IN THE LABORATORY

Improved Cage Designs for Use in Handling Monkeys

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The use of monkeys as experimental animals has always been somewhat of a problem due to the difficulty in handling. This is particularly true of new or unused monkeys.

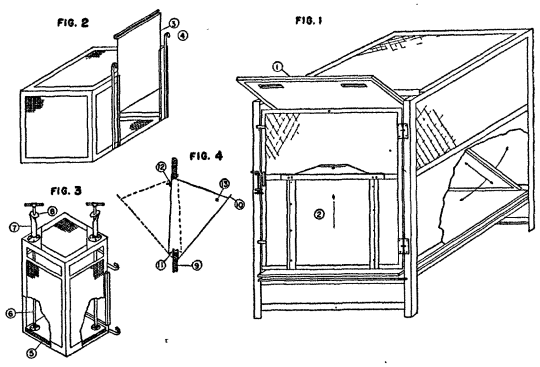
In this Laboratory the Rhesus monkey is used almost exclusively. Although the general stock is housed in a conventional animal house, those selected for tests are housed in the laboratory in large metal cages measuring approximately 28 x 31 x 40 inches. The lower half of the cage is enclosed with sheet metal, and the upper half and top with heavy, large-mesh screen. Underneath the floor, which consists of a removable panel of the same size screen as the top, is a removable pan for catching debris. The entire front of the cage may be opened by a large, side-hinged door. Two monkeys are usually housed in each cage, and the cages are set in tiers of two.

For some types of tests it is necessary to transfer the monkeys daily from the large cages to small individual cages for treatment. At regular intervals it is also necessary to remove the animals for venipuncture, etc. During these operations, which are difficult and time consuming, the animals formerly had to be transferred by hand and forcibly held quiet for the necessary blood work. Occasionally an animal would be injured or would escape and do considerable damage before being caught.

The following is a description of the cages and methods developed in this laboratory to eliminate some of the difficulties encountered in the handling of these monkeys:

The large cages were remodeled in such a way (Fig. 1) that a large, rectangular, plywood "sweep" (1) with hand holes cut in one end can be inserted into a space above the door, and an opening fitted with a sliding door (2) was cut in the lower center of the cage door. This opening is so fitted that a small transfer or exposure cage (Fig. 2), measuring 14 x 14 x 24 inches and fitted with a sliding door (3) which corresponds in width with the slide door on the large cage, can be hung over it by means of strap hooks (4). To transfer the monkeys, both slides are raised and the sweep inserted along the top of the large cage, brought down along the back, and slowly drawn forward. The monkey is forced along in front of the sweep into the small cage. When two monkeys are occupying the large cage, it is not difficult to insert the sweep between them in order to remove one. The sweep is also useful in confining the animals to the upper rear section of the cage when it is necessary to open the slide door or remove the floor screen and the debris pan for cleaning.

For securing the monkeys for the purpose of drawing blood, a separate "elevator" cage (Fig. 3) was designed. This is approximately the same size as the transfer cage and, like it, contains a slide door and hooks for attachment to the large cage. The elevator cage, made with a 2-inch opening extending across the top of each side panel, contains a plywood false bottom (5), or elevator, which can be raised and lowered by means of $\frac{1}{4}$-inch pipe (6) attached to its diagonally opposite corners. The pipe passes through 4-inch nipples (7) of $\frac{1}{2}$-inch pipe, which are attached to the reinforced corners of the top of the cage. The top of these nipples are cut off at an angle and the remaining lip bent back to an angle of approximately 40° to provide a fulcrum point for the outer edge of a large steel washer (8). The top of the $\frac{1}{4}$-inch pipe is provided with T's and short nipples to act as handles. When the elevator is



raised, the washers slide freely on the pipe; when the upward motion is stopped, they cock at an angle and secure the pipe at that point. By lifting the low side of the washers the pipe is released and the elevator can be lowered. After the monkey is transferred to the elevator cage, the elevator is raised until the animal is held securely against the screen at the top. In this position a limb of the animal can be drawn out through the most convenient opening on the side and the necessary work performed with a minimum of disturbance from the animal.

To facilitate the use of the "sweep" in the large cage, feeding and watering bins or troughs that can be swung in and out of the cage from the outside were designed. Fig. 4 is an end view of the bin in a cross section of the cage wall (9). The V-shaped bins, 5 inches wide at the top, 4 inches deep, and 10 inches long, are made of galvanized sheet iron and the bottom rounded on a radius of $\frac{1}{2}$-inch. The end pieces are attached about $\frac{1}{2}$-inch from the top edge of the bin to allow a lip or extension (10) along the top of the sides. The lower parts of the end pieces extend approximately 1 inch below the rounded bottom. An inverted V cut (11) is made into this extension, the apex of the V extending to the bottom of the bin. A rectangular opening is cut at a convenient level in the lower side or rear panel of the large cage to accommodate the bin. This opening is 10 inches long and of a height equal to the distance from the apex of the inverted V to the outer edge of the bin, not including the lip or side extension. Small slide bolts (12) are mounted

horizontally on each side of the opening of the cage, approximately ½-inch from the top. The bin is placed in the cage opening by inserting the lip and allowing the inverted V cut to rest on the bottom of the opening. It can then be swung either in or out until it is stopped by the extension lip on either side of the bin. To secure the bin in the "in" position, the bolts are slid over the outside of the bin; in the "out" position, they are slid into holes (13) drilled into the ends of the bin. When the bin is removed for cleaning, a metal plate slightly larger than the opening and having small tabs bent in on the bottom edge can be inserted to prevent escape of the animals.

