

## A PLETHYSMOGRAPH FOR THE KIDNEY

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In an acute analytical experiment, it is often necessary to make a continuous recording of the renal circulation. In order to record the arterial inflow and the venous outflow by modern thermoelectrical methods, special conditions are required. Under these circumstances, some inconvenience is caused by the necessity of developing the photographic film and by the impossibility of constantly maintaining a direct watch on the recording, in order to synchronize it with the kymographic recording of other processes. In many investigations, it is, therefore, preferable to make use of renal plethysmography. However the plethysmographs known to us are cumbersome, and have low sensitivity and other disadvantages.

The plethysmograph which we have constructed for the kidney, in contrast to existing models, consists not of double twin half-molds, drawn together by screws, but of single, somewhat kidney-shaped half-molds (Fig. 1), made of brass and nickelplated. The dimensions of each half-mold for the dog's kidney are 85 x 50 x 22 mm.

The working surfaces of the half-molds are covered with thin, elastic, heat-treated synthetic rubber of suitable shape\*. The rubber is fixed along the edge of the mortise by a silk ligature. Before fixing the rubber, the mortice groove must be smeared with rubber glue.

The "hilum" of the plethysmograph in each half-mold is composed of two semicircular notches (radius 4 mm). Fixing the rubber with the ligature is achieved by means of miniature pegs and a groove of the proper shape to apply the ligature around the "hilum". The half-molds are fixed together at one side with two marginal hinges, and at the opposite side by means of a single lock which can easily be closed in the depth of the peritoneal cavity. The outlet tubes from each half of the mold are connected to a common channel by means of a three-way tube.

Because of the very small dead space in the connecting tube system, the specially shaped thin elastic rubber enables the use of water transmission to be avoided. This considerably reduces the already small thermal capacity of the apparatus and also diminishes the chance of affecting the renal circulation through its temperature and pressure. The very small dead space of the system permits the recordings to be made, in the majority of cases, by direct transmission from the plethysmograph to a Marey's capsule without a buffer capsule, as usually used with apparatus with a large dead space. The low pressure in the plethysmograph system, causing very little interference with the changes in the volume of the organ in response to changes in the circulation, and the small thermal capacity account for the excellent recording qualities of the apparatus. In Fig. 2 is shown the plethysmogram of a kidney record with the interposition of pneumatic transmission but without a buffer capsule, and shows its changes under the influence of adrenalin.

\*The plethysmograph was made by mechanic V. M. Vlasyuk. The rubber was prepared in the experimental department of the "Krasnyi rezinshchik" factory.

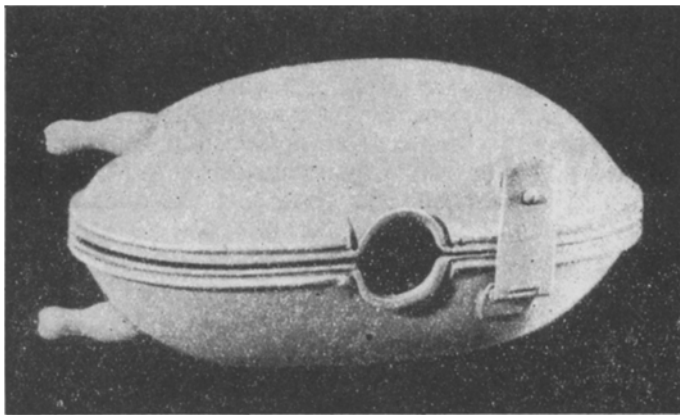


Fig. 1. Plethysmograph for the kidney (new model).

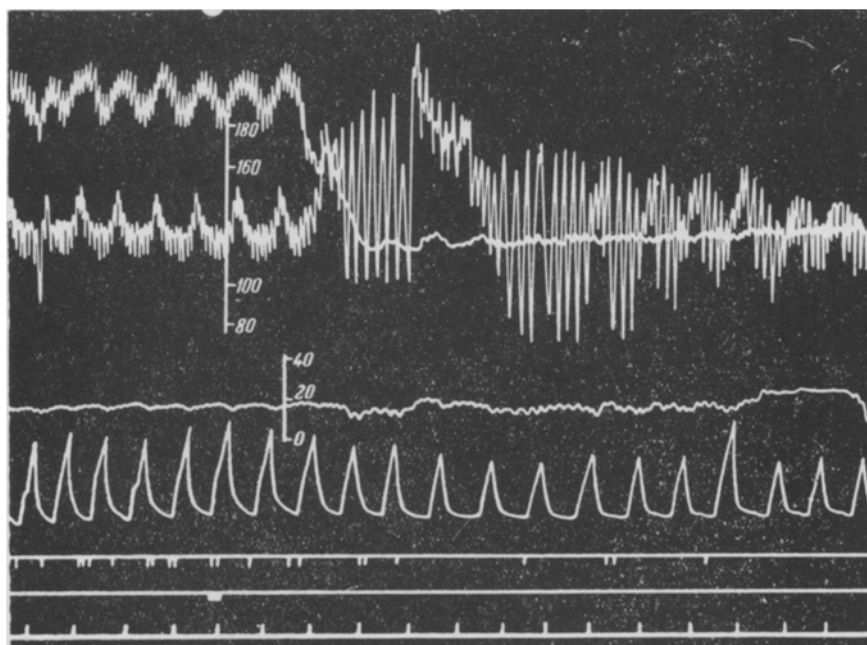


Fig. 2. Experiment on a dog weighing 18 kg. Morphine — ether — oxygen anesthesia. Significance of the curves (from above down): plethysmogram of the kidney, blood pressure in the femoral artery in mm of mercury, pressure in the pulmonary artery (catheterization) in mm of mercury, respiration, micturition, marker of the time of injection (0.2 mg adrenalin, intravenously), time marker (5 seconds).

The plethysmograph may be used with either air or water transmission. The recordings may be made by means of a Marey's capsule or a water manometer. When synchronous recording is carried out of the arterial pressure and of the pressure in the posterior vena cava, the plethysmograph gives an idea of the circulation in the kidney which is adequate for many physiological and pathophysiological investigations.

## SUMMARY

The renal plethysmograph consists of two separate kidney-like half-molds. The surface of these half-molds is covered with thin rubber of a special shape. The rubber is attached with the aid of a ligature at the edge furrow. The ligature around the portals of the plethysmograph is placed along the figured furrow and is held in place by means of miniature bitts. This instrument may be employed both in air and water plethysmography.