sure, by microchemical technique, it seemed particularly desirable to use unicellular plants in one-celled cultures. Hence unicellular algae were employed in mass cultures in test-tubes, in one-celled cultures in Van Tiegham cells and on agar plates.

A series of quantitative measurements is being compiled and will be published later.

The tests reported in this paper were begun in September, 1935, and have been carried on continuously since that date in the botanical laboratories of the University of Wisconsin. Assistance has been received from the Wisconsin Alumni Research Foundation. I am indebted to Dr. W. P. Zimmerman for the growth-substances used and for helpful suggestions relative to their use with algae.

MELVIN A. BRANNON

UNIVERSITY OF WISCONSIN

TEMPERATURE AND THE GROWTH OF HAIR

CASUAL observation of the variation in the growth of facial hair at different seasons of the year suggested its measurement. An experiment was planned, involving the measurement of the hair shaved from the same part of the face at approximately the same hour and with the same technique every day for one year (the subject, P. E., a florid male, aet. 59).

The crop harvested with one stroke of a straight razor from an area of about one square inch on the right cheek immediately in front of the ear, was washed free from soap, dried and mounted. On each slide selected for measurement one hundred hairs chosen at random were measured with an ocular micrometer. From each month's samples ten were selected for measurement; usually, the first, second and third; the eleventh, twelfth and thirteenth; the twenty-first, twenty-second, twenty-third and twenty-fourth. Each daily value was linked with the average temperature of the preceding day, as furnished by the U. S. Weather Bureau.

Table I gives the average rate of growth and the mean temperature.

TABLE I

Month	Mean temperature	Measured growth
January	58°	.305 mm.
February	54°	.386 "
March	61°	.404 "
April	70°	.458 "
May	74°	.464 "
June	81°	.516 "
July	83°	.533 "
August	82°	.538 "
September	79°	.545 "
October	73°	.533 "
November	64°	.495 "
December	60°	.375 "

A "scatter diagram" constructed from the individual daily measurements shows a very interesting break in the regression line at about 65° Fahrenheit, a temperature which ordinarily calls for heating of homes and office buildings.

PAUL EATON

MARY WRIGHT EATON

JACKSONVILLE, FLA.

VITAMIN B_1 CRAVING IN RATS[1]

WELL-AUTHENTICATED instances of excessive appetite or craving for special food stuffs are not numerous. We do know that some animals show a marked craving for common salt; other animals show an increased craving for phosphorus, expressed in a desire to eat bones; and some animals, including humans, may have a special appetite for calcium as shown by their ingestion of plaster and chalk. These cravings apparently have their origin in deficiencies produced either by a decreased intake of these minerals, or by an altered mineral metabolism in the case of sodium and calcium craving, dependent on changes in the adrenal[2] and parathyroid[3] glands, respectively.

Another and possibly more powerful craving may now be added to this list: the craving for vitamin B_1. In earlier experiments it was found that normal as well as vitamin B deficient rats show a great appetite for dried baker's yeast, which contains large quantities of vitamin B in addition to many other substances.[4] By virtue of the voluntarily increased ingestion of yeast the animal quickly lost all symptoms of vitamin B deficiency. This is in agreement with observations made by Harris, Clay, Hargreaves and Ward.[5] However, contrary to the results of Harris, *et al.*, we have found that rats show an overwhelming appetite for vitamin B in pure crystalline form, either as B_1 (betaxin or betalin), or Riboflavin. Vitamin B_1 was given in the form of an aqueous solution of synthetic thiamine chloride (betaxin, Winthrop Chemical Company, and betalin, Eli Lilly Company) in graduated inverted bottles. One vitamin deficient rat drank 11 cc, or 5,500 international units, in less than half an hour; another rat drank 29 cc, or 14,500 international units, in 24 hours. The odor of the vitamin as well as its taste arouses great interest. This is shown by the fact that the rats found the bottles at once, even when as many as twelve other containers filled with different foods or solutions were present in the cage at the same

[1] From the Psychobiological Laboratory, Henry Phipps Psychiatric Clinic and the Harriet Lane Home for Children, Johns Hopkins Hospital.

[2] C. P. Richter, *Endocrinology*, 20: 657–666, 1936.

[3] C. P. Richter and J. F. Eckert, *Endocrinology*, 21: 50–54, 1937.

[4] C. P. Richter, L. E. Holt, Jr., and B. Barelare, Jr., *Proc. Amer. Physiol. Soc.*, April, 1937, pp. 132–133.

