

AN IMPROVED APPARATUS FOR THE STUDY OF THE MOTILITY OF ISOLATED ORGANS

BY

CAMILLO BIANCHI AND GIOVANNI CERIOTTI

with the technical assistance of

MARIO ORTELLI

From the "Carlo Erba" Institute for Therapeutic Research, Biological Division, Milan

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The extensive use of isolated organs in pharmacological research and in biological determinations of certain substances has led to an effort to improve upon the existing apparatus. During the washing of suspended organs chemical and mechanical disturbances occur which may alter their reactivity, especially when the organ fragment is washed by repeated filling and emptying of the suspension bath, so exposing the tissue to the air for considerable periods of time. We have devised a new type of suspension bath for isolated organs which overcomes this difficulty. It is based on the principle used by Zamboni (1940), Schild (1946, 1947), and by Fastier and Reid (1949) that the organ is washed by a constant stream of fluid entering from the bottom and flowing out from the top of the bath.

The apparatus, as shown in Fig. 1, consists of a support (A) to which cylindrical metal chambers (B) of different sizes can be screwed.* These are equipped with a discharge tube (C) and a level tube (D). The bottom of the support opens into a T-tube. The other arms of the T-tube are for the oxygen (E) and for the inflow (F) of the perfusion fluid. The latter is connected to a two-way stopcock with a long handle, through which the arm may be connected either to the elevated reservoir of perfusion liquid (H) or to the collecting flask (I).

The organ bath is made entirely of bronze with the inner surface gold-plated. Satisfactory results have also been obtained with a similar bath plated with pure tin. The graduated glass level tube (D) has an internal diameter of 5 mm. to avoid the capillarity phenomenon and is connected to the metal part with rubber tubing. When the bath is connected through the two-way stopcock to the reservoir, the perfusion fluid, at the desired temperature, flows in from the bottom and flows out at the top through the discharge tube, thus washing the suspended fragment without exposure to air. A fixed volume of fluid may be used by keeping the washing time constant. The volume of liquid in the bath may be regulated at will by turning the stopcock through 180° so that the fluid flows into the collector. The outflow may be stopped when the desired volume is attained as indicated on the level tube.

*Height 110 mm.	Diameter 18 mm.	Usable capacity about 20 c.c.		
„ „ „	„ 25 mm.	„	„	„ 50 c.c.
„ „ „	„ 36 mm.	„	„	„ 100 c.c.

The suspension bath is immersed by means of a metal rod attached to it in a large thermostatic bath ($70 \times 50 \times 50$ cm.) at 37° C. A constant temperature is maintained by a "Vertex" thermostatic apparatus. The bath contains a copper

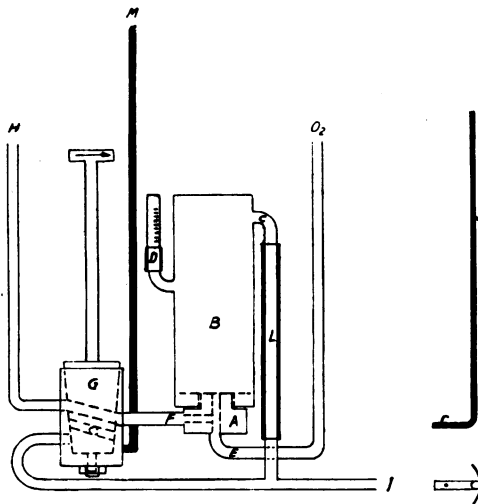


FIG. 1.—Organ bath and (right) hook for suspension of organ; for explanation see text.

With the pen which we have devised tangent to these arcs. This principle Vendramini (1947), who applied it only to the side of the lever where the acting force, i.e., the contracting organ, is exerted. By applying it also to the other side where there is resistance, i.e., to the writing point, the enlarged recording is exactly proportional to the movements of the organ. Lateral writing with very little friction is also achieved by this means and large displacements may be registered. The pen (Fig. 2) consists of a flat thin metal rod (A) moving on a fulcrum (B). The short arm is one-fifth the length of the long arm. To the end-points of both the arms, two thin metal arcs (C and D) are sealed whose radii correspond to the distances between the fulcrum and the end-points. Silk threads are attached to the upper points of the arcs and run through shallow grooves cut on the surface of the arcs. One (E) bears a metal hook to which the organ is attached; the other (F) is

warming coil for the perfusion fluid, gold-plated on the inside and of about one litre capacity (5.5 m. in length). The organ is placed on a movable hook (Fig. 1), which consists of a metal rod attached by a spring to the wall of the bath. This simple tool greatly facilitates the insertion and removal of the organ.

In addition to the suspension bath, an attempt has also been made to improve the writing pen, and a pen has been devised which gives exact proportional enlargement of the movements of the organ and records in straight lateral writing.

The pens commonly used, both the lateral and the frontal writing types, are so constructed that the points where force and resistance are applied move in an arc of a circle. the points remain constantly on the has been described by Zamboni and

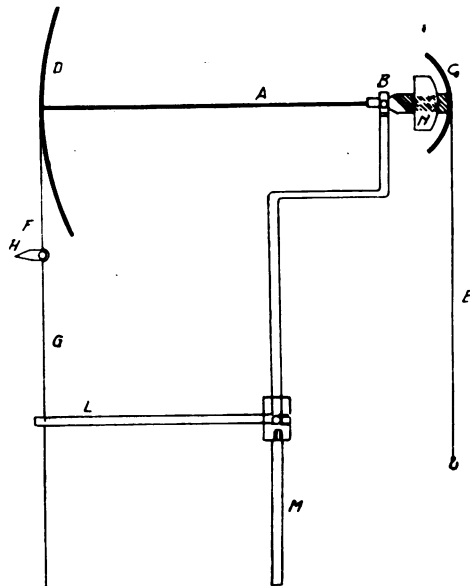


FIG. 2.—Writing pen; for explanation see text.

attached to a thin straight steel wire (G) through a small ring. A stylus (H) made of paper, cellophane, or celluloid is attached to the ring with sealing-wax. Weights may also be suspended from the ring, if necessary, to extend the organ. The metal wire runs through a hole in a rod (L) placed perpendicularly to it and attached to the support (M); in this way the stylus can only move in a vertical direction.

An accurate equilibration of the lever may be obtained by a weight (N) moving on a screw along the arm to which the organ is attached. The point of the stylus can be maintained in constant contact with the kymograph by simple torsion of the silk thread.

The pen has been used to register the contractions of isolated uterus and intestine of the rabbit, guinea-pig, and rat. There is a noticeable inertia, because of its weight, which makes it inadvisable to use the pen when frequent movements have to be recorded.

The apparatus described above has been in use for more than two years with satisfactory results.

SUMMARY

A description of a complete apparatus for the study of the motility of isolated organs is reported. A suspension bath is described which permits the washing of the organ without exposure to the air.

A writing pen is also described which records exact proportional enlargement of the movements of the organ in straight lateral writing.

We wish to express our sincere thanks to Professor Luigi Butturini for his valuable suggestion during the elaboration of this apparatus.

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