scratched or etched into the glass itself, might be more useful. A strip of material of the same thickness as the scale was placed between the mirror and the glass on the side opposite the scale. This was necessary to offset the tilting effect of the scale.

Glass of a thickness less than that specified above may be used, but with thinner glass the image of the lower surface is not perfectly clear, and only small objects (1–3 mm.) may be studied. If the $\frac{5}{8}$-inch glass is used, the image of the lower surface is as clear as that of the upper. The use of the thicker glass also permits the study of objects up to about 5 mm. in size.

There is also a definite relationship between the distance of the light source from the plate glass and the image obtained. The light should be placed 3–4 inches from the plate glass and as directly over the system as the microscope permits for optimum results.

Saturation Concentrations of Triethylene Glycol Vapor at Various Relative Humidities and Temperatures

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Recent experiments carried out in this laboratory have indicated the relatively narrow margin which exists between the concentration of triethylene glycol vapor required for optimum bactericidal action and the saturation point of this vapor in air of various relative humidities and temperatures. Although the presence of a mist due to supersaturation with triethylene glycol has been shown to produce no harmful effects on animals living in such atmospheres for long periods of time (*2*), this condition is undesirable for psychological reasons in situations of human habitat. It becomes important, therefore, to determine the maximum concentration of glycol vapor which may coexist with water vapor in the air, under various atmospheric conditions.

The following communication deals with the measurements of the saturation concentrations of triethylene glycol vapor in the presence of water vapor over a range of temperature extending from 20° to 29°C. Essentially, this problem resolves itself into the study of vapor-phase equilibria in a two-component system composed of triethylene glycol and water. If each component of this mixture obeyed Raoult's law, the equilibrium concentration of the glycol vapor at a given temperature would diminish linearly with an increase in the water vapor concentration, as shown by the dotted line in Fig. 1. However, the chemical nature of the two compounds suggests that their solutions would exhibit deviations from ideal behavior. Such deviations from Raoult's law have been confirmed by the experimental measurements here presented.

A complete description of the apparatus and experimental technique will be presented in a forthcoming publication.

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The experimental procedure involved an adaptation of the principle of the condensation method recently developed for the determination of vapor pressures of pure liquids (*1*), which permits determination of the equilibrium compositions of the vapor in multicomponent mixtures. Each component of the

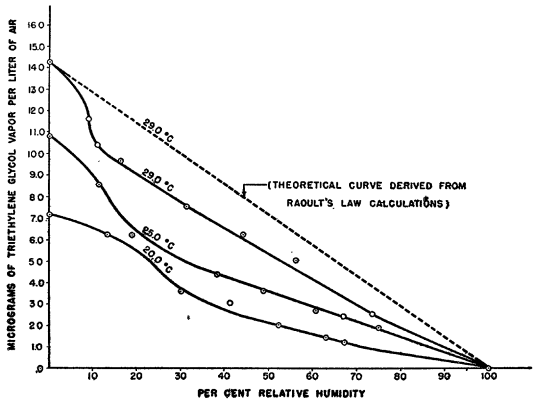

FIG. 1. Saturation concentrations of triethylene glycol vapor as a function of the relative humidity, at three different temperatures.

mixture (in this case, triethylene glycol and water) is independently vaporized at a constant rate into a stream of inert gas (dry nitrogen), which carries the vapor mixture to a highly polished condensation surface thermostatically maintained

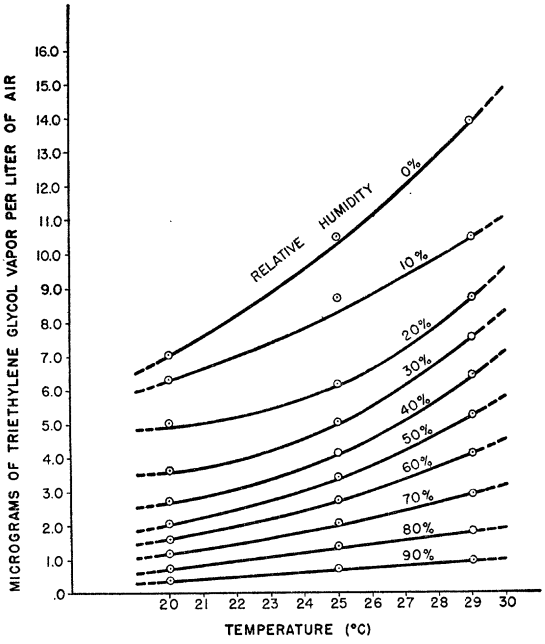

FIG. 2. Saturation concentrations of triethylene glycol vapor at various relative humidities for temperatures from 20.0°C. to 29.0°C.

at the desired equilibrium temperature. The formation and disappearance of a condensed film on this target serves to indicate whether the composition of the vapor mixture corresponds to supersaturation or undersaturation at the temperature of the target. The ratio of the vapor densities of the two com-

ponents in the gas stream is progressively varied by adjustment of the rate of flow of diluent gas until the equilibrium composition is attained. This can be done with a high degree of precision, since the equilibrium point can be approached from both sides, *i.e.* by determining the composition at which a condensate first forms on the target, as well as the point at which a film previously formed is removed by a more dilute gas mixture. This critical point, at which a condensate barely begins to form or, once deposited, barely begins to disappear, represents the equilibrium condition for the binary vapor mixture at the temperature of the condensation surface.

