there is some reason to believe that such culturing brings about some of the same changes as occur when it is propagated in the laboratory in pure culture.

We have recently isolated more than 200 cultures of *Lactobacillus bulgaricus* from fresh milk and have thus obtained a more adequate picture of the group as a whole than was heretofore available. What have been considered the prime distinguishing characters of this organism stand out in even bolder relief in these freshly isolated cultures. In a few characteristics, however, they vary from the conventional laboratory strains. For example, the new cultures do not grow as rapidly in milk, but this point should not surprise those who have given any thought to the subject of bacterial ecology.

With the application of proper selective methods, followed by dilution transfers, it was easy to obtain the cultures in substantially, if not strictly, pure cultures. Upon plating to obtain colony isolation, in the majority of cases, growth was not obtained either on aerobic plates or on those incubated anaerobically. At the suggestion of Professor Georges Knaysi, .05 per cent. sodium sulfite was added to the agar medium and the plates were incubated aerobically. All cultures yielded colonies on this medium and pure culture isolations were easily made. Probably the colony isolations could have been made by the conventional anaerobic methods—perhaps our technique was faulty—but, with such competent expert advice ready at hand, it was not necessary to lose further time with the more cumbersome methods. Although this rather strongly anaerobic nature of *Lactobacillus bulgaricus* appears to have been missed in the past, it is not especially surprising. The lactobacilli as a group are facultative with a distinct preference for anaerobic conditions on the part of a number of the species. Some of the other lactobacilli also behave as true anaerobes when freshly isolated and become facultative upon continued laboratory culture.

The more interesting new point about *Lactobacillus bulgaricus* is its thermophilic nature. Old laboratory cultures of this organism usually have maximum temperatures of growth around 50° C. A majority of the freshly isolated strains grow at 60° C., and vigorously at 55° C. While only a small proportion of the newly isolated cultures have failed to grow at these higher temperatures, out of a small collection of 18 strains, which were isolated and carried in the laboratory for about a year before testing, only six can grow at temperatures substantially above 50° C. This may be a coincidence, but we think not. Of three stock cultures of *Lactobacillus bulgaricus* which have been under artificial cultivation for many years, only one is now able to grow at 50° C.

For certain technical applications the thermophilic nature of newly isolated strains of *Lactobacillus bulgaricus* has an important significance.

J. M. SHERMAN
H. M. HODGE

CORNELL UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A HIGH SPEED CRYSTAL INK WRITER

VARIOUS oscillographs in use for following transient electric potentials depend on photographic recording, with the attendant trouble and delay of developing the record and the expense of equipment and film. This latter is especially serious when long-continued records are desirable, as in recent electrical studies of the brain. Ink writers, in turn, have been limited to relatively low frequency signals, the best so far described giving responses of approximately correct amplitude only below fifty cycles per second.

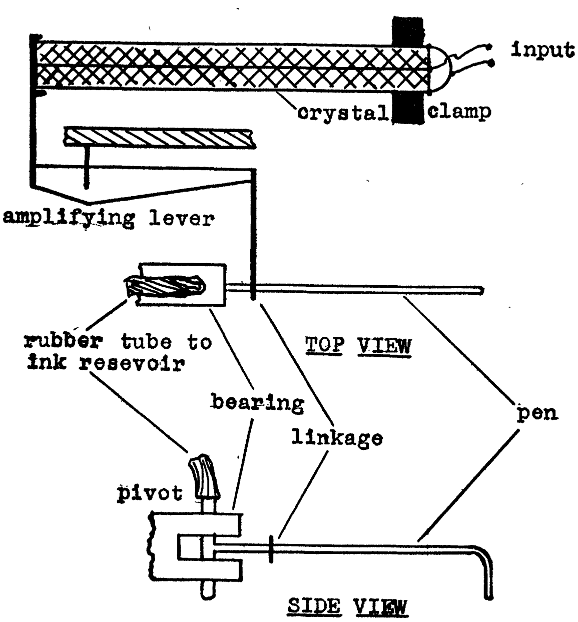

FIG. 1. Diagram of Crystograph.

The instrument here described is novel in that a piezo-electric crystal, rather than an electro-magnet, drives the pen. Besides improved frequency characteristics, this "Crystograph," as we have called it, possesses other advantages: no polarizing current or voltage is required; efficiency is high, a quarter of a watt of power giving deflections of two centimeters; a high impedance permits direct resistance-capacity coupling to the output of any amplifier supplying sufficient voltage (about 500 R. M. S. maximum) and power; its impedance characteristic also permits simple electrodynamic damping by an impedance in series with the input.

