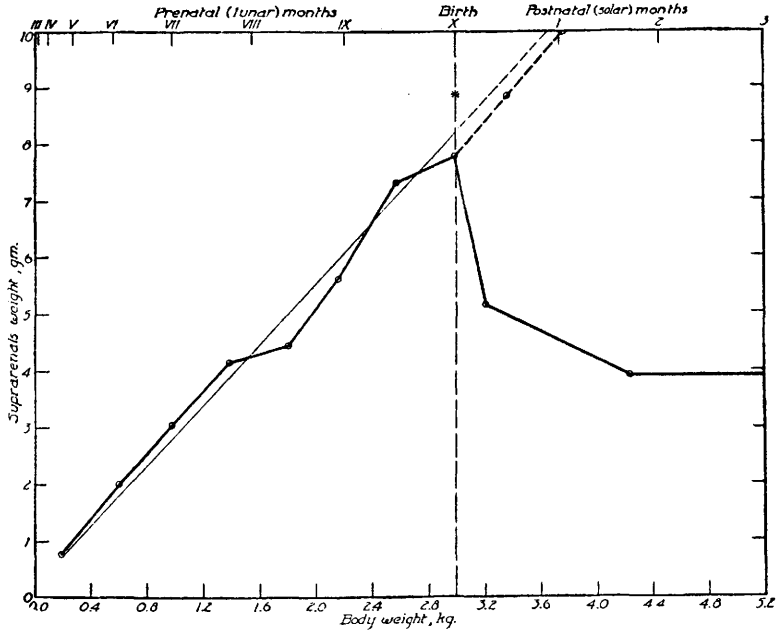
² Starkel, S., and Wegrzynowski, L., *Arch. f. Anat. u. Entwicklungsges.*, 1911, 191.

³ Thomas, E., *Beitr. z. path. Anat. u. allg. Pathol.*, 1911, 1, 283.

⁴ Kern, H., *Deutsch. med. Wochenschr.*, 1911, xxxvii, 971, 1180, 1318.

⁵ Armour, R. G., and Elliott, T. R., *J. Path. and Bact.*, 1911, xv, 481.

servations on fetal material indicate that the growth of the supra-renals before birth is proportional to the growth in body-weight for the relation between these weights is approximately rectilinear



A graph illustrating the ponderal growth of the human suprarenals in prenatal life and infancy. The weight of the suprarenals (in grams) is plotted against the total body-weight (in kilograms) and the computed age (in lunar months for the fetal period and in solar months for postnatal life). The body-length is indicated on the base line of the graph and the computed age on the upper line. The age in the fetal period is computed according to the "exact" empirical formula of Scammon and Calkins.⁶ The relation between body-weight and age in postnatal life is computed from the formula of van Leer,⁷ with the initial value changed from 3250 grams to 3000 grams to make the results comparable with those obtained in this series. The circles, in the fetal period, represent the mean values for 400 gram intervals of body-weight, that at 8 postnatal days represents the mean value for 48 infants between 2 and 14 days of age, and that in the second month represents the mean value for 78 infants between 2 weeks and 3 months in age. The star represents the mean value for all material reported in the literature and in our own records as "newborn", regardless of body-weight or body-length. The heavy solid line is the point to point curve of observed values. The heavy broken line is the point to point curve of observed values for "postmature" infants (over 3200 grams dead-weight at birth). The light solid line is the computed curve for growth in the weight of the suprarenals with respect to body-weight in the fetal period. The broken light line represents the continuation of this curve for "postmature" infants.

⁶ Scammon, R. E., and Calkins, L. A., *PROC. SOC. EXP. BIOL. AND MED.*, 1924, xxii, 157.

⁷ van Leer, S. A., *Arch. f. Kinderheilk.*, 1902, xxxiv, 293.

throughout the fetal period. An empirical formula has been fitted to these data by the method of least squares on the basis of the mean weight of the suprarenal for each 400 gram interval of total body-weight. The values were weighted by the square root of the number of cases in each interval. The expression obtained is:

$$S. W. = 2.704 B. W. + 0.13$$

where "S. W." is the weight of both suprarenal glands in grams and "B. W." is the total dead body-weight in kilograms. The calculated values obtained by this formula for the 400 gram intervals of body-weight show a mean deviation, taken without regard to sign, of 0.32 grams, from the corresponding observed values.

The course of the postnatal involution of the suprarenals is indicated by a point to point curve based on averages for the material arranged in two groups according to age; the first including all cases between 2 and 15 days, and the second, all cases between 15 days and 3 months. The decrease in weight amounts to approximately one-third of the natal weight in the first fortnight and to approximately one-half of the natal weight in the first trimester after birth.

The growth of the suprarenals in so-called "postmature" fetuses (as indicated by specimens above the calculated dead weight of the body at birth—see explanation of figure) continues at approximately the same rate as in the earlier part of the fetal period.

These data indicate that the suprarenals, unlike the uterus, show no phase of augmented rate of growth, with respect to the growth of the body as a whole, in the latter part of fetal life, preceding their neonatal involution.