particulates, but within limits these errors can be minimized. The questions of specificity, stoichiometry, and variable chemical composition as applied to staining reactions must also be considered with respect to the errors of quantitation *in situ* that may result from these factors.

With reference to errors inherent in microspectrography as practiced in histo- and cytochemistry, the validity of the Lambert-Beer law does not appear to be threatened by the degree of orientation of the molecules in most biological materials. However, the relative inhomogeneity in the distribution of absorbing substances introduces an error that can be significant. Reliable measurements are possible only in a well-defined extinction range, and nonspecific losses of radiation in some cases can be serious in the visible and ultraviolet region. The determination of the thickness of a cellular sample for analytical purposes likewise presents difficulties, and the chemical effects of radiation used for absorption measurements cannot be ignored.

From these considerations, it appears unwise to accept, too literally, the localizations of chemical substances in finer cellular structures as indicated by staining reactions. Furthermore, little reliability can be expected from attempts at quantitation *in situ* by means of microspectrography of stained structures in much biological material. Reliable localizations of chemical substances can be obtained in unstained material by microspectrography in the ultraviolet and x-ray regions. However, the errors of inhomogeneous distribution of the radiation-absorbing substance, nonspecific radiation losses, and chemical effects can gravely interfere with quantitative work in the ultraviolet. X-ray absorption, as it has been employed, is affected less by these factors, and its use can yield reliable quantitative data, as well as true morphological patterns.

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Technical Papers

Oxygenation of Blood by Isolated Lung

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Recent progress in intracardiac surgery has necessitated the diversion of blood from that side of the heart, usually the left, involved in the operative field. This has been accomplished by the use of mechanical pumps (*1*), which have short-circuited blood from the area. However, future advances in major intracardiac operative procedures—i.e., repair of septal defects—may well involve the diversion of blood from all chambers of the heart (except that to the coronary vessels). Although most of the technical difficulties governing the artificial propulsion of blood have been overcome, that of insuring adequate oxygenation persists.

Previously proposed methods of oxygenating blood *in vitro* in an extracorporeal blood circuit involving either mechanical mixing of blood with oxygen (*2*) or intravenous introduction of chemical oxidants (*3*) have proved unsatisfactory.

Although older isolated heart-lung preparations as a rule operated far below physiological efficiency, pulmonary oxygenation was well maintained. It occurred to us, therefore, that an isolated donor lung, functionally attached to a mechanical propulsive unit, would successfully oxygenate venous blood pumped through it without the disadvantage of the foaming or hemolysis of red blood cells associated with the use of artificial oxygenators.

To verify this point, the heart and lungs of a cat were removed following death by exsanguination. No attempt was made to maintain sterility of the operative field. As previously described by one of us (*4*), the pulmonary artery and veins of one side were

[1] The authors wish to express their appreciation to A. S. Buchberg for his technical aid.

cannulated and the opposite pulmonary vessels tied off. A tracheal cannula was inserted and attached to a source of oxygen under intermittent positive pressure. The animal's blood was placed in a reservoir kept under slight negative pressure by the action of a rotary pump (*5*), and circulated through the isolated lung, which was inflated 12 times/min by positive pressure. No effort was made to keep the lung at body temperature. High oxygen content of the blood was promptly achieved and maintained for periods of 60–90 min.

To test further the ability of the removed lung to oxygenate blood, the circulating system was stopped and the blood replaced by intensely cyanotic blood from another animal. The pump was then started again, and blood samples withdrawn from the pulmonary veins at 5- to 10-sec intervals. These were analyzed for oxygen content by the Scholander syringe method. The results of two experiments are graphically depicted in Fig. 1.

From the results shown, it is evident that the blood was completely oxygenated during a single passage through the isolated lung. In the case of the second procedure illustrated, the reservoir was kept at an abnormally high negative pressure, resulting in gross pulmonary edema sufficient to produce considerable frothy secretion in the tracheal cannula. Despite this limitation, oxygenation, although less complete than usual, was rapidly achieved and maintained.

The results indicate that the isolated lung, up to 90 min after removal from the body, and not subjected to any special care or treatment, is capable of oxygenating blood rapidly flowing through it. Certain limitations remain as yet undetermined. These include the longest interval following removal during which function is retained, the maximal blood flow permitting efficient oxygenation, and the maximal duration of function under mechanical propulsion. Whether the isolated lung releases any noxious substances that may injure an intact animal is as yet unestablished.

Further application of this form of oxygenation to experimental, and presumably clinical, surgery involves several hemodynamic considerations. It is questionable whether a single propulsive mechanism will maintain normal pressures and flow through the greater circulation and allow sufficient residual pressure to maintain adequate flow in the pulmonary bed, especially since aeration is accomplished by positive rather than negative pressure. Since a second pump may be necessary, analogous to the two sides of the heart, the problem of maintaining equal outputs of the two pumps will arise.

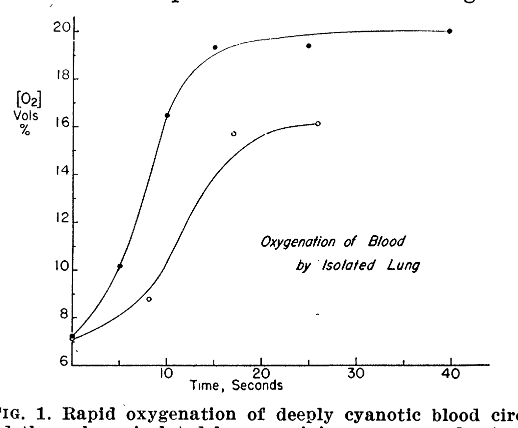

FIG. 1. Rapid oxygenation of deeply cyanotic blood circulated through an isolated lung receiving oxygen under intermittent positive pressure. ●—Expt. 1; ○—Expt. 2.

These factors are of future concern. Of interest is the fact that a relatively simple use of a natural oxygenator—an isolated lung—may make possible the diversion of blood from the heart. For the physiologist, it may permit more efficient perfusion of isolated organs for the investigation of their functions.

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Duration of Action of Residual DDT Deposits on Adobe Surfaces

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Observations made in different countries on the effectiveness of DDT residual deposits in anopheline control reveal that far from uniform results are obtained by different workers. Causes for this lack of uniformity may rest in several factors. The mosquito species being studied is undoubtedly an important factor, or at least a confusing one, since species differ markedly in habits, including house-resting habits, and also possibly may differ in response to minimal exposures to DDT. Observations of Muirhead-Thomson (*1, 2*) with *Anopheles gambiae,* for example, do not parallel observations of Wharton and Reid with *A. maculatus* (*3*), Swellengrebel and Lodens with *A. aconitus* (*4*), Bertram with *A. minimus* (*5*), or Downs and Bordas with *A. pseudopunctipennis* (*6*). Another factor of undoubted importance is the surface on which the DDT is being sprayed. Clapp *et al.* (*7*), Sundararaman and Peffly (*8*), and Maier *et al.* (*9*) have shown that surfaces of different construction materials commonly used in the tropics will retain DDT activity for varying periods of time.

Soil, as sun-baked adobe bricks, or as a plastering mixture of wet soil alone, or wet soil mixed with substances such as straw or manure, and applied over a wall of woven reeds or branches (*bajareque*) is a very

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