some stimulus to hatching. Yeast alone in tap water provides no stimulant for hatching that is very effective within 24 hr. The suspension used caused no hatching within 4 hr and very little within 24 hr. Therefore yeast alone is not likely to have added a stimulant to the aged media containing sugar that brought about hatching within 4 hr.

Durable eggs of *Psorophora discolor*, when submerged in media that promote growth in plants after a proper period of conditioning, hatch in a manner analogous to the elongation reaction of plant tissue. Water alone permits little or no hatching; purified stimulants cause less than half of the eggs to hatch; sugar in the medium may favor microorganisms that shorten the interval between submergence and hatching and increase percentage of hatch; freshly prepared extract of commercially canned cream-style corn and dilutions of coconut milk hasten hatching and increase the number of larvae hatched.

References

1. ABDEL-MALEK, A. *Ann. ent. Soc. Amer.*, 1948, **41**, 51.
2. CAPLAN, S. M. and STEWARD, F. C. *Science*, 1948, **108**, 655.
3. THIMANN, K. V. In D. E. GREEN (ed.) *Currents in biochemical research.* New York: Interscience, 1946, pp. 321–333.

A New Apparatus for Recording of Ecologic and Climatic Factors, Especially Temperature

Eilif Dahl

Botanical Laboratories, University of Oslo, Norway

For many purposes it is of interest to know for what length of time the temperature has been above a certain point, e.g., 0° C. A recorder that can supply this information may be constructed using the following principle.

If a ray of light of constant intensity illuminates a photographic plate, and the plate after a certain period is removed and developed, the degree of darkness will be a function of the time during which the plate has been illuminated. If the illuminated spot moves as a function of temperature, and such an apparatus is placed under varying temperatures, one may, after a certain period, remove and develop the plate. By photometry of the picture thus obtained, one may tell something about which temperatures occurred during the time of exposure, and the frequency of occurrence of each temperature.

A paper impregnated with a salt of a radioactive element of sufficiently high stability, e.g., a salt of radium, supplies a constant source of radiation that affects a photographic plate.

On this principle, the apparatus shown in Fig. 1 has been constructed.

A pointer (4) is connected with a bimetal strip (2) which bends with temperature. At the tip of the pointer, a metal plate is placed, and through this a slit (5) is cut. The slit is 1 cm long and consists of two parts, an outer one 0.5 cm long and 0.4 mm wide, and an inner one 0.5 cm long and 0.2 mm wide.

The system of bimetal strip and pointer is fastened in a metal case (1). The pointer moves parallel to the lid of the case (6).

The lid seen from below is pictured in Fig. 1 c. There is a frame (7) with two springs (8). In this frame a

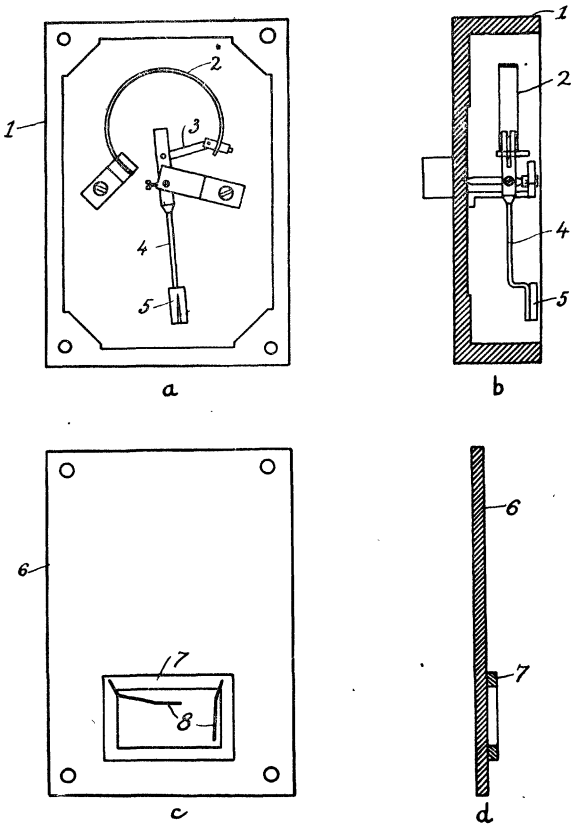

FIG. 1.

photographic plate is fastened so that two sides of the plate are pressed towards two sides of the frame. Thus the photographic plate is placed in a known position.

On the under side of the slit, a piece of paper impregnated with radium sulfate is fastened. Only the α- and β-particles going through the slit can reach the photographic plate. Some of the γ-rays going through the metal plate will reach the photographic plate, but if a fine-grained type of plate is employed, the photographic effect of the γ-rays is negligible in comparison to the effect of the α-particles.

When a photographic plate is placed in the frame, the lid fastened to the case, and the apparatus left under varying temperatures, different parts of the plate will be exposed to radiation at different temperatures. Each time a certain temperature occurs, one definite sector of the plate will be exposed, and in the course of time the exposures will be superimposed and added.

