5912

Prenatal Growth of Human Testes and Ovaries.

HERBERT WALD AND RICHARD E. SCAMMON.

From the Department of Anatomy, University of Minnesota, and the Department of Anatomy, University of Chicago.

The ponderal growth of the testes, with respect to body weight, has been studied from a series of 89 human fetuses, ranging from 16.3 to 3600 gm. in total body weight.[1] When the weight of the fetal testes is plotted against the weight of the body as a whole, it follows a rectilinear course which may be approximated by the expression:

$$TW = 0.000225\,BW + 0.0172 \qquad (1)$$

where TW is the testes weight in gm., and BW is the total weight of the body in gm. This formula was computed from the individual values by the method of means. The calculated values thus obtained show a mean absolute deviation of 0.025 gm., and a mean relative deviation of 8.03% from the observed values. This relationship of the weight of the testes to total body weight is similar to that exhibited by the weights of many other organs and parts of the body in the fetal period.

In order to obtain the rate of growth, an age-testes weight formula was obtained by substituting the Scammon-Calkins body weight-age formula[2] in the testes weight-body weight formula equation (1), thus

$$TW = 0.225\ (0.561 - 0.366T - 0.061T^2) - 0.0172^* \qquad (2)$$

Rate was calculated by obtaining the first derivative. The resulting rectilinear progression in rate is illustrated in Fig. 2.

The relation between testes-weight and body-length, as determined from 89 observations, is shown in Fig. 3. The empirical formula, determined from the averages of testes weight for 5 cm. intervals of body-length from 5 to 55 cm. inclusive (weighted by the square root of the number of observations in each interval) may be expressed as:

$$TW = 7.554e^{0.091165BL} \qquad (3)$$

[1] Material from the autopsy records of the University of Minnseota, and a collation of published records including the extensive data of Borovansky, (L. Borovansky, *Bull. internat. de l'Acad. d. sc. d. Boheme*, 1930, 15).

[2] Scammon, R. E., and Calkins, L. A., PROC. SOC. EXP. BIOL. AND MED., 1924, **22**, 157.

* Constant 0.225 modified for kilograms, coefficient of T corrected from 0.336 to 0.366. Error due to typographical error in original paper.

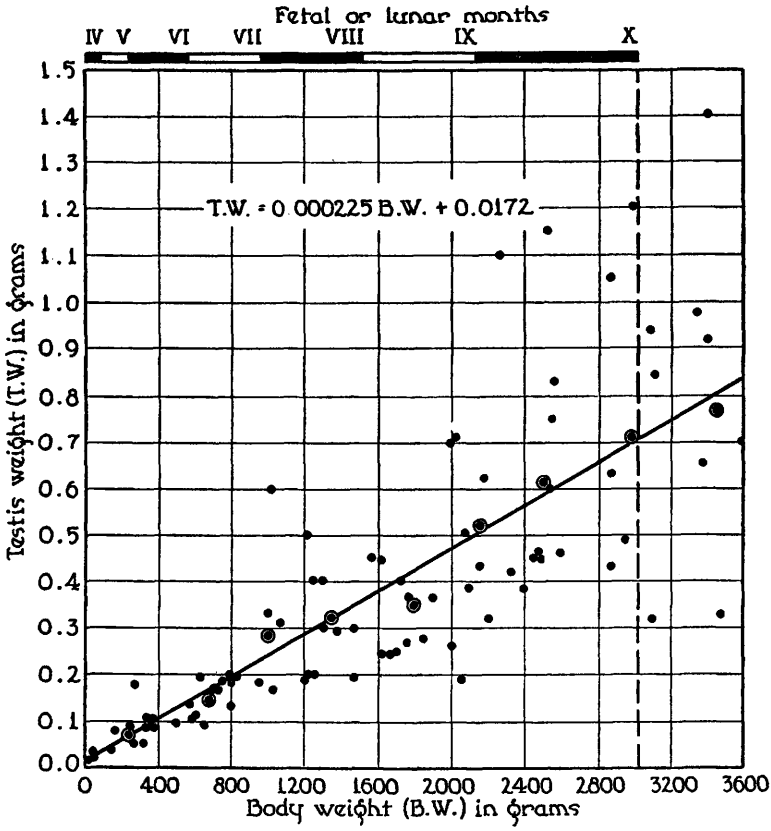

FIG. 1.

