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THE URINARY EXCRETION OF INGESTED RADIOACTIVE SULFUR

THESE experiments are the beginning of a study of sulfur metabolism in which radioactive sulfur is used as a "tracer." Radioactive sulfur is particularly well adapted for this purpose because its "half-life" of several weeks is long enough for relatively extended biological and chemical experiments. Before proceeding to the study of organic sulfur compounds it was necessary to know the course taken by inorganic sulfates.

In our first experiments we followed the rate of appearance in the urine of radioactive sulfur after its ingestion in the form of sodium sulfate. The subject, a man, on an approximately constant diet ingested, in the form of sodium sulfate, 202 mg of sulfur containing radioactive sulfur. The urine was collected in the following periods: For the purposes of a control, twenty-four hours before the experimental day; the first experimental day was divided into two periods, one of 9 hours of which the last 4 were after the last of the sodium sulfate had been ingested, and a second 15-hour period. The urine was collected for two days after this first experimental day.

The urine of the control day showed no detectable radioactivity; 15 per cent. of the radioactive material appeared in the urine in the first 9-hour period of the first experimental day, 32 per cent. in the second 15-hour period. There was no detectable amount of radioactivity in the urine of the two days following.

The excess urinary sulfur on the experimental day over the average of the other three days was approximately 80 per cent. of that ingested. Yet only 47 per cent. of the radioactive material was excreted.

More experiments will be necessary in order to arrive at other than tentative conclusions; but these results suggest that when added sulfate enters the tissues, there is an exchange with the sulfate in the tissues, and its excretion is correspondingly retarded.

The radioactive sulfur was prepared by the bombardment of elementary sulfur with fast deuterons from the cyclotron of the Radiation Laboratory at the University of California. This material was oxidized to sulfuric acid and then converted to sodium sulfate. All the urinary sulfur was converted to barium sulfate, and the radioactivity was measured in this form with a Lauritsen quartz fiber electroscope.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A FLEXIBLE GAS THERMOREGULATOR

GAS heat frequently possesses advantages for constant temperature devices. A simple but positive regulator for accurate thermal control employs the expansive properties of air to operate a mercury valve controlling the flow of gas from the main to the burner.

The chamber for air expansion consists of a cylindrical or spherical flask to the neck of which is sealed an 8 mm tube, which is bent to form a complete loop. A side tube, sealed on beyond the loop, serves as the gas inlet and the open end of main tube carries a smaller sliding tube which functions as a valve seat and gas outlet. By filling each limb of the loop a little less than half full with mercury and floating a short piece of stirring rod with a tapered end on the mercury in the gas limb of the loop, a mercury valve is formed with glass to glass contact at the valve seat. Blowing a small hole in the small glass outlet tube for a bypass and mounting the outlet tube in a stopper through which it can slide completes the device. The assembly is shown in Fig. 1.

The regulator operates by heating to 10–15° C. higher than the operating temperature. The expanding air pushes all the mercury into the gas limb and then escapes past it. By cooling to the operating temperature the mercury is equalized in the two limbs. Sliding the outlet tube through its stopper down to the glass float sets the temperature adjustment. Subsequent temperature changes will open or close the valve and cause a compensating heating effect. The bypass keeps the burner lighted when the valve shuts off the main flow of gas. In normal use the valve remains partly open and greatest sensitivity is secured by allowing the bypass to carry the major volume of the gas. As the valve is then operating at a small fraction of its full capacity, a greater volume of gas can be passed to offset cooling.

The temperature maintained varies slightly with changes in atmospheric pressure but is independent of changes in room temperature. The glass to glass contact in the valve avoids the usual mercury-glass contact with its resultant splashing of mercury causing

globules to hang on the walls of the valve chamber with a consequent rise in temperature. Unlike vapor pressure devices, operation is unimpaired over a range of at least several hundred degrees centigrade. The

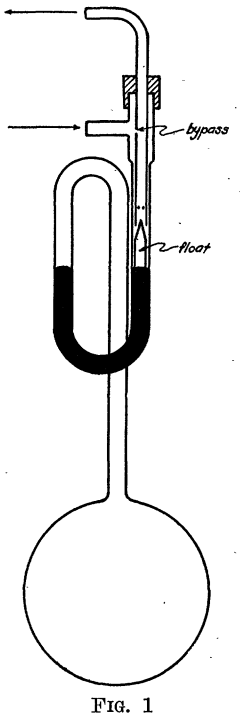

FIG. 1

regulator is ideally adapted to variable operating temperatures, since a change to a new temperature is effected simply by heating or cooling to a little above or below the required temperature, equalizing the mercury in the limbs by establishing the exact temperature and resetting the outlet tube to the proper adjustment. The outlet tube may be easily adjusted to small differences in temperature. Naturally, the precision of temperature control depends upon the volume of the expansion chamber and the inside diameter of the gas limb. With a 250 ml bulb and tubing of 6 mm inside diameter, temperature may be maintained within a $\pm$ 0.1° C.

Many modifications are apparent. For use in the thermometer well of an oven, the overall diameter of the loop and gas connections should be small enough to pass through from the interior. If this is undesirable, the loop and bulb may be separated, placed in position on the inside and outside of the oven and connected with a short section of suction tubing. By connecting the bulb to a longer section of glass or copper tubing, the mercury valve may be removed for a more or less remote control.

If it is required to change from one operating temperature to another without going beyond the new temperature, a glass stopcock may be sealed onto the air limb, permitting addition or removal of air from the expansion chamber without the necessity of exceeding the new temperature in order to permit final equalization of the mercury in the limbs. Precision of control may be increased almost indefinitely by the use of a larger expansion chamber.

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THE USE OF NEO-SILVOL AS THE COLLOIDAL SOLUTION IN DEMONSTRATIONS OF DIFFUSION

A COMMON practice in plant physiology laboratory procedure is to demonstrate the relative rates of diffusion of true and colloidal solutions by allowing various colored crystalloids and colloids to move through such gels as agar or gelatin, where the actual diffusion is not affected by convection currents or accidental movement.[1] Such substances as copper sulfate, eosin, cobalt chloride, safranin, and many others, have been used as the true solutions. Congo red and "Argyrol," a preparation of colloidal silver, are probably most often recommended as the colloids to be used. In that connection, the writer wishes to suggest the use of "Neo-silvol." This is a compound of silver iodide with a soluble gelatin base, containing 18 to 22 per cent. silver iodide in colloidal form. A 5 per cent. aqueous solution gives results which are more striking than in the case of either of the commonly used colloids. The tendency for this solution to enter the gel was markedly less than that of either Congo red or "Argyrol." Agar or gelatin work equally well as the medium through which the diffusion takes place, though the results may be more accurately observed with the latter.

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