

and secondary. Then from the various dimensions of the ring and the calibrating coil as regards number of turns of the primary and secondary, cross-section and length of core, intensity of primary currents and throws of the galvanometer, the permeability of the specimen can be calculated.

The objections to the above method are the tediousness of observing the constants (about a dozen in all) and making the calculation therefrom, and, further, the inaccuracies involved in assuming the areas of windings and core to be the same, in neglecting the difference in closeness of winding between the inside and outside of the ring, etc.

For the last two years the author has recommended the following method to his students. An exact non-magnetic copy of the ring specimen is made in the form of a plaster of Paris cast therefrom. This cast is wound precisely similarly to the iron ring. The permeability is then simply the ratio of the throws given by the iron ring and the plaster of Paris ring on making or breaking equal currents in the primaries. The calculations are thus greatly simplified and the inaccuracies involved in the above mentioned assumptions are greatly reduced and can be completely eliminated by winding the primaries and secondaries in alternate turns on the core. It is not claimed that by this method the galvanometer is more exactly calibrated, but it is calibrated under the exact conditions under which the actual measurements on the specimen of iron are made. It is calibrated, in fact, by the actual windings on the ring specimen, the iron core being replaced by a non-magnetic core.

With a view to testing the sum total of the errors inherent in the ordinary ring method, simultaneous determinations of the permeability of the same specimen were made by the two methods. It was found that the total error involved in the use of the ordinary calibrating coil was often large, amounting in some cases to as much as thirty-eight per cent.

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EMPIRICAL FORMULA FOR THE TEMPERATURE VARIATION OF VISCOSITY. BY  
A. WILMER DUFF.

[ABSTRACT.]

A careful determination was made of the viscosity of glycerine between zero and thirty degrees. The method employed depended on Stokes' formula for the rate of descent of a sphere through a viscous liquid. Several different forms of formula have been proposed for the representation of this temperature variation. It was shown that none of these would apply throughout a wide range of

temperature variation. By plotting a curve of the sub-tangent of the viscosity-temperature curve against the temperature, a subsidiary curve was formed which should, in all the types of formula proposed, be a straight line, but which turned out to be a parabola. On determining the constants of the parabolic equation and integrating this to obtain the equation of the viscosity-temperature curve, a formula was deduced which represented the experimental results to within the limits of experimental accuracy. This formula was an exponential one, the exponent being the inverse tangent of a linear function of the temperature. Reasons were given for believing that this would represent the temperature variation of the viscosity of any liquid.

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THE EFFECT OF GRAPE-SUGAR UPON THE COMPOSITION OF CERTAIN FAT-PRODUCING BACTERIA. BY ROBERT E. LYONS.

It has been observed by Dr. E. Cramer\* and others† in studies upon the composition of bacteria, that the same micro-organism grown upon Peptom and Grape-sugar Agar-Agar produces in each case different quantities of nitrogenous substances and matter which is soluble in alcohol and ether.

In this same direction Ducleaux‡ demonstrated that yeast cells grown upon a material containing grape-sugar produced fat, while the same yeast grown upon pure nitrogenous material did not produce fat.

To study how grape-sugar affects the quantities formed of nitrogen, ash, fat and matter to be extracted by means of alcohol and ether, three varieties of capsule bacilli were selected:

Pfeiffers' Capsule Bacillus.

Fadenziehender Capsule Bacillus.

No. 28 Capsule Bacillus.

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\*Dr. E. Cramer—"Zusammensetzung der Bacterien in ihrer Abhängigkeit von dem Nährmaterial." *Arch. für Hygiene*—16, 151-191.

†Tayosaka-Nishimura—"Zusammensetzung eines Wasserbacillus." *Arch. für Hygiene* 18, 318-333.

‡Ducleaux—"Sur la nutrition intercellulaire." *Ann. de l'Institute Pasteur*—1889 No. 8, p. 413.

§Fadenziehender and No. 28 are forms from the water of the River Lahn, near Mosbourg.