A New Mercury Manometer for Student Use

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A new approach to the design of a mercury manometer system for direct blood pressure recording to replace the time-honored, but often erratic, glass U-tube manometer has resulted in a much more student-proof apparatus in which the unique physical properties of plastics have been utilized.

Construction. Figure 1 shows the complete manometer-pressure bottle system.[1] The manometer is made of a single block of lucite, in which is bored a right-angular version of the traditional U. The float is accurately machined of hard rubber to fit one manometer bore, so that mercury creepage is minimized. A lucite float shaft guide is turned to fit snugly into the top of the vertical bore. Nipples, cemented into the other vertical bore and into a connecting hole drilled on the side of the manometer, furnish connections through vinyl tubing to the pressure bottle and to the arterial cannula. A mounting bracket is fashioned by hard soldering a triangular plate to a length of brass rod.

The pressure bottle unit consists of a bottle holder, a valve-and-pressure-tube assembly, and a 16-oz polyethylene bottle. The bottle support is made by bending a piece of stainless steel into a U-shape, which is welded to a stainless steel base. A brass bar, tapped to provide threads for a screw, is attached to the open end of the support. A round pressure plate is fitted to one end of the screw. A knurled knob is attached to the other end.

The valve-and-tube assembly consists of a rubber stopper through which are passed two lucite tubes, 2 and 12 in. in length, respectively. The longer tube is connected to the manometer. Over the upper end of the shorter tube is placed a simple "squeeze" valve consisting of a short length of rubber tubing in which a glass bead has been placed. The valve-and-tube assembly is clamped in the top of the pressure bottle by the bottle cap through which the tubes extend.

Application. After a base line has been established, the arterial blood pressure of an experimental animal may be approximated by screwing in the pressure plate, which consequently increases the pressure in the system. To flush the system, the pressure plate is advanced as far as possible, the tube between manometer and bottle is clamped, and additional air is introduced into the bottle by withdrawing the pressure plate and simultaneously squeezing the ball valve.

The manometer may be modified for electrosensitive paper recording by placing a binding post, which contacts the mercury, in the manometer near the base of the U and by extending the wire shaft completely through the float. These modifications provide a low-resistance path for the current from power source to recording paper.

[1] The author will furnish a more detailed description of this apparatus to anyone interested in duplicating it.

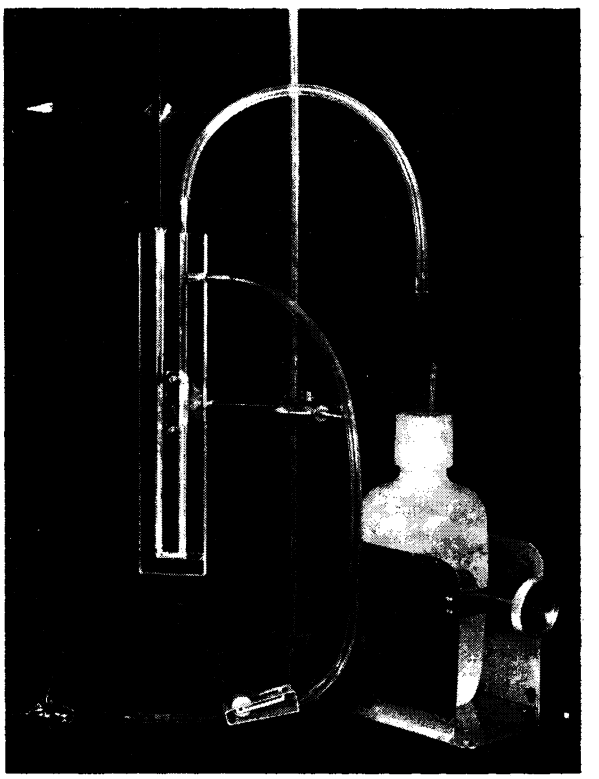

FIG. 1. Plastic mercury manometer and pressure bottle system.

Characteristics. One of the outstanding advantages of this manometer is the complete interchangeability of parts. Floats, float guides, and manometers are all machined to the same specification and need not be matched to fit. In addition, the one-piece design and absence of fragile extensions have resulted in a long estimated useful life for each manometer. Finally, the few working parts of the entire system decrease the chance of failure.

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Further Investigations into the Modification of Radiation Sensitivity Afforded by Cobalt

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In light of recent developments in the clinical usage of cobalt (*1*) and its ability to modify radiation sensitivity (*2, 3*), it appeared desirable to investigate the possible effects resulting from the utilization of cobalt under various conditions of administration.

Four hundred female Swiss-Wabster albino mice (25 ± 1 g) were divided into four groups: group A,

Purina stock chow diet; group B, cobalt diet; group C, Purina stock chow diet and irradiation; and group D, cobalt diet and irradiation.

