stasis in the femur had fixed such a large proportion of the material. Accordingly a therapeutic dose of 10 millicuries of radioactive iodine, mainly of the 12.6 hour period, was given. The femoral metastasis took up about 30 per cent. and the thyroid gland about 6 per cent. of the total amount administered. Radioautographs of the femoral metastasis were made by placing a film on the patient's thigh and allowing the radiation from the radioactive iodine to darken the film. The position of this metastasis as shown by the Geiger counter and by the radioautographs agreed well with the area of bone destruction shown in the x-ray plates.

About three weeks after the therapeutic dose the metastasis had lost about 85 per cent. of the radioactive iodine, while the thyroid still contained about the same amount as that originally taken up. A tracer dose given a few days after this finding showed prompt uptake by the thyroid gland, but no appreciable uptake by the femoral metastasis. This would suggest that at least the thyroid-like function of the metastasis had been impaired.

The patient is still under observation and a complete report will be made later.

The radioactive iodine was supplied to us through the kindness of Professor E. O. Lawrence, of the University of California, and Professor R. H. Evans, of the Massachusetts Institute of Technology.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SENSITIVE CHECK VALVE

BEFORE carrying out electrophoresis or diffusion experiments by methods involving the study of a boundary between solvent and solution, it is necessary to bring a small volume of the colloidal solution under consideration into ionic equilibrium with the solvent, usually a dilute buffered salt solution. Although this can be accomplished by simple stationary dialysis if sufficient time is allowed, it was thought likely that the equilibrium could be attained much more rapidly if some such device as the rocking dialyzer of Kunitz and Simms[1] were used. All that was required was some means of causing the buffer solution to circulate constantly past the dialyzing membrane. As was first pointed out to the author by Dr. D. A. MacInnes, the necessary energy for such circulation can be derived from the rocking motion of the dialyzer. A well-built rocker with a reliable source of power,[2] a small reservoir attached to one end of the table of the rocker, a larger reservoir to hold the bulk of the liquid, some rubber tubing and two check valves to render flow unidirectional constitute all the essential features of the set-up used in our laboratory to obtain the desired circulation. A diagrammatic representation of the assembly is shown in Fig. 1. In order to make the apparatus work, the level of the liquid in the larger reservoir must be intermediate between the upper and lower positions of the smaller reservoir and the check valves must be sufficiently sensitive to be opened and closed by small pressure gradients. A very simple and highly sensitive check valve suitable for such purposes was designed and constructed with the aid of Mr. William Duthie, machinist in our laboratory. Because of the satisfactory service the check valve has given, it was thought desirable to publish a description of it.

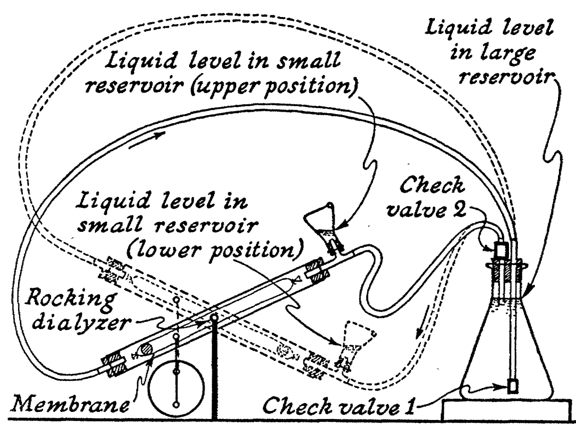

FIG. 1. Diagrammatic representation of assembly for rocking circulating dialysis.

The valve consists of nothing more than a very thin sheet of rubber resting against the opening of a hole drilled into a "lucite" rod. A slight pressure tending to cause a liquid to flow out of the hole pushes the rubber film away, but an equally small pressure in the opposite direction causes it to cover the opening securely, preventing the flow of liquid in that direction. As is illustrated in Fig. 2, two modifications of the valve were constructed. The simpler of the two, No. 1, was cut from a 2-inch section of a ¾-inch "lucite" rod. After drilling a 3/16-inch hole (a) through the center of the rod from one end to within 3/16 inch of the opposite end, hereafter designated as the head, a ⅛-inch hole (b) was drilled diagonally

[1] M. Kunitz and H. S. Simms, *Jour. Gen. Physiol.*, 11: 641, 1928.

