addition, the following were also used similarly: calcium pantothenate (dextrorotatory),[3] a pyrimidine component of $B_1$ (2-methyl, 5-ethoxymethyl, 6-amino pyrimidine) and vitamin $B_6$ hydrochloride.[4]

The wheat germ used was highly purified (about .5 per cent. of wheat grain) and contained per gram 24γ$B_1$ and 7.5–10γ$B_2$.[5] The equipment and general procedure was similar to that already described for oxydase determinations.[6] Reactions were carried out in apparatus similar to that already described.[7] It differed from it in having three compartments, one for the yeast suspension, one for the nutrient solution[8] and one for the vitamin solution or the wheat germ extract.[9] The apparatus was provided with glass hooks, both on the top and bottom parts of the ground joint. Rubber bands held the two parts together and made pressure measurements possible.

1 cc of a .4 per cent. yeast suspension and 1 cc of the nutrient solution were used in all the experiments. Of the vitamin-containing solutions, .2 to 1 cc were used and additional $H_2O$ to bring the volume to 1 cc. The total volume of the apparatus, exclusive of the monometer tube, was 15 cc, leaving 12 cc of air space. Thus at 31.0° C. (the temperature of the thermostat) an increase of 1 millimeter of mercury pressure represents very closely .028 milligrams of $CO_2$. Rate of shaking was two complete excursions per second. Shaking was interrupted at 15-minute intervals for reading. A typical experiment is given.

| | | | | |
|---|---|---|---|---|
| Nutrient solution | 1.00 cc | 1.00 cc | 1.00 cc | 1.00 cc |
| Yeast suspension .4 per cent. | 1.00 cc | 1.00 cc | 1.00 cc | 1.00 cc |
| Wheat germ extract .5 per cent. | | .20 cc | 1.00 cc | |
| Vitamin A | | | | 40 units |
| Wheat germ oil (E) | | | | .01 cc |
| Vitamin $B_1$ | | | | 1 γ |
| Vitamin $B_2$ | | | | 50 γ |
| Vitamin PP | | | | 10 γ |
| Additional $H_2O$ | 1.00 cc | .80 cc | | .60 cc |
| After 150′ of shaking mm of pressure | 72 | 90 | 148 | 78 |
| Mg of $CO_2$ produced | 2.016 | 2.520 | 4.144 | 2.184 |
| Increase due to addition | | 25 per cent. | 106 per cent. | 8 per cent. |

It appears that wheat germ contains a water-soluble heat-stable component, which stimulates yeast cells to greater activity in a manner usually attributed to vitamins. The effect is much greater than that of other vitamins studied. It may be due to a single or a mixture of essential food factors as yet not recognized.

This effect becomes particularly significant because nutritional authorities are endeavoring to establish certain levels for vitamins in flour and bread. It is expected that flour would contain 1.6 mg of thiamine, 1.2 mg of riboflavin, 10 mg of nicotinic acid and approximately 20 mg of iron per pound.[10] The additions would be made to offset the removal of vitamins by depriving the wheat of the wheat germ. The discovery here outlined may lead to making the reconstitution of the flour more complete.

HERBERT H. BUNZELL

NEW YORK, N. Y.

[3] Through the courtesy of Dr. R. R. Williams.

[4] Through the courtesy of Dr. K. G. Falk.

[5] Determinations made by Dr. D. J. Hennessey, of Fordham University.

[6] Bul. No. 238, B.P.I., U. S. Dept. of Agriculture, 1912.

[7] *Jour. Biol. Chem.*, XVII, p. 409, 1914.

[8] A. J. Schultz, L. Atkin and C. N. Frey, *Jour. Am. Chem. Soc.*, 59: 2547, 1937.

[9] Catox apparatus can be secured from Palo-Myers, Inc., New York City.

[10] Personal communication from Dr. Russell M. Wilder, chairman of the Committee on Food and Nutrition, National Research Council.

# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## A METHOD FOR MAKING SNOWFLAKE REPLICAS

THE exquisite beauty and infinite variety of the snowflake described in the early writings of Tyndall and others was brought to popular attention by the pioneer crystallographic work of Wilson A. Bentley, whose photomicrographs of snowflakes are classic in this field of study.

The technique of photographing snowflakes, while not exceedingly difficult, is rarely attempted because of the equipment needed and the essential factor that camera, slides, microscope and other apparatus must be kept below 0° C.

The technique for preserving snowflakes is extremely simple. A strip of velvet, or other dark material, fastened to a board or table, a few glass microscope slides, a toothpick or wire and a weak solution of a suitable resin are all the equipment necessary. The only other essential detail is an occasional snow flurry. The above-mentioned material is kept outdoors in a sheltered place ready for appropriate precipitation.

