

fect in the stomach of the pancreatic juice have concluded the absence of pancreatic juice in the stomach from the absence of bile. The anatomic explanation of our findings is suggested by a study of the anatomy of the pancreatic ducts by Baldwin,<sup>5</sup> showing a patent and probably functioning accessory duct in 77 per cent of cases studied and a separate opening of the pancreatic and bile ducts in 25 per cent of the cases.

Whether the disappearance of trypsin and bile after washing the stomach with acid is due to the closure of the pylorus or to a closing effect of the separate ducts from the liver and the pancreas we are not prepared to state. We wish to emphasize that wherever the closing mechanism is located, the effect in the pernicious anemia cases is a prolonged closure, lasting from 30 to 40 minutes. In a case of healed duodenal ulcer the closing effect was much more marked, more than an hour and a half elapsing before signs of duodenal regurgitation occurred after the introduction of acid into the stomach.

This is a preliminary report.

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<sup>1</sup> Boldyreff, W., *Zntrblt. f. inn. Med.*, 1908, vi.

<sup>2</sup> Boldyreff, W., *Ergebnisse d. Physiol.*, 1911, xi, 121.

<sup>3</sup> Boldyreff, W., *Quart. J. Exp. Physiol.*, 1915, viii, 1.

<sup>4</sup> Baird, M. McC., Campbell, J. M. H., and Hern, J. R. B., *Guy's Hosp. Rep.*, 1924, lxxiv, 23.

<sup>5</sup> Baldwin, W. M., *Anat. Rec.*, 1911, v, No. 5.

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### The Prenatal Growth of the Human Thymus.

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The weight of the human thymus in the fetal period is characterized by great variability. Therefore a large number of observations are necessary to demonstrate even the approximate course of prenatal growth of this organ.

The ponderal growth of the thymus, with respect to body-weight, has been studied in a series of 1043 weighings of the organ from human fetuses under 4000 grams in total (dead) body weight. In no instances were observations made on fetuses living over 48 hours.

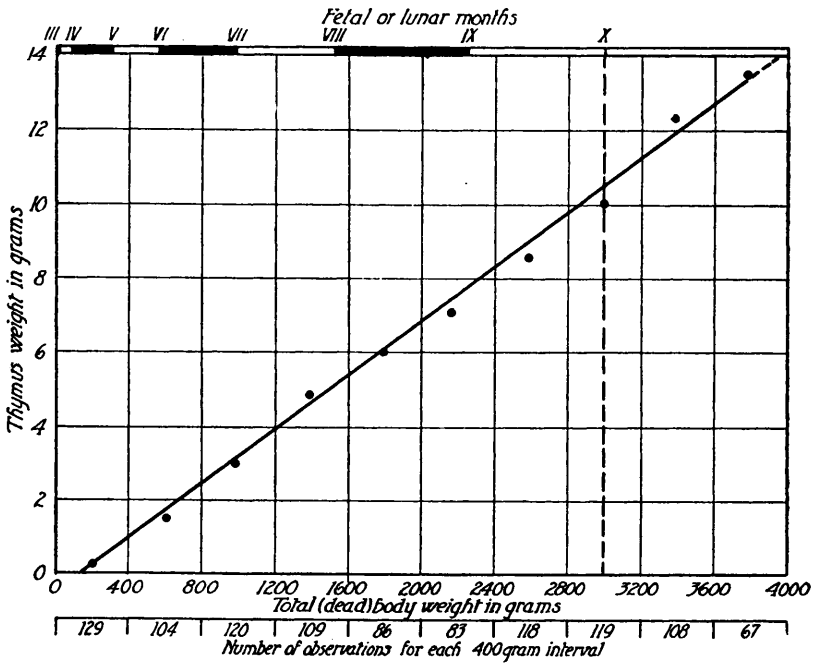


FIG. 1.

Illustrating ponderal growth of the thymus with respect to the total body-weight in the fetal period. The body-weight (in gm.) is base line of the graph. Estimated age<sup>1</sup> is represented by panels, upper margin of figure. Observed, mean, thymus-weights for 400 gm. intervals of total body-weight are indicated by dots. Graphical expression of empirical formula for relation of thymus-weight to body-weight is heavy solid line. Number of observations in each 400 gm. interval of body-weight is indicated in lower panel of graph. The vertical broken line in the field represents computed birth value of body-weight.

As shown in Figure 1, the relation appears to be rectilinear. It may be approximated by the empirical formula :

$$TW = 0.0036418 BW - 0.474 \quad (1)$$

where "TW" is the weight of the thymus in grams and "BW" is the (dead) weight of the total body in grams. This formula was computed from the means of thymus-weight and of body-weight for the ten 400 gram intervals of body-weight from 0 to 4000 grams (weighting by the square root of the number of observations in each interval). The calculated values show a mean, weighted, absolute deviation of 0.248 grams from the observed averages. The mean, weighted, relative deviation is 6.03 per cent. This relative deviation lies mainly in the two lower weight-intervals, the mean, weighted, relative deviation for the upper eight intervals being 3.31 per cent.

