led to the quantitative recovery of a highly pure, stable, antigenic toxoid which should prove suitable for clinical use (*6*).

The purified toxoid is not precipitated by an anti-*C. diphtheriae* rabbit serum and is relatively free of porphyrin. It gives the usual protein reactions, and in general its characteristics are almost identical to those of the purified toxin prepared by Pappenheimer (*3*). The details of the purification procedures, as well as the characteristics of the purified toxoid, will be reported later.

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A Simple Anaerobic Method of Obtaining Plasma

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By the method described here one can obtain plasma for gas analysis without the inconvenience and uncertainty of transferring the blood from the syringe into which it is drawn and

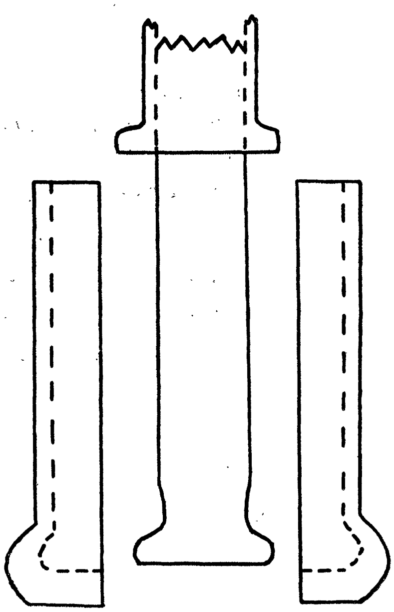

FIG. 1

without the use of oil or mercury. The method is described for a 5-ml. syringe, but syringes of any size can be used.

About 5.5 ml. of blood is drawn into a 5-ml. syringe containing some heparin solution and greased with stopcock lubricant. The needle is removed, and about 1 ml. of blood is delivered for estimation of the hematocrit, pH, etc. A short piece of thick-walled rubber tubing is slipped over the nozzle of the syringe. The two halves of the plastic spacer shown in Fig. 1 are placed around the plunger and held with rubber bands, the plunger then being pushed in until stopped by the spacer. The length of the spacer is such that the syringe contains about 4 ml. of blood. The lumen of the rubber tubing is now full of blood; and while the spacer is held firmly against the barrel of the syringe a glass plug is inserted into the lumen, displacing the blood. The syringe is centrifuged, plunger down, at about 1,500 r.p.m. in a 50-ml. cup fitted with a reducing ring.

When centrifugation is finished, the spacer and the glass plug are removed. The tip of a blood-gas pipette is inserted into the lumen of the tubing, and, by means of gentle twisting pressure on the plunger, plasma is delivered directly into the pipette.

"Braking" Pipettes

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A "braking" pipette is an extremely important tool in many microtechniques. A good braking pipette, because of its slow, controlled rate of flow of air, enables the investigator to pick up several single cells in a measured amount of fluid as small as 0.5 $mm.^3$

The conventional type of braking pipette, constructed by pulling a fine, hair-like constriction in a capillary pipette, is very unsatisfactory. If any moisture collects in the constriction, it is almost impossible to clear it. Even if it is baked out, the residue left in the constriction usually changes the characteristics of the pipette, *i.e.* the rate of flow. It is unusual to make two of these with the same characteristics, since a good one is usually the result of a happy accident. An improvement over the constriction pipette has been described by Linderstrom-Lang and Holter (*1*), but their construction does not solve the problem of condensation in the brake, because they use a continuous capillary system such as that used in previous constriction pipettes.

The following two types of braking pipettes have proved easy to make; characteristics of one type can be duplicated in any number of pipettes, and both types are satisfactory in operation.[1]

Type A: The chief advantage of this type, in which a replaceable glass capillary brake is used, is that the brake can be replaced when necessary. For instance, if the pipette is calibrated, and a change in rate of flow is required, the brake can be replaced without recalibrating the tip. Furthermore, the possibility of moisture collecting in the brake is eliminated, in as much as the latter is not part of a continuous capillary system.

A piece of heavy pyrex capillary tubing, 6 cm. long and with an internal diameter of 0.5 mm., is joined to a capillary tube of the same length and external diameter but with an internal bore of 1.0-mm. diameter. The end of the 1.0-mm. capillary tube is flared as shown in Fig. 1a. A 0.3- to 0.5-mm. capillary

[1] I wish to acknowledge my indebtedness to Mr. James Graham, University of Pennsylvania Medical School, Philadelphia, for his excellent suggestions and cooperation in connection with the development of these pipettes.

tube is pulled to a finely drawn-out braking tip. A globule of low-melting-point, transparent, sealing resin[2] is melted onto the capillary near the end opposite the brake. The capillary tube is then dropped into the lumen of the pipette and heated cautiously over a microflame until the resin makes a seal at point