By means of this experimental technique the vapor-phase equilibria have been determined at three temperatures (Fig. 1). The graphical presentation of these results, with the marked deviations from a straight-line relationship, indicates that at any relative humidity the saturation point is reached with glycol vapor concentrations well below the theoretical value based on Raoult's law.[2] The area under each curve represents an isothermal region in which glycol vapor and water vapor can coexist in the air without formation of an aerosol. Conversely, any concentration above each curve identifies an atmosphere supersaturated with the vapor mixture.[3] The relative saturation of the air with glycol vapor will therefore be a function not only of relative humidity but also of temperature. A rise in temperature from 20° to 29°C. at 50 per cent relative humidity will more than double the capacity of the air to hold triethylene glycol vapor. A similar effect may be achieved at a constant temperature of 25°C., for example, by lowering the relative humidity of the air from 50 to 16.5 per cent. The accuracy of the experimental results is approximately ± 3 per cent.

By interpolation, the saturation concentrations for intermediate temperatures may be computed from the experimental results obtained at the three temperatures indicated. The temperature coefficient throughout this region is best calculated by means of the Clausius-Clapeyron equation. For pure triethylene glycol, the equation obtained is $\log_{10} P = \frac{-3{,}170}{T} + 7.758$, where P is the vapor pressure in mm. Hg and T is the absolute temperature. The partial pressure of triethylene glycol vapor at various relative humidities can be computed for intermediate temperatures by means of this equation, or a graphical interpolation may be employed. Fig. 2 presents the results of such an interpolation.

[2] It should be noted, however, that for this type of graphical presentation, positive and negative deviations from the straight line do not indicate the sign of the deviations from Raoult's law.

[3] Under natural conditions, the critical concentration at which an aerosol begins to form will also be affected by the number and type of condensation nuclei present in the air.

References

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2. Robertson, O. H. *Harvey Lect. Ser.*, 1942–43, **38**, 227; Robertson, O. H., *et al.* (To be published.)

Book Reviews

The operculate land mollusks of the family Annulariidae of the Island of Hispanola and the Bahaman Archipelago. Paul Bartsch. (U. S. National Museum Bull. 192.) Washington, D.C.: Government Printing Office, 1946. Pp. iv + 264. (Illustrated.) $.75.

This taxonomic treatise on the pomatiasid operculate land snails of the islands of Haiti and the Bahamas categorically divides their shells into 24 genera, and "*Incertipoma*," which is "a catch-all for all annulariids that cannot be definitely assigned to their proper genus" and which includes 11 new species. The major groups are founded mainly on the structures of the opercula, which, according to the descriptions, show remarkably little variation inside each genus. Of the 24 genera, 16 are new (and one renamed); of the 17 subgenera, 8. Of 194 species, 117 are described as new; of 96 subspecies, all but 6. In general, the dimensions of only the type shell are given, without specification of sex, although the pomatiasid males are much smaller than the females, and usually little intergradation in shell size is found on examination of the animals. Occasional notes on habitat are included. One of the most notable species is *Sallepoma mutabile* Bartsch, which is omitted from the key to the species in this new genus because its range of variation covers all the differences used for the demarcation of the other species (with the possible exception of its sutural characters, which are not described). The shells of practically every species and subspecies are illustrated by excellent photographs. The taxonomic index is apparently very complete.

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Performance records of individual trees and clones of Cinchona in Guatemala. John R. Shuman. Pp.: text, 4; Tables, 80. (Tabulation filed with Library, U. S. Department of Agriculture, 1947.)

Along with the procuring of cinchona bark in Latin-American countries during the war, great efforts have been made by public agencies, as well as by private Cinchona growers, toward the permanent re-establishment of quinine in the Western Hemisphere. The numerical results of a three-year study on the performance of individual trees and clones of Cinchona in Guatemala are made available to those interested in its commercial cultivation through this tabulation, which is being filed with the Library of the U. S. Department of Agriculture in Washington, D. C. It is the purpose of this review to bring this summary, which represents the largest tabulation of clonal performance records of Cinchona in the world, to the attention of all interested agencies, private as