[2] A 1/80 HP universal motor with a 1: 595 reduction gear manufactured by Bodine Electric Company of Chicago may be used for this purpose.

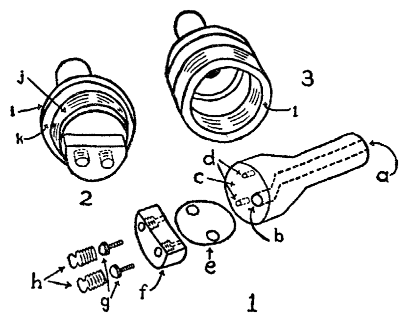

FIG. 2. The check valves. 1. Valve No. 1 shown unassembled. 2. Valve No. 2 shown assembled. 3. Cap for valve No. 2.

from near the edge of the head end so that it connected with (a). The rod was then turned down to the shape indicated in the figure, the head retaining its ¾-inch diameter and the small end being reduced to about 7/16 inch. The surface (c) was polished thoroughly. Two holes (d) were then drilled into the head as illustrated and tapped to accommodate No. 1–72 screws. A rubber diaphragm (e), about .01 inch thick, was cut to fit the surface (c), and holes were punched in it to correspond to those at (d) in the head. This diaphragm was fastened onto the head of the valve with "lucite" block (f), cut from a ¾-inch rod and held in place with two No. 1–72 brass screws (g). The holes in the block accommodating the screws were countersunk and threaded to take the "lucite" plugs (h). Valve No. 2, which is slightly more complicated than No. 1, is shown assembled. The rubber flap is shown resting against the opening of hole (b). A slight pressure from within will bend the diaphragm away, but a slight pressure in the opposite direction will cause the flap to cover the opening securely. Valve No. 1 can be used only on the end of a tube conducting liquid into some sort of reservoir. Valve 2, which is identical in principle, was cut from a 1⅛-inch "lucite" rod and was constructed in such a manner that a cap, 3, could be fitted over it, permitting it to be introduced at any point in a circulation system. A collar (i) was left at the base, and the shoulder (j) was threaded. The cap, 3, which screws onto the valve, 2, was cut from a similar rod. By polishing the surface of the collar (k) and the edge of the cap (l), it was possible to obtain a perfectly tight seal without the use of gaskets, if a little vaseline was applied to the threads before assembling.

Because of the elasticity of the rubber flap, the valve can be used in any position. Pressure differences as low as half a centimeter of water have been found to be sufficient for its operation. Constructed as it is so that only rubber and lucite are exposed, it can be used with most aqueous solutions, excepting concentrated acids and bases, and with those organic liquids which attack neither "lucite" nor rubber. Suitable materials could probably be found for making a similar valve for almost any special purpose.

The advantage of rocking circulating dialysis as here described over stationary dialysis for the equilibration of electrolyte concentrations was demonstrated by dialyzing 15 cc portions of distilled water against 2 liters of 0.2 M NaCl solution for various times using (a) rocking circulating dialysis and (b) stationary dialysis. The latter was accomplished by simply suspending the dialyzing bag near the bottom of the salt solution and allowing it to stand unagitated. Electrolyte concentrations after dialysis were estimated by measuring conductivities. As may be seen in Fig. 3,

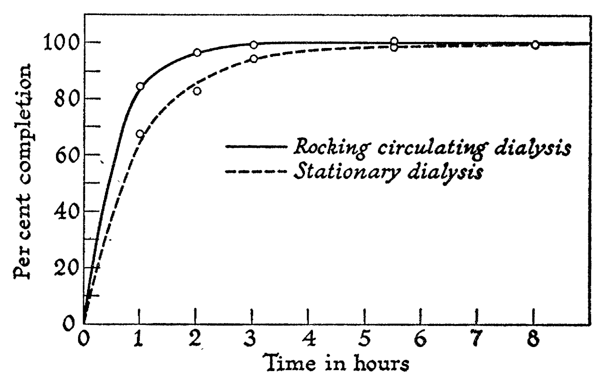

FIG. 3. Comparison of the rates of equilibration by rocking circulating dialysis and by stationary dialysis.

practical equilibrium is reached in about 3 hours by the rocking method but only in something more than 8 hours by the stationary method. In equilibrating viscous materials like protein solutions with electrolyte solutions, the advantages of the rocking method proved to be even more pronounced.

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