Medium IV of Koser and associates[3] was used first and was later modified by the addition of 0.2 gms NaCl and 0.2 gms asparagine per liter.

Repeated observations have shown that vitamin B_6, in amounts of 0.3 to 1.2 gamma per cc stimulates the growth and acid production of *Staphylococcus albus* when nicotinic acid and thiamin are present.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

GRAPHICAL METHOD FOR DETERMINING WARBURG VESSEL CONSTANTS AT VARIOUS FLUID VOLUMES

IN the use of the Barcroft-Warburg manometer for studies on cell and tissue metabolism it is frequently necessary to know the value of the vessel constant, k, for a number of different values of V_F, the volume of liquid in the vessel, under otherwise constant experimental conditions. The vessel constant is ordinarily obtained by calculation from the well-known formula:

$$k = \frac{V_G \frac{273}{T} + V_F \alpha}{P_o}, \tag{1}$$

where V_G is the volume of gas space in the vessel containing a volume of liquid V_F, both volumes being expressed in cubic millimeters; T is the absolute temperature of the thermostat; α is the absorption coefficient at the experimental temperature for the gas concerned; and P_0 is the number of millimeters of manometer fluid equivalent to one atmosphere of pressure.

This calculation is somewhat tedious if there are a number of vessels concerned, and there is always the possibility of an unsuspected numerical error somewhere in the computation. We have found it much more convenient to use a graphical presentation of the relation between k and V_F, as shown in Fig. 1. In this graph the values of k_{O_2} and k_{CO_2} for a given vessel and experimental temperature are plotted on ordinary cross-section paper against various values of V_F. It can be seen that the relation between k and V_F is strictly linear, and that it is a simple matter to obtain the vessel constant for oxygen or carbon dioxide at any desired value of V_F, particularly when V_F is not a simple whole number.

The linear relationship between k and V_F is not readily evident from equation (1), since V_G is a function of V_F, but if it is recalled that $V_G = V_T - V_F$, where V_T is the total vessel volume as obtained in the usual calibration with mercury, equation (1) may be written:

$$k = \frac{(V_T - V_F)\frac{273}{T} + V_F \alpha}{P_o} \tag{2}$$

from which the following equation may be obtained:

$$k = \frac{V_T}{P_o} \cdot \frac{273}{T} - \frac{V_F}{P_o}\left(\frac{273}{T} - \alpha\right) \tag{3}$$

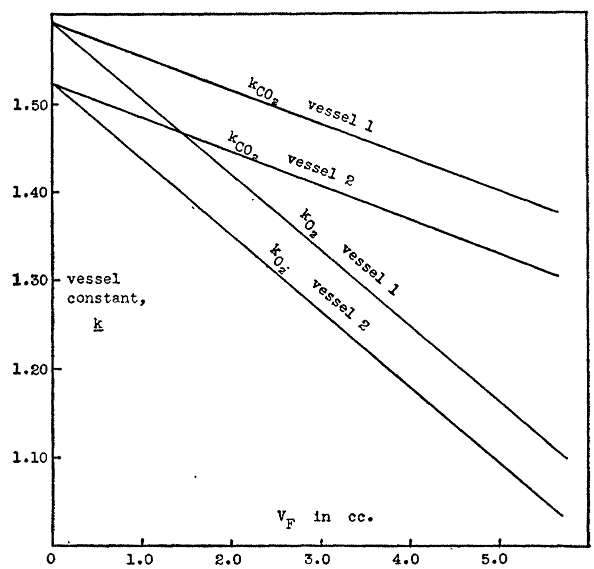

FIG. 1. Graphical presentation of the relation between the vessel constant, k, and the amount of liquid in the vessel, V_F, for two different vessels and for both oxygen and carbon dioxide.

Equation (3) is of the form $y = a - bx$ and expresses a linear relationship between k and V_F, since under ordinary conditions the other components of the equation are constants.

It will be noted that for a given temperature and manometer fluid the slope of the curve is determined by the solubility of the gas concerned, while the intercept on the y axis is determined by the vessel volume, V_T. Thus for a given vessel the curves for different gases will all start from the same point on the y axis, differing only in their slope, as shown in Fig. 1, while for a number of vessels the curves for a particular gas will all be parallel and will differ solely in their intercept on the y axis. It is thus a simple matter to plot the curves for a number of vessels, and for several different gases, on a single sheet of cross-section paper, and to read off at a moment's notice the value of the vessel constant for a particular vessel, gas, and V_F value.

To construct the curves for a number of vessels, the simplest procedure is to establish the intercept on the y axis for each vessel by dividing the value of V_T for the vessel (in cu. mm) by P_o, and multiplying the result by the value of 273/T. These points are laid out along the y axis, and then for a single vessel and a particular gas the slope of the curve is established by determining from equation (2) the value of k at an arbitrary value of V_F (*e.g.*, 5,000 cu. mm or 5.0 cc), and plotting this point on the chart. A straight line through this point and the corresponding intercept point gives the calibration curve for the particular vessel and gas. Lines parallel to this are now drawn through the intercept points for the other vessels, and the complete chart for one gas and for all the vessels is thus obtained. The curves for a second gas may then be drawn on the chart in like manner.

Similar charts may be prepared for a number of different temperatures, but it should be noted that a change from one temperature to another will alter not only the slope of the curves but also the intercept, since both components of the right-hand side of equation (3) are functions of temperature.

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DETERMINATION OF RELATIVE HUMIDITY WHILE MEASURING RESPIRATION IN A GAS TRAIN SYSTEM[1]

RECENT studies on the sterilization of papayas at 110° F., as prescribed by federal quarantine regulations, indicated that the relative humidity of the treating medium was of distinct importance. For instance, it was found that at approximately 100 per cent. relative humidity the fruits were severely injured, while if the humidity was lowered to 80 per cent., injury did not occur. Hence, in conducting respiration studies it was considered desirable to measure the relative humidity with the accuracy of a sling psychrometer and yet enclose the psychrometer in the gas train. The apparatus shown in Fig. 1 served this purpose. It is constructed from a glass tube 25 mm in diameter and approximately 100 mm long. Two openings in the tube take No. 0 stoppers to hold the thermometers, and a small bulb blown opposite one of the openings serves as a reservoir for the wet bulb thermometer. The ends are brought down to a diameter of 8 mm and tubing of this size is sealed to each end. The apparatus is then sealed in the gas train system and may be immersed in a water bath at any desired temperature. The air in this apparatus should be circulated at a speed of approximately 15 feet per second to obtain accurate readings on the wet bulb.

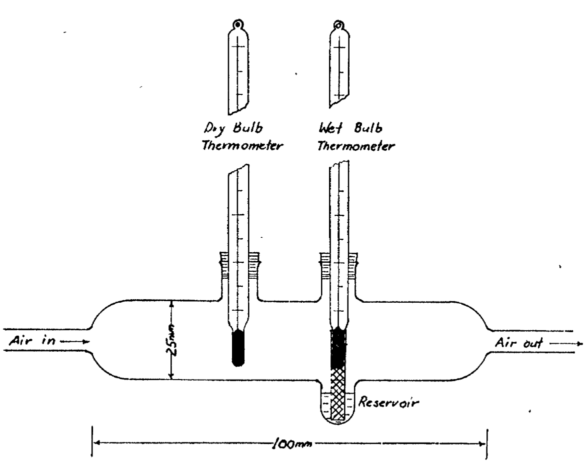

FIG. 1

[1] Published with the approval of the director as Technical Paper No. 54, Hawaii Agricultural Experiment Station.

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