to bimodality was noticed. The frequency curves of the area-length index, in general, showed skewness in the opposite direction and decreased range during the period of increased size. It would seem then that there is throughout, a negative correlation between the length of the cells and the area-length index. The coefficient of variation for both length of cells and area-length index was increased during the period of increased size.

## 110 (2342)

## On the growth of the human cerebellum in early life.

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All investigators of the ponderal growth of the human cerebellum in early life have been impressed by the rapid rate of increment of this part of the brain in the first year. This has lead certain students of human growth to conclude that the rapid growth of the cerebellum in infancy is correlated with the marked development of muscular co-ordination and activity in this period.

The following figures represent an attempt to test the truth of this concept. They consist of the results derived from the computations of the growth in volume of the cerebellum in the fetal period and of weight in the period of infancy. These computations are based upon the following empirical formulae:

1. For the relation between the cerebellum volume and body-length in the fetal period:

Volume of the cerebellum (cc.) $= 0.01\,[(0.095 \text{ crown heel length in cm.})^{4.9} + 20.0]$, as developed by Dunn.[1]

2. For the relation between body-length and age in the fetal period:

$$\text{Age in fetal months} = 2.3 + \frac{2.5\,(\text{body-length in cm.})}{28} + \frac{(\text{body-length in cm.})^2}{784}$$

as developed by Scammon and Calkins.[2]

1 Dunn, H., *J. Comp. Neurol.*, 1921, xxxiii, 405.

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

3. For the relation between cerebellum weight and age in postnatal life:

$$\text{Weight of cerebellum (gm.)} = \frac{\text{Age (years)}}{0.094 + 0.0078 \text{ age (years)}} + 19.8,$$ as developed by Scammon and Dunn.[3]

Unfortunately it is necessary to use volumes for the fetal period and weights for infancy in these calculations, but the difference between the volume and the weight of the cerebellum is relatively small in prenatal life, and the correction for this slight difference would accentuate rather than reduce the changes herein recorded.

As will be seen from tables I and II, the absolute volume of the cerebellum increases at first slowly, and then rapidly to the close of the fetal period; the increment in the tenth month being 8.12 cc. After birth, on the other hand, the increment in weight of the cerebellum undergoes a constant decrease from 6.19 grams in the first postnatal month to 2.52 grams in the thirteenth month.[4]

The percentage increment in weight or volume also shows striking changes. This index is determined by dividing the absolute increment in each month by the value at the beginning of the month and multiplying by 100. The percentage increment showed a marked rise from the fifth to the sixth fetal month, the value being over 162.5 per cent in the latter interval. After the sixth fetal month the percentage increment decreases at first rapidly and then more slowly, falling to about 38.8 per cent for the first month after birth and to 3.34 per cent for the last month in the first year.

These results are shown in graphic form in the following figure where solid columns are used to represent the monthly percentage increments, and open columns the absolute monthly increments.

These figures indicate that while there is indeed a rapid growth in the cerebellum the first year, this growth is not stimulated by the factors of extra-uterine environment. This growth in early

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[3] Scammon, R. E., and Dunn, H. L., PROC. SOC. EXP. BIOL. AND MED., 1922, xx, 114.

[4] All calculations, both prenatal and postnatal, are made in lunar months of four weeks.

infancy is rather to be regarded as a diminishing residuum of the tremendous growth energy of the organ which is exhibited in the latter half of intra-uterine life.

