are placed even for 8 hours in sea water at pH 9.5 containing no dye.

(6) Azure B penetrating the sap also increases the pH value, and this increase is again less than the increase brought about by addition of azure B free base *in vitro.* Owing to a slower penetration and greater toxicity of azure B as compared to cresyl blue, these results on azure B are rather unsatisfactory but experiments are being continued.

(7) The penetration of dye from methylene blue solution at pH 9.5 is still slower than from the azure B solution, so that sufficiently accurate results are not obtainable before the cells are injured but experiments are being continued.

It is concluded that cresyl blue and azure B free base penetrate the vacuoles of living cells of *Valonia macrophysa.*

The fact that the penetration of dye causes the pH value of the sap to increase less than when the same amount of free base of the dye is added *in vitro,* may in all probability be due partly to the production of acid by the cell rather than to the penetration of dye salt, just as was proved to be the case with the sap mixture of *Nitella.* It is partly due to the impurity in the free base of dye which slightly raises the pH value when added to the sap *in vitro.*

Owing to the fact that the sap of *Valonia* is not so well buffered as that of *Nitella* and also to the fact that the electrode is affected by the 0.6 M inorganic salt in the sap of *Valonia,* these results with *Valonia* are not so convincing as those with *Nitella.*

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Analysis of Ether-Air Mixtures by Thermal Conductivity Method.

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For the purpose of rapid determination of ether concentration in ether-air mixtures we have found the thermal conductivity method of gas analysis satisfactory. Since the heat conductivity of ether vapor is only about one half as great as is that of air, the admixture of ether vapor with air decreases the loss of heat from the wire and causes its temperature to rise. The consequent increase of electrical resistance of the wire is readily determined and, if the apparatus is calibrated, the change of resistance is a measure of the ether concentration.

The apparatus used in this investigation consisted of a rectangular brass block 14x4x2 cm. in size through which 2 parallel holes 1 cm. in diameter were bored longitudinally. In each cell a platinum wire 0.005 cm. in diameter was suspended axially from plugs closing the ends, and heated by a current of 0.2 ampere. The gas was introduced through lateral tubes close to the ends of the cells. The calibration was effected by means of several ether-air mixtures of known concentration. These were made up by breaking, in a closed flask of known volume, a capillary tube containing a weighed quantity of ether. The mean experimental error of the determination was about 5% with concentrations between 0.3% and 1.3%. It is probably considerably less than this with mixtures of the usual anesthetic strength (6%-8%).

For concentrations of less than about 5% the resistance of the wire was approximately proportional to the concentration. When, however, larger concentrations were used proportionality no longer obtained. With concentrations greater than 10% the apparent heat conductivity began to increase until with mixtures of about 30% it was equal to that of the air. Mixtures stronger than 30% had a cooling effect greater than that of air. An explanation of the reversal of the apparent heat conductivity of mixtures of increasing concentration is to be found in the following facts. If a heated wire, 0.005 cm. in diameter, is suspended axially in a tube 1 cm. in diameter in a gas of about the density of air the loss of heat from the wire is entirely by conduction and convection currents do not occur. Langmuir[1] has shown that if the gas is more dense than air the stationary layer of gas surrounding the wire is less than 5 mm. in thickness. Hence to obviate entirely the development of convection currents in ether-air mixtures the radius of the tubular cell must be no greater than the thickness of the stationary layer. To test this theory a pair of cells 4 mm. in diameter was employed. We found that the resistance of the wire increased continuously, with increasing concentrations of ether up to 70%, beyond which observations were not made. There was no reversal of the apparent heat conductivity. From this we tentatively conclude that, in spite of the density of the gas mixture, the diameter of the cell was small enough largely to prevent convection currents.

While it is necessary to avoid cells whose diameter in proportion to the density of the gas would insure large convection currents and consequent unsteady bridge readings, the precision of the method is satisfactory when convection is reduced by proper design of the cell so that bridge readings are steady, whether or not convection is en-

[1] Langmuir, *Phys. Rev.*, 1912, xxxiv, 401.

tirely prevented. Since it is not easy to maintain the axial position of the wire in very narrow cells, it is better to use cells as large as possible without so greatly increasing the diameter as to secure troublesome convection currents. If the range of the concentrations to be measured is from 0 to 10% the 1 cm. cell with a wire of 0.005 cm. is satisfactory. For concentrations from 10% upward a cell of about 5 mm. diameter would be preferable.

As moist air has a heat conductivity different from that of dry air, it is necessary to dry the air in the reference cell and to dry the ether-air mixture as it is drawn into the cell. Calcium chloride has been found to be satisfactory for this purpose. It appears not to absorb any ether.

The temperature of the platinum wire carrying 0.2 ampere was calculated to be 68° above room temperature. There is good reason to believe that this temperature is certainly too low to cause ignition of the vapor, and in many hundreds of analyses with various percentages of ether no ignition has occurred. Since, however, the wire may break and a spark be formed, it is safer to disconnect the cell from the reservoir from which the specimen was drawn, before the current is turned on. If the cell is then left open at one end no harm would result from ignition.

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Further Note on the Relative Protection by Polymorphonuclear and Mononuclear Cells in Local Streptococcus Infection.

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Our investigations on the protective effect of granulation tissue (Gay and Morrison[1]) (Gay, Clark and Linton[2]) against a highly virulent streptococcus introduced into the pleural cavity of rabbits, led us to attribute a predominating if not exclusive rôle to mononuclears as compared with polymorphonuclear cells. In the acute stage of the inflammatory process when polymorphonuclears predominate the animals are fully as susceptible as normal controls. We have never denied that polymorphonuclears have a distinct protective energy with some bacteria and in some locations.

[1] Gay, F. P., and Morrison, L. F., *J. Am. Med. Assn.*, 1923, lxxx, 1298.

[2] Gay, F. P., Clark, A. R., and Linton, R. W., *Archiv. Path.*, 1926, 1, 857.