Acid Phosphatase and Lipids in the Mast Cells of the Rat[1]

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The presence of alkaline phosphatase and cytochrome oxidase, localized in the form of cytoplasmic granules in the mast cells, has already been reported (*4, 5*). Acid phosphatase has been stated to occur only in negligible amounts in the mast cells (*4*). With a slight modification of the technique of Gomori and of Wolf, Kabat, and Newman (*2*), we have been able to demonstrate that acid phosphatase, like alkaline phosphatase, is abundant in the mast cells. This enzyme is localized in the mast cells as discrete, coarse, cytoplasmic granules, brown to black in color. This localization in granules, in contrast to the diffuse appearance of the enzyme in other tissues (*3*), suggests that possibly these granules which contain acid phosphatase correspond to the mast granules. No phosphatase activity was found in the nucleus.

To demonstrate acid phosphatase activity in tissues embedded in paraffin it is necessary to incubate them in the buffered substrate for comparatively long periods of time. For this reason it is thought that the method is faulty, and that perhaps the enzyme is partially denatured during infiltration in paraffin at high temperatures. For the demonstration of acid phosphatase, tissues are fixed in chilled acetone for 12 hours or longer, cleared in toluol or chloroform, infiltrated in paraffin, sectioned, and mounted in the usual manner. The deparaffinized sections are then incubated at 37° C. in a solution of sodium β-glycerophosphate buffered (acetate) to pH 4.7. In these sections enzyme activity in the mast cells is shown after long periods of incubation and is never clear before 24 hours. Often the section must be incubated 72 hours or longer. Better results are obtained when the paraffin infiltration method is eliminated. Whole mesenteries are spread on pieces of cork (previously immersed in cold acetone) and fixed in chilled acetone overnight. The acetone is removed in several quick rinses of distilled water, and the mesenteries incubated in the buffered substrate at 37° C. Some acid phosphatase activity is noted within 1 hour in granular foci in the mast cells. Maximal enzyme activity is obtained in 4–6 hours. Longer incubation periods are undesirable, because after 24 hours the mast cells become so dark that details are obscured. It seems advisable, then, to eliminate the paraffin method from this technique whenever possible. Perhaps embedding in collodion would be satisfactory, since it does not require infiltration at high temperatures.

Our previous findings do not reveal lipids stainable with Sudan IV in the mast cells of the rat. Although Sudan IV gives consistently negative results in the mast cells, when Sudan black B is applied to frozen sections of tissues fixed in formal-calcium-cadmium (*1*), black granules are revealed in the cytoplasm of the mast cells. These lipid granules resist dissolving with solvents and appear to represent phospholipids. Lipid granules have been demonstrated previously in human mast cells (*5*) by the use of Sudan black.

[1] This investigation was supported partially by a grant from the Gans Fund, Bethany College, Bethany, West Virginia.

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Sulfur Collection in Precipitation by Means of an All-Weather Noncorrosive Rain and Snow Gauge[1]

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Sulfur, an essential element for the growth of plants and animals, is known to be present in three amino acids (cystine, methionine, and djenkolic acid), the tripeptide glutathione, and two vitamins (thiamine and biotin). Increasing attention is being given to the content in foods of the sulfur-containing amino acids (*2*) as factors in food quality. The total sulfur in plants (and possibly the total of these essential sulfur compounds) is increased by increasing the supply of available sulfur in soils (*4*).

In the course of ordinary fertilizer practice, available sulfur has been supplied to the soil in the form of ammonium sulfate, potassium sulfate, and superphosphate. However, with the anticipated increased use of higher-analysis fertilizers these sources of sulfur will be decreased. Thereafter, except for a small reserve in the soil, the chief natural source to growing plants will be that brought down in the precipitation.

With regard to soil reserves, Lipman and Conybeare (*3*) have reported that, on the average, the soils in the United States contain only about 700 pounds of total sulfur/acre. This is for the most part insoluble and unavailable at any one time; also, that becoming available is subject to rapid loss by leaching. Thus, the quantity of sulfur brought down by precipitation will become increasingly important.

In order to measure the sulfur brought to the soil in rain and snow, a special rain gauge has been designed at this Station. The two general requirements to be met in making this gauge accurate and workable for the purpose were: (1) prevention of absorption of sulfur in gaseous form from the air, and (2) effective functioning in both winter and summer.

[1] Journal Paper No. 294, Purdue University Agricultural Experiment Station. Contribution from the Department of Agronomy. Project supported in part by funds of the Texas Gulf Sulfur Company.