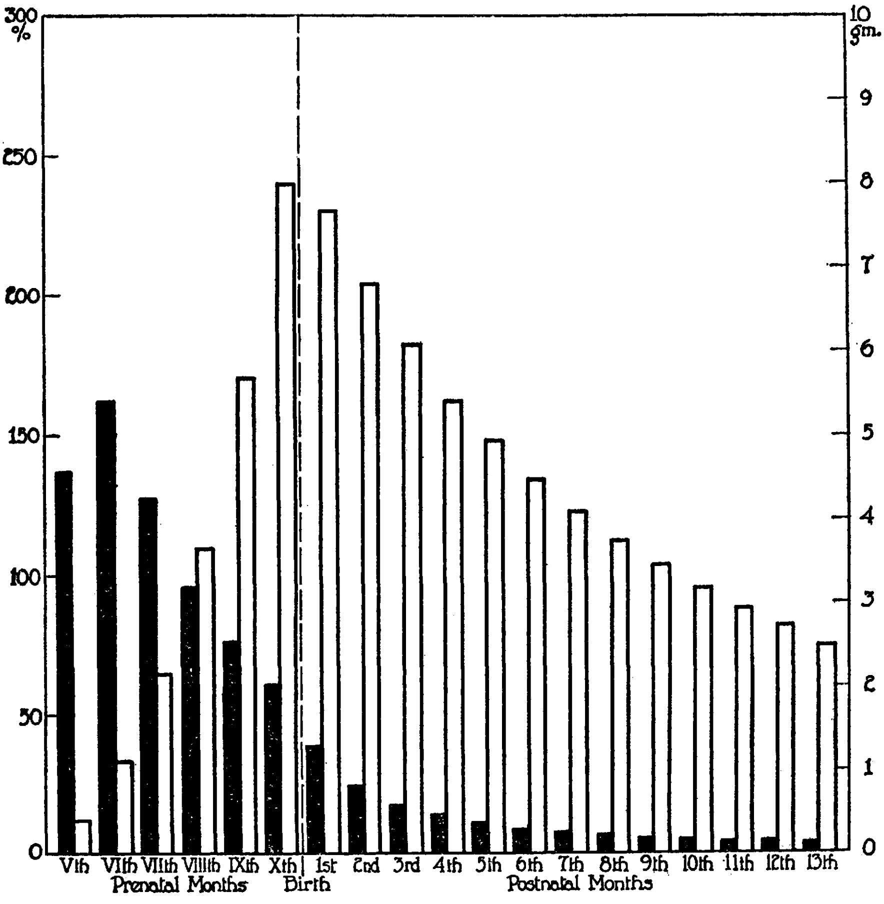

TABLE I.

Volume of the cerebellum in the fetal period, weight of the cerebellum in the first year.

| Age fetal months (of four weeks) | Cerebellum volume (cc.) | Age postnatal months (of four weeks) | Cerebellum weight (gm.) |
|---|---|---|---|
| 5 months | 0.64 | Birth | 19.80 |
| 6 months | 1.68 | 1 month | 27.49 |
| 7 months | 3.83 | 2 months | 34.31 |
| 8 months | 7.50 | 3 months | 40.40 |
| 9 months | 13.18 | 4 months | 45.87 |
| 10 months | 21.30 | 5 months | 50.82 |
| | | 6 months | 55.30 |
| | | 7 months | 59.40 |
| | | 8 months | 63.14 |
| | | 9 months | 66.58 |
| | | 10 months | 69.75 |
| | | 11 months | 72.69 |
| | | 12 months | 75.41 |
| | | 13 months | 77.93 |

TABLE II.

Absolute and percentage monthly increments in the cerebellum volume and weight.

| Age | Absolute monthly increments (vol. or wgt.) | Monthly percentage increments |
|---|---|---|
| | (cc.) | |
| 5th fetal month | 0.37 | 137.03 |
| 6th fetal month | 1.04 | 162.50 |
| 7th fetal month | 2.15 | 127.97 |
| 8th fetal month | 3.67 | 95.82 |
| 9th fetal month | 5.68 | 75.73 |
| 10th fetal month | 8.12 | 61.60 |
| | (gm.) | |
| 1st postnatal month | 7.69 | 38.83 |
| 2nd postnatal month | 6.82 | 24.80 |
| 3rd postnatal month | 6.09 | 17.75 |
| 4th postnatal month | 5.47 | 13.54 |
| 5th postnatal month | 4.95 | 10.79 |
| 6th postnatal month | 4.48 | 8.82 |
| 7th postnatal month | 4.10 | 7.41 |
| 8th postnatal month | 3.74 | 6.30 |
| 9th postnatal month | 3.44 | 5.45 |
| 10th postnatal month | 3.17 | 4.76 |
| 11th postnatal month | 2.94 | 4.22 |
| 12th postnatal month | 2.72 | 3.74 |
| 13th postnatal month | 2.52 | 3.34 |

It may be urged that the intra-uterine growth of the cerebellum may represent a response to the muscular activity indicated by quickening, which usually takes place some time in the fifth month when the cerebellum begins its more active growth. This argument, however, seems invalidated by the fact that all of the parts of the brain, as well as all other of the portions of the body show an increased growth in weight at this time, and therefore there is no particular reason for assuming that the growth of the cerebellum at this period is activated by any special factor which is not influencing the other parts of the body.

## 111 (2343)

## Carotin in Perillus bioculatus (Fab.) and its derivation from the lymph of Leptinotarsa decemlineata (Say).

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One of us[1] has shown that the variations in the hypodermal color pattern of the stink-bug *Perillus bioculatus* (Fab.) from white and black to red and black (with various intermediate yellow and black forms) are not caused by inheritance but by variations in physiological activity, which can be controlled by the temperature of the environment, and influenced by sexual functions, such as egg laying. The food of the stink-bug is always highly colored with orange-yellow pigment for it consists almost exclusively of the eggs and larvae of the potato beetle, *Leptinotarsa decemlineata* (Say), as well as the adult beetle itself. When the larvae and adult beetles are attacked the golden yellow lymph is the only portion eaten.

A chemical examination of the pigment in the lymph of the potato beetle showed that it consists exclusively of carotin. No other carotinoids could be detected. The concentration of carotin in fresh lymph obtained from 200 full-grown larvae was found to be 0.0136 per cent, which is as high as is encountered in fresh green leaves.

The red and yellow colors in the hypodermis of the stink-bug were also found to be due to carotin. Some water-soluble

[1] Knight, H. H., *19th Report, State Entomologist of Minnesota,* 1922, 50.