The motion of a "bimorph" type Rochelle salt crystal is transmitted through an amplifying lever to a pen of stainless steel tubing designed for maximum strength consistent with low moment of inertia (Fig. 1). One or more of these write on 1⅛ inch paper tape moving at a speed up to 20 cm/sec, the highest justified by the frequency characteristic of the Crystograph. Response amplitude is practically independent of frequency to 130 cycles per second; within 40 per cent. to 190. Figure 2 shows the frequency characteristics.

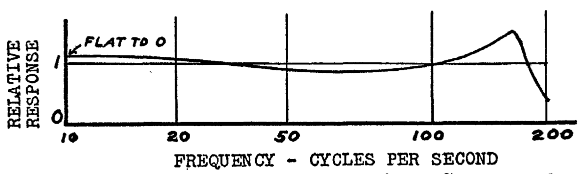

FIG. 2. Frequency response curve of the Crystograph.

With this frequency range, greater than that of the string galvanometer as ordinarily used, it is possible to obtain satisfactory ink electroencephalograms and electrocardiograms, and to study potentials and discharge frequencies of central nervous system, muscle and even peripheral nerve, except for spike shape. The Crystograph may also be useful in the physical sciences, as in recording number and amplitude of Geiger counter discharges.

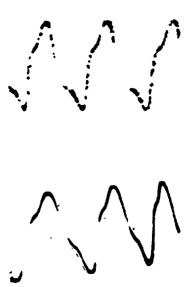

FIG. 3. Typical wave forms obtained from the Crystograph (above) compared with the cathode ray oscillograph (below). A distorted 60 cycle wave.

We hope to be able to present more details concerning the construction and uses of the Crystograph in a future issue of the *Review of Scientific Instruments.*

FRANKLIN OFFNER
R. W. GERARD

DEPARTMENT OF PHYSIOLOGY
UNIVERSITY OF CHICAGO

ANOTHER METHOD OF PREPARING DISTRIBUTION MAPS

THE method of placing the black dots on outline maps as described by Hubricht[1] reminded the writer of the method which she had used for a number of years. The type of one-cent pencil which has the more or less conical eraser attached within the wood is necessary. By means of a safety razor blade the eraser may be sectioned horizontally until the area of the end of the eraser is equal to the size of the dot desired. By dipping the end of the rubber into india ink and then using the eraser as a stamp, black dots of uniform size and color intensity may be placed upon the outline maps. The method is quick and the dots are photographed very satisfactorily.

WINONA H. WELCH

DEPAUW UNIVERSITY

[1] SCIENCE, 84: 48, 1936.

LABELING MUSEUM SPECIMENS AND LABORATORY EQUIPMENT

THE following method was devised and has been found quite satisfactory at Ashland College.

An electric stylus and white or colored transfer paper (obtainable from Demco Library Supplies, Madison, Wisconsin), such as are used by librarians to mark the backs of books, are used to burn the desired labels on various objects. Rough objects should be made smooth by filing. After the label is dry it may be shellaced.

The method has been successfully tried on the following: fossils, rocks, mollusca shells, wood fungi, arrow heads, microscope base, projection lantern, ground glass stoppers and plain glass, after treatment with the fumes of hydrofluoric acid.

The chief advantages of this method over the gummed label method are: that the specimens can be washed without injury to the label; the size of the labels can be varied to suit the size of the specimens; the labels are neat, permanent, inexpensive and can be done by any one who can print or write well.

E. E. JACOBS
MARY AUTEN

ASHLAND COLLEGE

BOOKS RECEIVED

Anales de la Universidad Central. Tomo LXI, Num. 296. Abril—Junio de 1936. Pp. 351. Illustrated. Universidad Central del Ecuador, Quito. Numero suelto, $2.00.

CURRIER, L. W. *Zinc and Lead Region of Southwestern Virginia.* Bulletin 43 of the Virginia Geological Survey. Pp. xii + 122. 26 plates. PARK, C. F., JR. *Preliminary Report on Gold Deposits of the Virginia Piedmont.* Bulletin 44. Pp. viii + 42. 14 figures. The Survey, University, Virginia.

KAHN, R. L. *Tissue Immunity.* Pp. xix + 707. Illustrated. Thomas. $7.50.

Report of the National Research Council of Japan. Vol. II, No. 4; April, 1934–March, 1935. Pp. 2 + 100. The Council, Tokyo.

Television. Addresses and Papers. Vol. I. July, 1936. Pp. viii + 452. Illustrated. RCA Institutes Technical Press, New York.

Yearbook of Agriculture, 1936. Pp. 1189. Illustrated. Government Printing Office, Washington. $1.25.