As soon as a suitable flake is observed on the dark background a drop of solution is placed on the glass slide with the toothpick or wire, and the flake is lifted with the same tool and placed in contact with the drop.

The solution should wet the flake completely. A second drop placed on top of the snowflake is sometimes desirable, particularly if the flake has large proportions. After wetting the flake in this manner the solvent soon evaporates, leaving the snowflake encased within a shell of resin.

A 1 per cent. solution of polyvinyl formal resin designated as Formvar 15–95 dissolved in ethylene dichloride and cooled below 0° C. was found to produce excellent replicas. The thickness of such a replica is of the order of 20,000 Å U.

As soon as the solvent has evaporated, the slides may be removed to a warm place. The case may be protected from abrasion by covering with a transparent sheet of resin or a glass coverslip or slide.

Because of the simplicity of this technique the casting materials can be carried anywhere, thus greatly increasing the possibilities of obtaining unique specimens.

A slight modification of the method provides an equally easy way to make a permanent record of breath patterns and any other structures, such as frost crystals, hoar frost and similar perishable formations.

When molecular films are deposited on the plate, it is placed in the freezing compartment of a refrigerator, and upon cooling to about 10° C. is held for a brief moment in the presence of moist air (which forms the so-called "breath patterns"), replaced in the ice chamber and the condensate is frozen. Meanwhile the 1 per cent. solution is cooled below 0° C. The plate containing the frozen breath pattern or other formation is then dipped into the solution, removed and returned to the cold chamber until the solvent evaporates. A perfect replica remains after the plate is warmed and the water evaporates.

VINCENT J. SCHAEFER
RESEARCH LABORATORY,
GENERAL ELECTRIC COMPANY

## THE USE OF INFRA-RED FILM FOR ELECTROPHORETIC AND ULTRACENTRIFUGAL ANALYSES

OPTICAL analysis in the air-driven ultracentrifuge or the Tiselius electrophoresis or diffusion apparatus is usually carried out in the visible region with some modification of the Töpler Schlieren method. Ultraviolet light, formerly employed for the examination of protein solutions by absorption recordings, is generally unsuited for the newer optical systems because of the expensive quartz lenses required.

We have encountered some difficulty in examining certain systems, particularly protein solutions containing dyes or bacterial pigments, because of their opacity to visible light. In overcoming this, advantage has been taken of the fact that many substances which absorb markedly in the visible region are transparent in the near infra-red. Thus even a deep brown solution of iodine in carbon tetrachloride is freely transparent to certain infra-red rays.[1]

The only modifications required in the new procedure are infra-red sensitive photographic films or plates, and a good source of infra-red radiation, such as a Nernst lamp, although satisfactory results can be obtained with an ordinary tungsten lamp. Infra-red plates and films are only slightly more expensive than panchromatic materials and can be obtained in a wide variety of sizes. They can be used in most cameras and plate holders although occasionally an older model may be found which is not infra-red "tight," with consequent general fogging. Theoretically, the focal length should be increased about 2 per cent. for infra-red work,[2] but in practice we have obtained sharp boundaries through visually opaque solutions without any disturbance of the usual focus of the ultracentrifuge or electrophoresis optical system.

As certain infra-red sensitized films and plates are sensitive to visual blue and red as well, filters may be necessary if the recording is to be made solely by infra-red radiation. In most cases the solution to be examined will serve as the filter. Exposures made by infra-red light alone should be longer than for the visible region. Development and fixation are conducted as for panchromatic materials.

Our experience has been limited to the plates and films used in amateur photography, sensitized up to 8600 Å—an extension of 1600 Å above the visible red. Although these have proved satisfactory for our purposes the possibility exists that solutions might be encountered which absorb in the region 7000–8000 Å as well. For these some of the special far infra-red sensitized plates available may be indicated.

HENRY P. TREFFERS
DAN H. MOORE
COLLEGE OF PHYSICIANS AND SURGEONS,
COLUMBIA UNIVERSITY

[1] R. W. Wood, "Physical Optics," p. 15, New York: Macmillan, 1934.
[2] "Infrared Photography with Kodak Materials," Eastman Kodak Company, 1940.

## BOOKS RECEIVED

*Blood Transfusion Association. Report, 1940–41; Project for Supplying Blood Plasma to England.* Pp. iv + 121. The Association, New York.

SCHUCHERT, CHARLES and CARL O. DUNBAR. *A Textbook of Geology. Part II—Historical Geology.* 4th edition, revised. Pp. xiii + 544. 343 figures. Wiley. $4.00.

SHERRINGTON, SIR CHARLES. *Man on His Nature.* Pp. 413. 12 plates. Cambridge University Press, Macmillan. $3.75.

SIGERIST, HENRY E. *Medicine and Human Welfare.* Pp. xiii + 148. 20 figures. Yale University Press. $2.50.