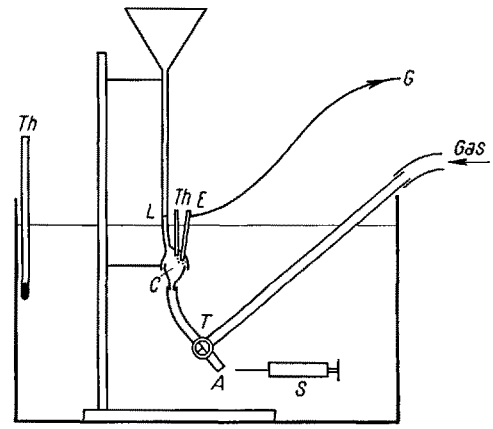
PRO LABORATARIO

## A New Polarographic Procedure for Measuring the Blood Oxygen Tension *in vitro*

Several polarographic methods for measuring the oxygen tension of the blood *in vitro* have been described during the past few years. Hitherto, most success has been achieved by using the dropping mercury electrode[1] which, however, is not very promising in respect to a truly continuous recording of the oxygen tension of the blood *in vivo*. Since the platinum electrode[2] seems to be more hopeful in this direction we have adopted such an electrode which has been developed recently by CLARK[3], and which is already commercially available[4]. In a preliminary stage of the development of a method for the continuous recording of the blood oxygen tension *in vivo*, it was possible to incorporate this electrode into a simple and reliable arrangement for measuring the blood oxygen tension *in vitro*.

CLARK's electrode assembly consists of a platinum cathode and a silver anode which are both included in the same unit and connected by an electrolyte bridge (NaCl 0·9% in our case); a membrane of thin plastic material (polyethylene or something similar, as it is available from commonly used plastic bags) separates the whole electrode system from the blood so that the blood is not in contact with either of the electrodes and the current flows only within the electrode system (and not in the blood); this membrane is not permeable for water and electrolytes but the oxygen from the blood reaches the cathode across the membrane and a thin film of saline. Freshly adapted membranes of this kind give stable and reproducible readings for several days in blood and even longer in saline or in the gas phase.

The Figure shows the general set-up of the apparatus. The heparinized blood sample (5–7 cm³ for each determination) which has been freshly and anaerobically drawn into a syringe or which was stored at body temperature under anaerobic conditions, is introduced from syringe *S* through the adapter *A* into the chamber *C* up to about the level *L* in the gas outflow tube where the tube is closed by a clamp; the whole system is maintained at 37°C in the water bath, the temperature within the chamber being read off from the thermometer *Th*. The current at a voltage of 0·6 V is led through a standard polarographic circuit and recorded with a galvanometer *G* of appropriate sensitivity (G–M Laboratories, sensitivity 0·0182 $\mu$A per scale division). In order to get a stable and reproducible reading it was found essential to shake the electrode *E* constantly and gently by hand after which a stable and well-defined reading value adjusts itself after a few seconds. After the sample reading, the calibration curve is taken on the same sample; the gas outflow tube is opened, the threeway-stopcock *T* is turned into the appropriate position, and air, nitrogen, oxygen or other oxygen mixtures are successively bubbled through the chamber *C* until




equilibrium is reached; the calibration readings are taken again with closed gas outflow tube and shaken electrode. The calibration curves are linear. In general 3 sample readings and 3 calibration curves are determined which agree closely; the time needed for one sample determination and one calibration curve is about 20 min.

Calculated $P_{O_2}$ values thus obtained were compared with (1) adjusted tonometer equilibrations with determination of oxygen in the gas phase by the Van Slyke technique, and (2) data obtained from determinations by the Riley technique. The agreement was satisfactory; a report on these results will be given in another paper.

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F. KREUZER

*Department of Physiology, Dartmouth Medical School, Hanover, N. H., January 17, 1957.*

*Zusammenfassung*

Es wird ein neues und einfaches polarographisches Verfahren unter Benützung von Clarks Platinelektrode beschrieben, das die Messung der Sauerstoffspannung des Blutes *in vitro* gestattet.

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[4] «Clark oxygen electrode», patent pending, manufactured by Yellow Springs Instrument Company, Yellow Springs, Ohio, USA.