

Results on muscles of dogs anesthetized with morphine and ether. The technique was the same as above except for the method of counting. In these experiments the number of open capillaries was compared with the number of muscle fibers in a field of given area. In resting muscle the results were: fibers 4.40; capillaries 2.65, or 0.60 capillary per fiber. In active muscle the results were: fibers 4.44; capillaries 5.65, or 1.27 capillary per fiber.

$$\text{Ratio } \frac{1.27}{0.60} = 2.11$$

These results appear to correspond more nearly with the findings of Hartman, Evans and Walker¹ than with the earlier observations reported by Krogh.² The choice of anesthetic appears to have made no difference in these experiments in the number of capillaries open in rest and in exercise.

5142

Certain Physiological Changes Accompanying Prolonged Mental Reaction

MARY L. SMULL, A. S. RAUBENHEIMER, F. M. BALDWIN, RALPH WEBB, EDITH HARKER, ZELMA HUXTABLE AND MARJORIE ABERNETHY. (Introduced by G. Martin.)

From the Department of Zoology, University of Southern California.

In an attempt to note the extent and to find the limits of certain suspected physiological changes produced during periods of prolonged mental effort, several series of carefully planned experiments were undertaken involving 3 subjects familiar with the solution of mental arithmetic problems. The task was uniform throughout and consisted in the solution of multiplication of 4 numbers by 4 numbers from memory alone. The level of metabolic rate was measured by oxygen consumption using the Graphic Metabolism machine. Changes in the blood elements, erythrocytes and leucocytes and changes in hemoglobin content were checked in the usual manner by use of the hemocytometer and the hemoglobinometer. Conspicuous changes in excretory products were determined by routine urine analyses, involving variations in specific gravity, reaction, occur-

¹ Hartman, F. A., Evans, J. I., and Walker, H. G., *Am. J. Physiol.*, 1929, **90**, 668.

² Krogh, A., "The Anatomy and Physiology of Capillaries," New Haven, 1922.

rence of albumin and sugar, di-acetic acid and acetone. Five specific tests were made on each of the subjects, the first series to establish the "norms" without mental effort. The second series covered a one-hour concentration period. The succeeding tests were for 4, 8, and 12 hours duration, respectively, repeated on 4 successive days. Checks were made preceding and following the 4-day series to establish metabolic levels. In general there appears a slight rise in the metabolic level on the second day of the 12-hour series in 2 of the 3 subjects. On the third day the metabolic level of all 3 continued well above the basal rate, while records from the fourth day show an extremely high level in all subjects. The urine analysis showed fluctuations in specific gravity within normal limits; the reaction was from neutral to acid during the daily interval with no trace of either sugar or albumin in any subject. Acetone was positive after the first day, but with no traces of di-acetic acid. There was no apparent significant change in the hemoglobin content of the blood, and although the erythrocyte and the leucocyte counts show that these elements in the blood increase in numbers during the day these fluctuations are considered to be within normal limits when one day is compared with another throughout the 4-day cycles.

5143

A Simple Spirometer.

FRANCIS MARSH BALDWIN. (Introduced by E. G. Martin.)

From the Department of Zoology, University of Southern California.

In attempting to carry out the laboratory exercises on the volumetric changes in respiration one often finds large sections of elementary students in classes with perhaps a single rather high priced and somewhat delicate piece of apparatus—the Spirometer. A rather simple and seemingly sufficiently accurate piece has been devised which can easily be assembled by appropriating glassware found at hand.

Two large battery jars, 10 liters capacity, are filled two-thirds full of tap water taking care that the level of the water is the same in each jar. A 1000 cc. graduate cylinder is also filled with water and inverted in one of the jars, taking care that no air is allowed to enter on inversion. The respired gasses to be measured are collected by displacement. The delivery tube for the purpose is assembled and