A Method of Optically Recording Contractions and Electrocardiograms from Isolated Frog Hearts

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This method was devised for recording simultaneously the muscular contractions and electrocardiograms from the isolated frog heart. The apparatus consists of a glass tube, 15-mm bore and 6–7 cm long, with two short side arms about 1 cm from the top and bottom, respectively, of the tube. The bottom is sealed by a rubber stopper through which projects a small glass tube containing an electrode projecting into the tube and which is vertically adjustable within the tube. The lower side arm is connected by rubber tubing with a small leveling bulb, which is filled half-full with the control solution used for perfusion (e.g., Ringer's or Clark's). This

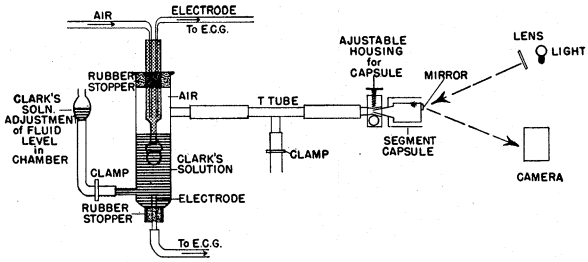

FIG. 1. Diagram of apparatus.

bulb is convenient for adjusting the fluid level in the tube, which is filled about half-full with the solution.

The heart is perfused by the method of Straub. The perfusion cannula bearing the frog heart passes through a rubber stopper of proper size to close the top of the tube. The heart is then put in the tube, and the cannula adjusted so that the heart is just immersed in the control solution. The tube thus becomes a modified cardiometer. The upper side arm is connected by a short piece of 2-mm bore rubber tubing bearing a T tube to equalize pressure, with a Wiggers (*1*) segment capsule. The capsule is covered by a moderately stretched condom diaphragm which carries the mirror. The second electrocardiographic electrode consists of a German silver wire about 18 gage which is passed down inside the perfusion cannula so that its tip is just above the constriction of the cannula. The perfusing solution, and the control solution in which the heart is immersed, adequately serve as conductors. A diagram of the apparatus appears in Fig. 1.

A variant of this procedure consists in attaching the tip of the ventricle by means of a clip and fine wire conductor to a small flat tambour loosely covered by a condom diaphragm. The wire is attached to the center of the tambour diaphragm so that a very slight tension is maintained on the heart. One electrode is then connected with this wire. The tambour outlet is then connected with the segment capsule as above. No solution surrounds the heart in this case. This method was found to be inadequate to record feeble contractions.

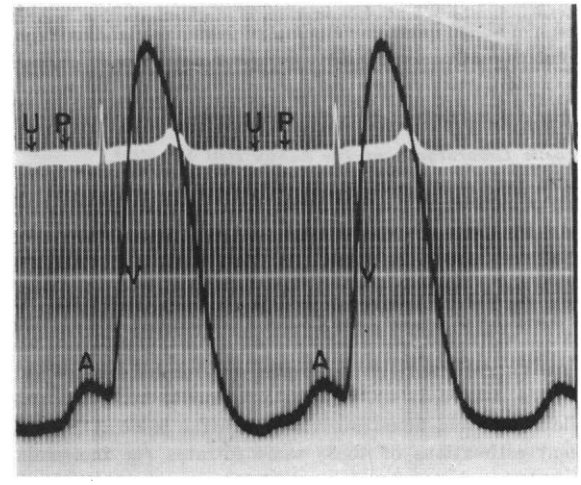

FIG. 2. Electrocardiogram and cardiometer curves. *U* and *P* waves show as small deflections. *A* and *V* indicate auricular and ventricular volume changes.

The cardiometer in our experience has proved to be adequate to record any visible contraction. It affords much greater flexibility, and the sensitivity of the recording apparatus may be easily and rapidly altered by varying the volume of air above the fluid. We have found some 5 cm³ of air in the tube a convenient volume to secure regularly an excursion of 8–10 cm from normal frog hearts.

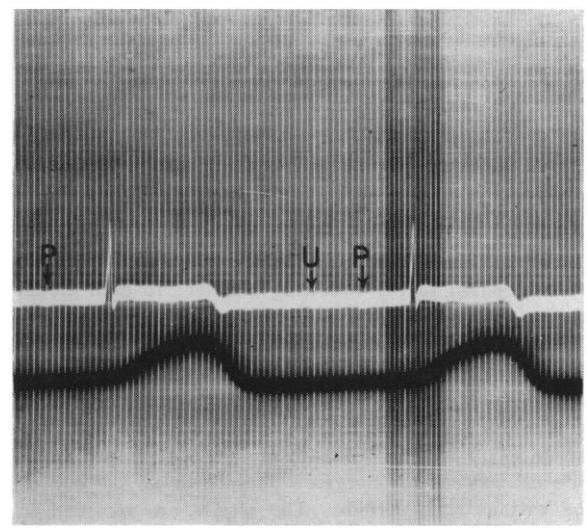

FIG. 3. Above—Electrocardiogram. Below—ventricular myogram.

Fig. 2 was obtained using the first method described. Fig. 3 was obtained by the second method.

Reference

1. WIGGERS, CARL J. *J.A.M.A.*, 1915, **64**, 1305.