The normal diet consisted of Purina stock chow pellets. The cobalt diet consisted of dried Purina chow pellets prepared daily by immersion for 2 min in an aqueous 2-percent solution of $CoCl_2 \cdot 6H_2O$ (*4*).

To give all animals easy access to food, the pellets were scattered in the cedar shavings that covered the bottom of the cage. Thus, the cobalt-fed animals ate *ad libitum* the cobalt-treated surfaces or the less enriched cores of the pellets. Groups of animals were kept on this cobalt diet for 5, 8, and 36 days before and for 15 days after irradiation. In another group, the animals were fed a cobalt diet only throughout the observation period after irradiation. To study the effects of feeding conditions, other groups of mice were fed through attached food baskets. This inhibited their random choice of food.

The irradiations were made with a Kelley-Koett deep therapy x-ray unit operated at 200 kv, 6 ma, inherent filtration equivalent 0.25 mm Cu, 1 mm Al plus 0.5 mm Cu added filter, target specimen distance 28 cm, 48 r/m in air, total dose 720 r in air. The animals were irradiated in a well-ventilated lucite cage in groups of 10 (5 animals from group C and 5 from group D) and observed for 30 days after irradiation. Deaths were recorded every 24 hr.

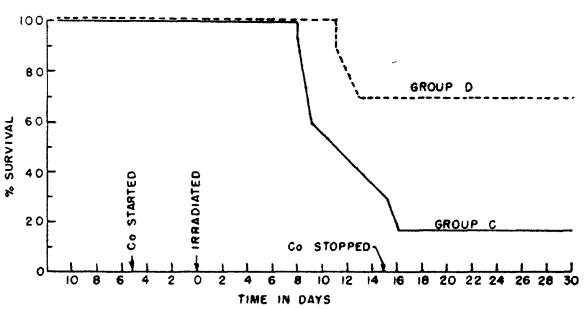

FIG. 1. Survival of mice after total body irradiation (720 r). Cobalt was fed to groups B and D for 5 days before and for 15 days after irradiation. Groups A and B (nonirradiated controls) had no deaths during the 35-day study. Group C: stock-fed irradiated animals. Group D: cobalt-fed irradiated animals.

Animals that were fed the cobalt-treated pellets for 5 days before and for 15 days after exposure to irradiation showed a decrease in radiosensitivity (Fig. 1). A 3-day extension of the cobalt feeding period prior to irradiation gave comparable beneficial effects, in confirmation of previous publications (*5*). However, mice that were fed 36 days before and 15 days after irradiation exhibited no modification in radiation sensitivity (Fig. 2). Results similar to those in Fig. 2 were obtained when the cobalt food was offered immediately after exposure to the radiation and was continually offered throughout the 30-day observation period. The data indicate that the beneficial effect of cobalt on radiation sensitivity does not occur when

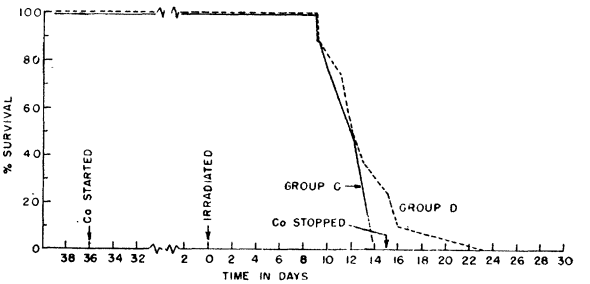

FIG. 2. Survival of mice after total body irradiation (720 r). Cobalt was fed to groups B and D for 36 days before and for 15 days after irradiation. Groups A and B (nonirradiated controls) had no deaths during the 66-day study. Group C: stock-fed irradiated animals. Group D: cobalt-fed irradiated animals.

cobalt is given over longer periods of time, either before or after irradiation. This could mean that the greatest protection occurs at the time when the stimulus to the blood-forming system is exercised (*6, 7*) and is not associated with the polycythemia that usually accompanies cobalt administration over long periods. Bethard, Skirmond, and Jacobson (*8*) expressed a similar interpretation of their findings while studying the effects of P^{32} radiation on cobalt-treated and non-cobalt-treated rats.

The manner in which the cobalt diet was offered to the animal, as well as the time element involved, had an important influence on radiation sensitivity. Animals that were fed cobalt food through the attached food baskets not only failed to develop a resistance to irradiation but died earlier than the irradiated animals that were fed the normal chow through food baskets (*2*). A possible explanation for this may be found in the fact that 20 percent of the control cobalt-fed animals died, thus suggesting a possible cobalt toxicity.

The exact amount of cobalt eaten by the animals under the different experimental conditions remains to be determined. The amount is probably relatively small in experiments with beneficial effects, surely under the previously estimated 3 to 4 mg. From the investigations made by Gardner (*1*) on the clinical usage of cobalt, it can be tentatively estimated that the mouse will tolerate about 0.04 to 0.05 mg cobalt per day without noticeable ill effects. Appropriate experiments for more detailed knowledge are under way.

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