normal. One case of obesity thought to be of pituitary origin was 10 per cent. from the normal average and hence may be regarded as suspicious. The case of acromegaly was also 10 per cent. below, and the myxedema 27 per cent. below.

9 (941)

The energy metabolism of infants in relation to age and nutritive condition.

By JOHN R. MURLIN.

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Recent studies of the heat production of infants by Benedict and Talbot,[1] Bailey and Murlin[2] and Murlin and Hoobler[3] indicate a progressive increase from birth to the age of one year, whether the metabolism is reckoned on the basis of weight or on the basis of surface area (Meeh).

On the basis of weight the average metabolism of 13 newborn infants, determined while they were sleeping, is 1.87 calories per kilogram and hour; of normal infants between the ages of two and four months inclusive, it is 2.38 calories per kilogram and hour; between 6 and 12 months the average is 2.45 calories per kilogram and hour.

On the basis of a square meter of skin surface the metabolism of the newborns (up to 14 days of age) is, on the average, 25 calories per square meter and hour; of normal infants from two to four months inclusive, 35 calories per square meter and hour; and between six and twelve months the average is nearly 42 calories per square meter and hour. These differences on the basis of surface area are based on the assumption that the surface bears the same relation to weight ($11.9\sqrt[3]{(W)^2}$) in all.

An analysis of all the observations on infants between the ages of two months and one year studied by Howland,[4] Benedict

[1] Carnegie Institution of Washington, Publ. No. 201; also *Amer. Journ. Dis. of Children*, 1914, VIII, p. 1.

[2] *Proc.* of this Soc., 1914, XI, p. 109.

[3] *Ibid.*, 1914, XI, p. 115.

[4] *Zeitschr. f. physiolog. Chemie*, 1911, LXXIV, p. 1; also Trans. of XVth Cong. on Hygiene and Demography, 1912, II, Pt. II, p. 438.

and Talbot and Murlin and Hoobler shows that the normal, recently-fed, sleeping infant produces about two and a half calories per kilogram and hour. With but two exceptions (out of 48) the underweight and atrophic infants produce more than this and the overweight infants produce less. It is suggested, therefore, that for practical purposes two and one half calories per kilogram and hour or sixty (in round numbers) calories per kilogram and twenty-four hours may be regarded as the average normal heat production of sleeping infants within this range.

10 (942)

The measurement of the surface area of adults.

By **DELAFIELD DU BOIS** (by invitation) and **EUGENE F. DU BOIS.**

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Meeh's[1] formula $K\ WT^{2/3}$ is accurate in principle only when applied to individuals of differing weights but of similar body form.

The surface area of five adults of widely different weights and forms was measured by the following method. The subject was dressed in a tight fitting suit of union underwear, the hands were covered with cotton gloves, the feet with socks and the head with a tight fitting bag of woven cotton material. The gloves were then covered with melted paraffin and over the rest of the surface strips of paper were pasted in such a manner that a stiff mould of the body was formed. This was then cut in small pieces which would lie flat. Patterns of these pieces were made by printing them on photographic paper of known area and weight. These patterns were then cut out and weighed and the surface areas of the various parts of body calculated.

Many linear measurements of the subject were taken and an effort made to find the length and average breadth of each part of the body. After numerous trials characteristic measurements of length and breadth were chosen. The products of the length and breadth when divided into the surface area as actually deter-

[1] Meeh, *Zeitschr. f. Biol.*, XV, 435.