Ponderal growth of the human testes with respect to total body weight in the fetal period. The body weight (in gm.) is indicated on the base line of the graph. The estimated age (as computed from the "approximate" formula of Scammon and Calkins) is represented by panels along the upper margin of the figure. The observed individual testes weights are indicated by solid dots. The observed, mean testes weights for 400 gm. intervals of total body-weight are indicated by the circled dots. The graphical expression of the empirical formula for the relation of testes-weight to body-weight is represented by the heavy solid line. The vertical broken line in the field represents the computed birth value of body weight.

where TW is the testes weight in mg., e is the base of the natural logarithms, and BL is the total, or crown-heel body length. The mean, weighted, absolute deviation of the observed from the calculated means as determined by the above formula is 0.048 gm. and the corresponding relative deviation is 13.51%.

This is a different type of exponential curve than that used by Scammon and co-workers to express the relation of the weights of many other organs and body parts to body length in the fetal period. In these instances the weight of the organ could be ap-

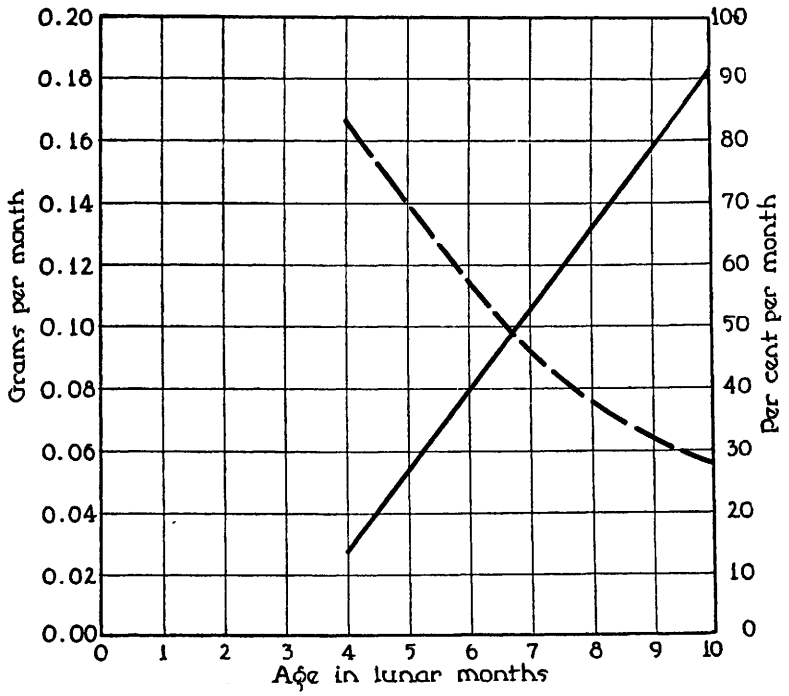

FIG. 2.

The solid line is a semischematic curve illustrating the absolute instantaneous velocity of growth of weight (gm. per lunar month) of the testes in the prenatal period. The broken line is a semidiagrammatic curve illustrating the changes in relative instantaneous velocity (instantaneous velocity ratio) of the testes in the prenatal period.

proximated by a small fraction of the body length raised to a power approaching a cube. This follows the general formula:

$$OW = a\,B\,L^{b} \qquad (4)$$

in which OW represents organ weight and BL, body length.

This difference may be due to the inadequacy of the data, and not to a fundamental difference in the nature of the relationship of increase of testes weight with body-length.

These figures indicate: (a) that the ponderal growth of the testes in the fetal period is quite comparable to that of the body as a whole, and that of most of its major parts and organs; and (b) that although the growth of the absolute weight of the testes is proportional to the growth in body weight during the fetal period, the *relative* weight of the organ, with respect to body weight, undergoes a reduction during this period from 0.143% at 3 lunar months to 0.023% at birth.

TABLE I.
Body Weight-Testes Weight in the Fetal Period.

Intervals of body weight. (gm.)	No. of cases	Mean body weight (gm.)	Testes Weight (gm.)				Deviation		Age* in lunar months
			Observed			Calculated Mean			
			Mean	Maximum	Minimum		(gm.)	%	
0 to 400	13	230.0	0.070	0.180	0.011	0.069	0.001	1.43	4.89
400 to 800	12	674.0	0.141	0.189	0.096	0.169	0.028	19.86	6.29
800 to 1200	7	1010.6	0.286	0.600	0.169	0.245	0.041	14.36	7.05
1200 to 1600	10	1347.0	0.324	0.500	0.194	0.321	0.003	0.93	7.68
1600 to 2000	13	1774.0	0.354	0.720	0.245	0.416	0.062	17.61	8.37
2000 to 2400	9	2164.0	0.520	1.100	0.190	0.504	0.016	3.08	8.94
2400 to 2800	9	2517.0	0.615	1.150	0.391	0.584	0.021	3.41	9.41
2800 to 3200	9	2995.0	0.717	1.200	0.315	0.691	0.028	3.91	9.99
3200 to 3600	7	3453.0	0.766	1.400	0.332	0.794	0.028	3.66	10.51

*Age calculated with Scammon-Calkins age-body weight formula.