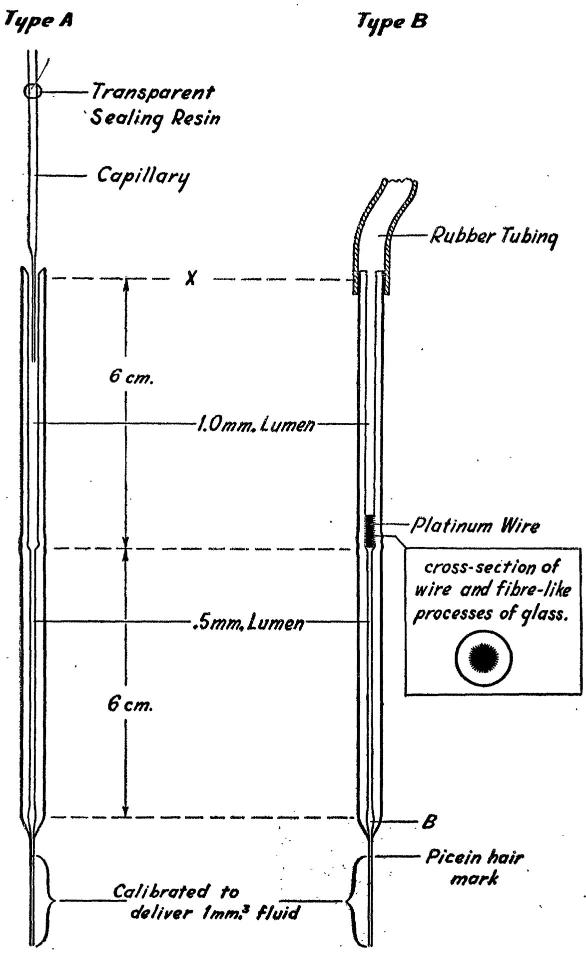

FIG. 1a   FIG. 1b

X. The pipette is completed by pulling a tip in the conventional manner. A convenient way to mark the calibration on the tip is to pull a fine thread of heated black picein to a fine hair, winding it in a circle around the capillary tube at the calibration point before it is entirely cool. Then, by bringing the point where it is applied near a microflame, it will be sealed to the glass. The capillary brake may be cut close to the resin seal, and the pipette is ready for attaching the rubber tubing to complete a mouth-suction pipette.

Type B: The rate of air flow is controlled by taking advantage of the slight difference of the coefficient of expansion between platinum wire and pyrex glass. The two main advantages of this type are that (1) any number of pipettes with the same characteristics may be made by using the same length and diameter of platinum wire in the brake, and pyrex capillary tubing from the same lot of glass; and (2) fluid as well as moisture, if drawn into the brake, may be baked out over a microflame, and the pipette dried in a hot-air oven without materially changing the characteristics of the pipette.

A piece of heavy-wall pyrex capillary tubing 6 cm. long, with an internal diameter of 0.5 mm., is fused to a heavy pyrex capillary tubing of the same length, with an internal diameter of 1.0 mm. A piece of platinum wire 8 mm. long, with a diameter of .017 mm. (#25 gage), is inserted at point X (Fig. 1b) and worked down to the point where the two inside-diameter bores meet. The pipette is then heated at that point in an oxygen-air-gas flame until the platinum wire is white hot. The capillary tubing will shrink around the white-hot wire. Care must be taken not to fuse the capillary bore closed at either end of the wire. This can be avoided by adjusting the blowtorch to a rather sharp flame. The pipette should be held in this flame for about a minute after the capillary has shrunk onto the platinum wire, the capillary allowed to cool to a cherry red in an air and gas flame for about another minute, and then the capillary "smoked" in a gas flame and allowed to cool to room temperature. As the pipette cools, the difference in coefficient of expansion of the platinum wire and pyrex glass causes the platinum wire to shrink away from the glass. The space between the wire and the glass will become filled with fiber-like processes of glass, which becomes the air "brake."

The tip is pulled in the ordinary manner, except that bulb B (Fig. 1b) has to be blown from the tip end of the pipette instead of the open end marked X. (The tip may be formed, if desired, before the platinum wire is inserted.)

A pipette made in this manner has a smooth, slow movement of fluid in the tip, even when a maximum of suction is applied by sucking on rubber tubing applied to point X. A slightly faster pipette may be made by using platinum wire 8 mm. long, with a diameter of .026 (#22 gage).

[2] Transparent sealing resin (see *Chemistry and physics hand book* (23rd ed.), p. 2002.

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A New-Type Atomizer for Large-Scale Application of 2,4-D

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If 2,4-D is to be used on a large scale for the eradication of weeds on range land, grainfields, roadsides, and similar situations, a relatively simple and cheap means of application is necessary. Water sprays require 120 gallons of water per acre when used at the rate of 1 to 1,000. Because of the lack of ample water supplies and because of the weight of the material and equipment required for their distribution, water sprays offer difficulties in any extensive operation of weed control. However, by employing the principle of atomization using concentrated oils, oil emulsions, or water solutions of 2,4-D, application can be made at as low a rate as 3 gallons per acre or less. Atomization of the solution is accomplished by passing air at low pressure (2 pounds) over the solution to be atomized. It is broken up into finely divided particles which form a mist.

The most important feature of the apparatus is the atomizing nozzle, a pattern for which was furnished by the Shell Oil Company of New York City through its representative, C. S. Harris. The nozzle is of brass, 1 $\frac{11}{16}$ inches long, $\frac{7}{8}$ inch wide, and