When the plate is removed and developed, and a photometric curve is made across the "spectrum" thus obtained, it is possible to calculate from it which temperatures occurred during the observation period, and the part of the observation period during which the temperature was higher than a given value. To obtain such results certain points must be taken into consideration:

1. A suitable photographic plate must be chosen. It should be fine-grained and should not change its proper-

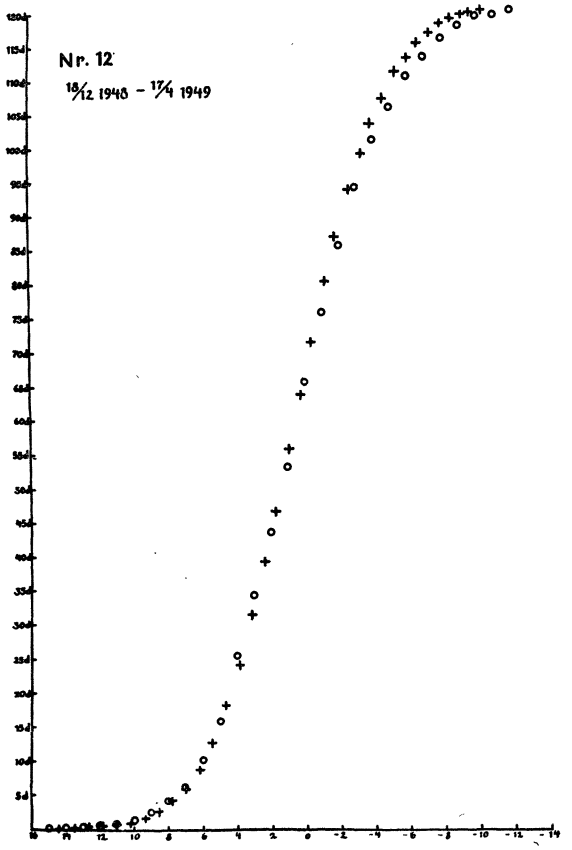

FIG. 2.

ties even during long observation periods. The Agfa Normal Diapositive Plate serves this purpose.

2. A suitable balance between the observation period, the activity of the radioactive paper, and the sensitivity of the plate must be found. For recordings of over one year an amount of approximately ½ γ radium sulfate/cm² was found suitable.

3. The relation between the time of exposure and the degree of darkening of the photographic plate must be found. The relation is very closely linear when a fine-grained plate is subjected to radiation by α- and β-particles even at low intensities.

4. The sensitivity of the plate as a function of temperature must be found. An experiment gave a sensitivity increase of 8% when the temperature was raised 23° C. This is an error for which correction must be made.

5. A standard exposure at definite temperatures must be made and photometric curves must be taken in the same way as in the original plates, to know which sectors of the plate correspond to which temperatures.

6. Because the slit has a certain width, the photometric curves give only an approximate representation of the relationship between the temperatures and the frequency of occurrence of each temperature interval, an error for which a correction must be made.

As a test, some of the apparatus was left for a certain period in the observation hut of the Norwegian Meteorological Institute at Blindern, Oslo, where continuous recordings with thermographs are made. From the thermograph curves the same factors may be calculated as from the photometric curves.

One of the results is given in Fig. 2. The ordinate shows number of days with temperatures higher than that given on the abscissa. Circles represent values calculated from the thermograph curves; crosses, values calculated from the photometric curves. The correspondence is good.

It will be evident that the same principle, although only with approximation, may be employed in all factors where the records can be transferred to the movement of a pointer, e.g., humidity, barometric pressure, etc. However, one does not know at which temperatures the exposures were made, and errors due to differences in the sensitivity of the plate with temperature cannot be corrected for. This difficulty may be overcome by making the width of the slit variable. If one side of the slit is fastened to a bimetal strip, this may be arranged so that the width of the slit decreases at higher temperature to compensate for the differences in sensitivity of the plate. Thus the same principle may be applied over a wide range of ecologic, climatologic, and other types of instruments.

A more detailed description and discussion is found in *Physiologia Plantarum*, 1949, 2, 272.

Cup Assay with Vitamin B_{12} as a Standard

John C. Foster, John A. Lally, and H. Boyd Woodruff

Research Laboratories of Merck and Company, Inc., Rahway, New Jersey

The cup assay method proposed by Heatley (*1*) for the estimation of penicillin has several advantages over standard turbidimetric or titrimetric procedures. Chief among these is the adaptability of the method to routine handling of large numbers of samples from a variety of sources. Evaluation of reproducibility of the method and discussion of factors influencing it have been presented by Heatley (*6*). The requirements for satisfactory microbiological assay methods have been listed by Foster and Woodruff (*4*).

Assays for biotin, thiamine, and riboflavin (*2, 5*) by the cup assay technique have been described. The factors crucial for antibiotic cup assays apply equally to the determination of growth-promoting factors by the cup method.

The microbiological estimation of LLD (*L. lactis* Dorner) type activity by means of *Lactobacillus lactis*,