TABLE II.
Body Length-Testes Weight in Fetal Period.

Body length intervals (cm.)	No. of cases	Mean body length (cm.)	Testes Weight (mg.)				Deviation	
			Observed			Calculated Mean	(mg.)	%
			Mean	Minimum	Maximum			
5 to 10	1	9.8	11.0	11	11	18.4	7.4	67.3
10 to 15	2	11.2	15.0	15	15	20.9	5.9	39.3
15 to 20	1	19.1	37.0	37	37	43.0	6.0	16.2
20 to 25	6	23.4	98.3	50	180	63.7	34.6	35.2
25 to 30	5	27.3	104.4	50	189	90.9	13.5	12.9
30 to 35	7	32.1	128.9	93	166	140.8	11.9	9.2
35 to 40	16	37.4	281.4	130	600	229.1	52.3	18.6
40 to 45	17	42.6	366.2	188	720	277.5	11.3	3.1
45 to 50	19	47.1	531.6	257	1150	553.2	21.6	4.1
50 to 55	15	52.9	793.3	332	1400	937.7	144.4	18.2

TABLE III.
Weight of Ovaries in the Fetal Period.

Body length intervals (cm.)	No. of cases	Mean body length (cm.)	Weight of Ovaries (gm.)		
			Mean	Minimum	Maximum
10 to 15	1	11.8	0.0130	0.013	0.013
15 to 20	3	17.9	0.0387	0.034	0.045
20 to 25	2	24.0	0.0495	0.042	0.057
25 to 30	9	28.6	0.1344	0.067	0.248
30 to 35	9	33.5	0.1662	0.040	0.381
35 to 40	13	38.0	0.1645	0.040	0.332
40 to 45	10	42.7	0.2607	0.198	0.400
45 to 50	18	47.6	0.2005	0.080	0.420
50 to 55	14	51.8	0.2436	0.090	0.586

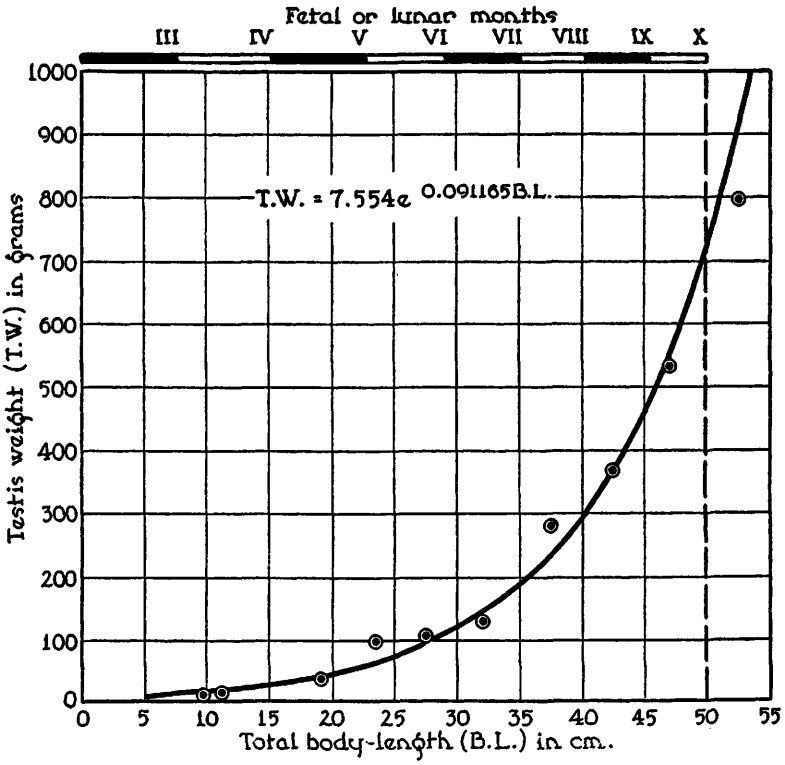

FIG. 3.

A graph illustrating the ponderal growth of the testes with respect to crown-heel body-length. The body length (in cm.) is indicated on the base line of the graph. The estimated age (as computed from the empirical formula of Scammon and Calkins) is represented by the panel along the upper margin of the figure. The observed mean testes weight for 5 cm. intervals of total body length are indicated by circled dots. The vertical broken line in the field is the computed birth value of body length.

An attempt was made to analyze a series of 79 cases of ovary weights. However, due to the great variability in this material, no reasonable trend line could be obtained.