

calories on infants over 24 hours of age was obtained as compared with 26.75 calories obtained by Benedict and Talbot¹ for normals from 2 to 8 days of age. These observers found a rather constant heat production from second to seventh day, the average of all basal periods being 27.87 cal. per sq. m. per hr. as compared with 25.72 calories for our prematures.

In comparing maximum with minimum heat values for each infant an average of 44.5 per cent. increase was obtained. Percentages varied from 5.7 with slight restlessness to 88.77 with hard crying 36 minutes ($\frac{3}{4}$ of the period). Comparing the increases obtained in succeeding periods of the same observation in which all the factors, except the activity, were the same, an average of 16.5 per cent. was obtained. Increases varied from 2.5 per cent. with very slight restlessness to 40.5 per cent. with crying 16 minutes of a 33-minute period. Minimal metabolism in children of comparable ages averages 31 cal. per sq. m. per hr. after feedings of from 60 to 84 grams breast milk and 24 cal. after feedings of from 25 to 35 grams.

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A test for peristaltic activity.

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The agent used is the red dye known as Sudan III. Its advantages are that it may be used in very small amount thus interfering very little, or not at all, with the normal processes in the alimentary tract. The amount used for man is from 50 to 70 milligrams ($\frac{3}{4}$ to 1 grain). It is soluble only in a fatty medium or in fat solvents. Taken with, or just after a meal, it is not impossible that a slight amount may be combined with the fat of the meal and absorbed to a slight extent; otherwise it is not, apparently, susceptible to the alimentary secretions. The tests have not been interfered with by any absorption that may have occurred. The red color of the dye is essential for the test.

The rapidity with which the dye, mixed with the ingesta, will

¹ Benedict and Talbot, Carnegie Institute Pubs., No. 233.

pass through the intestinal tract will depend upon peristaltic activity, the secretions, the frequency of evacuations and the amount of material ahead of it. In constipation the time will be lengthened and in diarrhea it will be shortened.

The test consists in giving 50-70 milligrams ($\frac{3}{4}$ to 1 grain) of Sudan III in a gelatin capsule, just before, or after, a meal. One or two grams of the feces from the subsequent evacuations are taken and dried. A record should be kept of the time of administration of the dye and of the evacuations which follow. After drying, the material is extracted with ether. The extract from the first feces passed (before the dye appears) is used as a control. Its color is usually greenish yellow or light brown. Later evacuations, depending on conditions, begin to show a red color. If the tests be continued long enough, the maximum red color will be obtained which will decrease, in later evacuations, until the normal color is again reached.

Three experiments upon the same individual gave the first appearance of the dye in 17, 15 and $25\frac{1}{2}$ hours respectively. The maximum color was obtained in 17, $38\frac{1}{2}$ and 51 hours. The return to a normal color occurred after $52\frac{1}{2}$ hours (4 evacuations), $65\frac{3}{4}$ hours (6 evacuations), and 73 hours (5 evacuations).

In another experiment, in which the subject had diarrhea, the dye appeared in the excreta $4\frac{1}{2}$ hours after it was administered. The first evacuation occurred 15 minutes after the dye had been taken and was used as the control. The maximum color was reached in about $11\frac{1}{2}$ hours and the normal color was reached in about $48\frac{1}{2}$ hours (7 evacuations).

Seventy milligrams of the dye were given to a poodle dog just after his bowels had moved. There was another evacuation $3\frac{1}{4}$ hours later, just before the animal was killed. The postmortem showed that the small intestines were practically empty except at the ileum, near the cecum. The large intestine contained a fair amount of material. Samples of the contents were taken from the stomach and at 30 centimeter (1 foot) intervals along the intestinal tract. A satisfactory test was obtained from the gastric contents, showing that a fair proportion of the dye was still present. The samples from the small intestine showed only faint reactions because of the scanty amount of material present—that from the duodenum was practically colorless. The sample from the ileum gave a good reaction because of the increased

amount of material present. The samples from the rectum and colon gave the most marked reactions of any, thus showing the presence of a considerable proportion of the dye. The intestinal tract was measured and it was determined that the dye had passed through it at the rate of 1.2 centimeters per minute. The dog evidently had diarrhea and the passage of a considerable proportion of the dye through the length of the intestines in $3\frac{1}{4}$ hours is relatively rapid.

Earlier experiments upon the cow and goat, under normal conditions show that the minimum time for the passage of the dye is 16-17 hours for the former and 14-17 hours for the latter. The uniformity in the minimum time of passage in widely separated species of animals is remarkable, when the difference in habits, food eaten, and the length of the alimentary tract is considered.

The minimum time is tabulated as follows:

Man	15	—25 hours
Cow	16	—17 hours
Goat	14	—17 hours
Horse	$15\frac{1}{4}$	—20 hours (Cuguini, powdered Brazil nut)

The ratio of the body length to the length of the intestinal tract is given as follows:

Man	1	—10 (Legs not included in body length)
Horse	1	—12 (Colin)
Cow	1	—20 (Colin)
Goat	1	—27 (Colin)

The average length of the intestinal tract of man is reckoned at 30 feet. From figures taken from Colin, who has computed the length of the intestinal tract in the domesticated animals, that of the horse is $3\frac{1}{4}$, the goat $3\frac{1}{2}$ and of the cow 6 times longer than that of man.

The fact that the herbivorous animals normally evacuate their bowels more frequently than man during the 24-hour period is a factor to be considered.

The test is simple, easy to carry out and the Sudan III has apparently no irritating or injurious effect upon the bowels. In the absence of an X-ray apparatus, much important information may be obtained. It would seem to be a useful method in arriving at a more positive diagnosis relative to certain intestinal disorders, such as torpidity, intussusception, strangulated hernia, impaction, or where any obstructive cause might be suspected.