and according to Jackson[1] is "beautifully preserved. The holotype with two additional fragmentary pieces is in the collection of the University of Rochester, at Rochester, New York." To quote Professor Fairchild,[2] who also figured the specimen, "The fragment of the test or shell of a sea-urchin (Fig. 44) found in the ravine below Smith Street is the oldest echinoid as yet found in America." (Fig. 44 should read Fig. 45).

J. T. SANFORD

WICHITA FALLS, TEXAS

REPORTS

THE BANTING RESEARCH FOUNDATION

A RECENT report of The Banting Research Foundation shows that, in all, twenty-two different grants were distributed to workers in the laboratories of the universities throughout Canada during the year 1935–1936. A number of them were for comparatively small sums. For the first time in the history of the foundation a larger number of grants was made to workers in the University of Toronto than to other universities, and yet more grants were refused applicants in Toronto than in other universities. This is probably to be explained by the fact that the financial depression has perhaps affected the University of Toronto less than some of the other universities, though it has had the effect of increasing the number of well-qualified men who are unable to find posts and who consequently make application to the foundation to give them the means by which they can carry on their investigations. It is to be hoped that the raising of the depression will be followed by a more equitable distribution of the grants.

As a result of a grant made to Dr. A. C. Abbott and Dr. James Prendergast, of the University of Manitoba, the careful study of the effect of pregnancy on the state of the thyroid gland was published. The grant to A. J. Cipriani, of McGill University, was continued in order to enable him to complete his study of the methods of electrical recording of heart and respiration rates. The summer grant made to B. K. Coady and D. L. MacIntosh, of Dalhousie University, following small grants made in previous years, resulted in the publication with Professor Mainland of a series of four papers dealing with the character and counts of white blood cells with proper statistical analysis of their variation. The grant to K. A. Evelyn, of McGill University, was continued for another year in order to make clinical application of his method of photo-electrocolorimetry. The description of this apparatus has now been published and already various laboratories have adapted it for use, and there is no doubt that a valuable tool has been put in the hands of biochemical workers. Papers on the clinical application of the instrument are already in press.

A grant to Dr. L. Farber, of the University of Toronto, enabled him to make the preliminary steps in a study of the metabolism of certain of the infective bacteria. A grant to Dr. A. W. Ham, of the University of Toronto, enabled him to complete his study of the histological changes produced by chronic vitamin C deficient diet. This paper is ready for press. A grant to C. O. Hebb, of McGill University, resulted in a paper showing the relationship between external pancreatic secretion and the glucose content of the blood stream. A grant made to A. H. R. Smith, of the University of Toronto, led to a minor paper dealing with the anesthetic effects of some substituted furans and the development of a method of electrical recording of pulse pressure. Grants made to Professor L. Irving and K. M. Robertson, of the University of Toronto, enabled further progress to be made with the study of the effect of the carbon dioxide anhydrase, particularly in regard to the production of bone. The grant made to Dr. S. H. Jackson, of the University of Toronto, enabled a study to be made of the effect of skin infections on the glucose tolerance of animals fed both a high and a low carbohydrate diet. This material is also ready for press. A grant to Dr. E. M. Macdonald, of the University of Toronto, for the study of the transmission of immunity to the infant, is making progress. A grant to C. B. Stewart, of Dalhousie University, for a study of the accuracy of percussion has enabled him to gather a sufficient number of cases for a statistical study. A grant made to Dr. T. S. Perrett, of the University of Toronto, enabled further progress to be made on the effect of heparin on the prevention of thrombosis. A grant made to B. Schachter, of the University of Toronto, working under Professor G. F. Marrian, enabled them to publish a short paper on the oestrogenic substances in mares' urine, which shows that there is less variation in free and combined substances during pregnancy in this species than occurs in man. A grant made to Dr. M. C. Watson, of the University of Toronto, has led to the publication of the effects of sex hormones (supplied in part by Professor Marrian) on the disturbances of the menstrual cycle. A grant made to Dr. F. Smith, of McGill University, has led to the publication of a paper pointing

[1] Robert Tracy Jackson, Boston Society of Natural History, Mem. 7, pp. 285–6, 1912.

[2] Herman Leroy Fairchild, "Geologic Story of the Genesee Valley and Western New York." Published by the author. pp. 51–2, 1928.

out that strains of pneumococci exist which can grow under anaerobic conditions. A grant made to Dr. S. Weinstein, of the University of Toronto, led to the publication of a paper on the purification and assay of one of the sex hormones obtained from human urine during pregnancy. The grant to Dr. J. K. W. Ferguson, of the University of Western Ontario, for apparatus enabled him to complete a study of the carbamic compounds which are so important in the transport of carbon dioxide in the blood stream; a study of very considerable physiological importance. A small grant was made to Dr. M. J. Wilson, of the University of Toronto.