[5] L. R. Harris, Janet Clay, Florence J. Hargreaves and A. Ward, *Proc. Roy, Soc. London*, Series B, 113: 161–190, 1933.

time. It was difficult to stop the animals from drinking the substance, once they had tasted it. Efforts to remove the bottle were met with fierce resistance. The bottle was held tightly with both paws and even with the teeth. By reaching far up into the bottles the rats made an effort to obtain every remaining drop of the vitamin. Riboflavin (lactoflavin), Dimethyltetrahydroxyamyliso-alloxazin 0.05 per cent. solution, Winthrop Chemical Company, elicited a similar, although less marked, craving. Due to the small available amount of the vitamin preparations, it was not determined how long the craving might remain evident.

It is of general biological interest that such a powerful craving should be associated with a food stuff of the great nutritive importance of vitamin B_1 and that both smell and taste elicit marked responses. The fact that the animals showed an immediate liking for the vitamin indicates that the appetite may not depend entirely on the experience of a beneficial effect resulting from the ingestion of the vitamin. This question of the rôle played by experience and by the deeper biological factors dependent on the taste mechanism we must leave unsettled at present.

The knowledge of the existence of this craving should be helpful for work in animal behavior for use as a reward stimulus. We do not know how general this craving is in different species of animals. In the rat it would seem to be one of the strongest of all the cravings.

CURT P. RICHTER
L. EMMETT HOLT, JR.
BRUNO BARELARE, JR.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD OF MEASURING THE VOLUME OF AMPHIBIAN EMBRYOS

DURING the course of an investigation on the physiology of development of amphibian embryos, it became necessary to determine the volume of the eggs. Two facts make accurate determinations of volume by existing methods very difficult: (1) it is impossible to obtain accurate wet weights, from which the volume can be calculated after the specific gravity of the eggs has been determined; (2) the early stages burst if brought in contact with the air-water interface. Both these difficulties are avoided by the method described below.

The present method is an indirect, colorimetric determination and is based on the fact that a known concentration of material, when made up to different volumes, will give colorimetric readings that vary as the dilution of the solutions. The determinations are made with the aid of a glass container whose appearance in section and dimensions is shown in Fig. 1. It consists of a bulb with a narrowed mouth above and capillary entering it below. The purpose of the capillary is to permit the removal of the contents without having large air bubbles in contact with the eggs. The total volume of the container is about 4 cc. Before being used, the container is filled with water and a reference mark is made on the capillary at the upper level of the water in it when the bulb is in a vertical position. In the container shown in the figure this was 35 mm from the upper end. Thereafter, when the container is filled with fluid, the level in the capillary is adjusted to the reference mark, and thus the same volume of fluid is used in every experiment.

To make a determination the container is filled with water, the height of the fluid in the capillary adjusted, and the open end of the capillary sealed with a piece

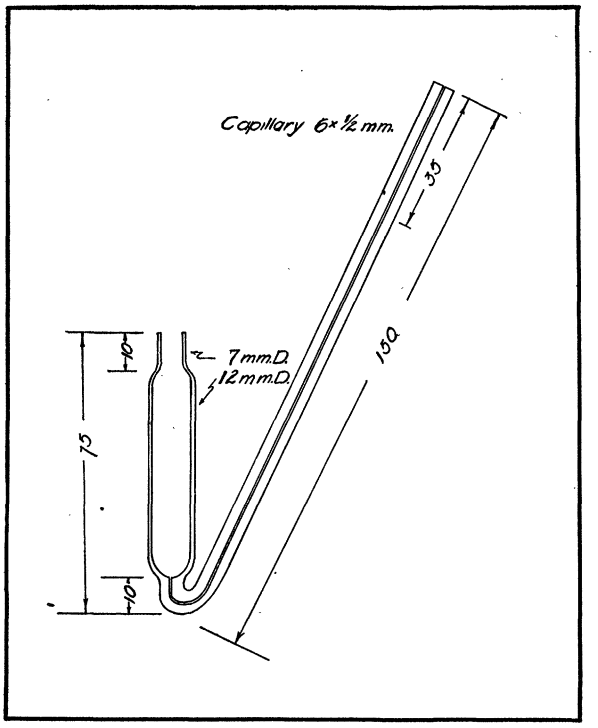

FIG. 1

of Scotch tape. It is important that the seal be airtight, otherwise the embryos may be drawn into the capillary during subsequent manipulation. The container is then immersed in a beaker of water, and the embryos, which have been removed from their membranes, are introduced into the bulb by means of a pipette. In this way they are never in contact with the surface film. Enough embryos are used to make up a volume of about 1 cc. This number varies from 200 *Rana pipiens* and 75 *Amblystoma punctatum* embryos