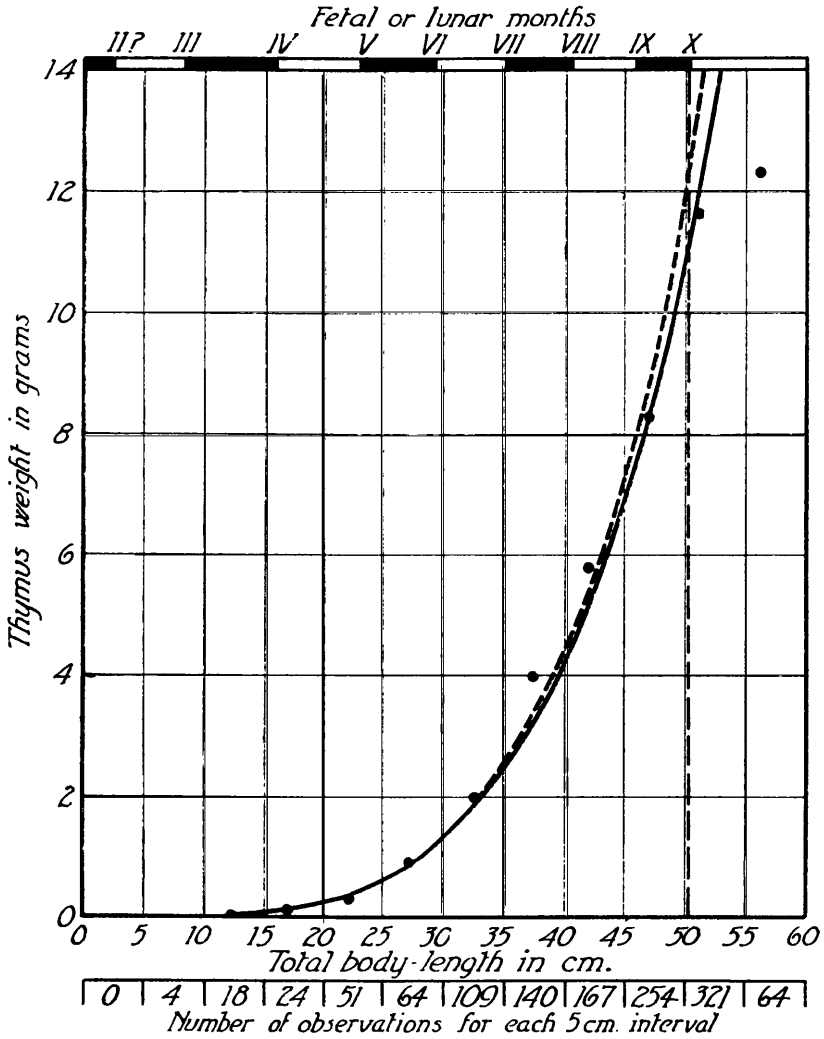


FIG. 2.

Illustrating ponderal growth of the thymus with respect to crown-heel body-length. The body-length is on base line of graph. Estimated age<sup>2</sup> is represented along the upper margin of the figure. The observed, mean, thymus-weights for 5 cm. intervals of total body-length are indicated by dots. Graphical expression of the first empirical formula for the relation of thymus-weight to body-length is represented by the solid curve. The graphical expression of the second empirical formula is represented by the heavy broken curve. The number of observations in each 5 cm. interval of body-length is indicated in the lower panel of the graph. The vertical broken line in the field represents the computed birth value of body-length.

The relation of thymus-weight to body-length is shown in Fig. 2. As in the preceding series, in no instances were observations made on fetuses living over 48 hours. Two approximate, empirical expressions have been developed for this relationship, the first by using the mean thymus-weights and body-lengths for the 5 centimeter intervals of body-length from 5 to 60 centimeters (based upon 1216 observations), and the second by using the means of thymus-weight and body-length for the 5 centimeter intervals from 5 to 55 centimeters (based upon 1152 observations). In each case the expression was calculated by the method of means, weighting by the square root of the number of cases in each 5 centimeter interval of body-length.

The expression obtained by the first procedure is:

$$TW = 0.0001312 L^{4.0654} \quad (2)$$

where "TW" is the thymus weight in grams and "L" is the total or crown-heel length of the body in centimeters. The calculated values obtained by this expression show a mean, weighted, absolute deviation of 0.700 grams from the corresponding observed averages. The mean, weighted, relative deviation is 13.52 per cent.

The expression obtained by the second procedure is:

$$TW = 0.0001076 L^{4.329} \quad (3)$$

The calculated values of this expression show a mean, weighted absolute deviation of 0.511 grams from the corresponding observed averages and the mean, weighted, relative deviation is 12.286 per cent. Neither of these formulae can be regarded as entirely satisfactory expressions for the relation between thymus-weight and stature.

The formulae indicate a closer correlation between thymus-weight and body-weight than between thymus-weight and body-length. The constants of the empirical formula for thymus-weight and body-weight indicate an increase in relative weight of the thymus in the fetal period, a phenomenon previously noted by Legou,<sup>3</sup> Jackson<sup>4</sup> and others. This report is preliminary to a more detailed biometric study of the growth and variability, and possible sex differences, of the thymus in prenatal life.

<sup>1</sup> Scammon, R. E., and Calkins, L. A., *PROC. SOC. EXP. BIOL. AND MED.*, 1923, xx, 355, (formula 1).

<sup>2</sup> Scammon, R. E., and Calkins, L. A., *PROC. SOC. EXP. BIOL. AND MED.*, 1924, xxii, 157 (formula 5).

<sup>3</sup> Legou, E., *Quelques considérations sur le développement du foetus*, Thesis, Paris, 1903.

<sup>4</sup> Jackson, C. M., *Am. J. Anat.*, 1909, ix, 117.