V. E. HENDERSON
D. T. FRASER
Honorary Secretaries

SPECIAL ARTICLES

NEW RECORDS IN HUMAN POWER

FIVE young men of international renown in distance running have been examined recently in this laboratory. In the group were: Lash, who within the past year has established new world's records in the 2-mile run, indoors and out; Cunningham, who holds world's records in the mile run, both indoors and out; San Romani and Venzke, milers on the U. S. Olympic team, who, with the fifth man, Fenske, have run the mile in near world's record time. All the men were in good running form at the time of the experiments.

Observations were made on the runners during rest and in four grades of work. The work of the first three grades was on a motor-driven treadmill: (1) a 15-minute walk at 5.6 kilometers per hour up an 8.6 per cent. grade; (2) a 5-minute run at 11.3 k.p.h. on the same grade; (3) a 5-minute run at 18.7 k.p.h. on a 4.0 per cent. grade. The fourth form of work was actual racing in an indoor track meet on February 13; five minutes after each man's race, venous blood was drawn for analyses.

The blood of these runners is like that of untrained man. The alkaline reserve, defined as the vols. per cent. of CO_2 in oxygenated blood at $pCO_2 = 40$ mm, averaged 48.1 as compared with 48.0 in a group of untrained men. The concentration of hemoglobin in blood and of proteins in plasma were within the limits observed in untrained man. The oxygen-combining capacity after the races ranged from 22.5 to 24.5 vols. per cent. in Cunningham, Venzke and Lash. The respective increases in the races were 7.6, 8.2 and 13.2 per cent. Each observed increase in oxygen capacity closely corresponds to the increase calculated from the observed change in plasma protein on the assumption that no protein leaves the circulation. The plasma chloride in rest and after races was normal, except for Lash, whose chloride shifted from 106.1 m.-eq. per liter in resting plasma to 99.0 after the race in which he broke the world's record for the 2-mile run. The races caused blood lactic acid to rise from 10, 16 and 9 mgm per cent. in rest to 116, 134 and 150, respectively, in Lash, Cunningham and Venzke.

The ratio $\frac{\text{residual air}}{\text{total lung volume}}$ averages 0.288 in the 5 runners and 0.285 in 11 non-athletic young men measured in this laboratory. The average vital capacities in the 2 groups are 5.36 and 4.74 liters, respectively. Expressed in liters per m of body height, the averages are 3.03 liters, ranging from 2.85 to 3.52, in the runners, and in the other group 2.73, ranging from 2.27 to 3.05. Hurtado[1] found an average of 2.72 liters per meter of height in 50 young men.

The maximum ventilation of San Romani, Venzke and Lash, the only runners who went through the hardest grade of work in the laboratory, averaged 113 liters per minute, as compared to 98 liters per minute of 99 other subjects in maximum work. The ratio $\frac{\text{tidal air}}{\text{vital capacity}}$ is practically the same in both groups, averaging 0.458 and 0.464, respectively. The greater ventilation in the runners was due principally to their average respiratory rate of 48, the rate of the untrained being 44. The tidal air of the runners was 2.38 liters with the untrained 2.25 liters. For a given oxygen intake the runners' ventilation was about 12 per cent. less than that of the other subjects.

In the walk at 5.6 k.p.h. the oxygen intake of the 5 runners averaged 1.0 liter per m^2 body surface and the blood lactic acid, 13.4 mgm per 100 cc blood; in 8 untrained young men the averages were 0.99 and 19.1. The similarity of oxygen intake means that in this sort of activity the efficiency is about equal, but the lower lactic acid level in the runners reflects their superiority of oxygen supply to tissues.

Oxygen intake and blood lactate in the harder grades of work are shown in Fig. 1. It will be noted that the runners adapted themselves quite readily to the speed by attaining relatively high oxygen intake. They kept the lactic acid at a fairly low level and finished the run with comparative ease. In this run all the untrained men were compelled to supply a considerable fraction of the energy anaerobically. Thus they accumulated more lactic acid, and only 2 were able to continue for the full 5 minutes. The measurements recorded in this run probably represent maxi-

[1] A. Hurtado and C. Boller, *Jour. Clin. Invest.*, 12: 793, 1933.