

## Design of cages for work with copper-deficient rats

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1. Cages are described for housing copper-deficient rats.
2. The cages are of simple design and constructed of glass and Perspex. Urine and faeces can be readily obtained without exposing the animals to contamination with copper.

In the production of a trace-element deficiency in laboratory animals it is necessary not only to provide a diet deficient in the trace element concerned but also to exclude contact between the animal and all other sources of this element. Several materials, glass and Perspex, galvanized iron and stainless steel have been used for the construction of cages which can be maintained 'metal-free' for the production of copper-deficient animals. For example, C. F. Mills (personal communication) and Gallagher, Judah & Rees (1956) used glass and Perspex cages, and Lahey, Gubler, Chase, Cartwright & Wintrobe (1952) used galvanized cages for pigs. For experiments involving the production of copper-deficient rats (McCosker, to be published), special cages, both stock and metabolism, were made of materials which would withstand soaking in 50% hydrochloric acid for washing free from metal and they were constructed in such a way that they could be easily modified for varying numbers of animals and readily dismantled for cleaning or storage.

### *Stock cages*

The cages were made of glass and Perspex (Pl. 1 *a, b*) and fitted with all-glass food and water containers. These cages were easily dismantled for washing free from metal and they could be subdivided to provide cages of different sizes to contain either groups or individual rats.

One unit, of overall dimensions 27 in. length  $\times$  13 in. width  $\times$  8 in. depth, could be subdivided to provide the following housing: two cages 12 in.  $\times$  12 in.  $\times$  6 in., four cages 12 in.  $\times$  6 in.  $\times$  6 in. (cf. Pl. 1 *a*), six cages 12 in.  $\times$  4 in.  $\times$  6 in., eight cages 6 in.  $\times$  6 in.  $\times$  6 in. (cf. Pl. 1 *b*), and twelve cages 6 in.  $\times$  4 in.  $\times$  6 in. Such a unit consisted of two major walls 27 in.  $\times$  8 in. of  $\frac{1}{4}$  in. Perspex, fitted with three slotted vertical partitions 13 in.  $\times$  8 in. of  $\frac{1}{8}$  in. Perspex and slide-on lids of  $\frac{1}{8}$  in. Perspex to suit the different cage sizes.

The floors and dividing walls of the different cage combinations consisted of 6 mm diameter glass rods which passed through holes drilled in the Perspex walls. These rods were held in position by being flattened at one end and having a ring of rubber pressure tubing on the other end pressed firmly against the side of the cage.

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These cages proved satisfactory in all experiments in which copper-deficient rats were produced. One important precaution proved necessary. The level of the tray which contained the droppings had to be arranged so that the rats' tails, which readily passed between the glass rods of the floor, did not come into contact with the droppings. This was necessary particularly when copper-deficient and copper-supplemented rats were housed in adjacent units.

The units were used also to rear litters of rats. For this purpose a Perspex floor was placed over half of the floor of the compartment and an extra series of bars (Pl. 1*a*) were placed in the floor to prevent the young from falling through.

#### *Metabolism cages*

The glass and Perspex cage shown in Pl. 2*a, b* was designed to obtain urine and faeces from copper-deficient rats without unnecessarily exposing the animals to contamination with copper. All parts of this cage with which the rat came in contact could readily be subjected to the most stringent washing-up technique.

These cages were built on a block-board base 14 in. square, in the centre of which was a hole  $7\frac{3}{4}$  in. in diameter. This base supported the whole structure of the cage which consisted of an 8 in. glass funnel from which the stem had been removed, a Perspex roof which was supported by four vertical rods (one at each corner), a circular wall of 6 mm diameter glass rods and a floor of glass rods 11 in. long.

The glass funnel was placed through the hole in the block-board base; it served to collect both urine and faeces which fell through and which were eventually separated by the device shown in Pl. 2*a*.

The Perspex roof was fitted with a sliding lid covering a central entrance hole 5 in. in diameter.

The wall consisted of glass rods 7 in. long and 6 mm in diameter which were loosely set  $\frac{1}{2}$  in. into the base in holes, spaced at regular intervals around the circumference of the funnel, and also into corresponding holes in the Perspex roof.

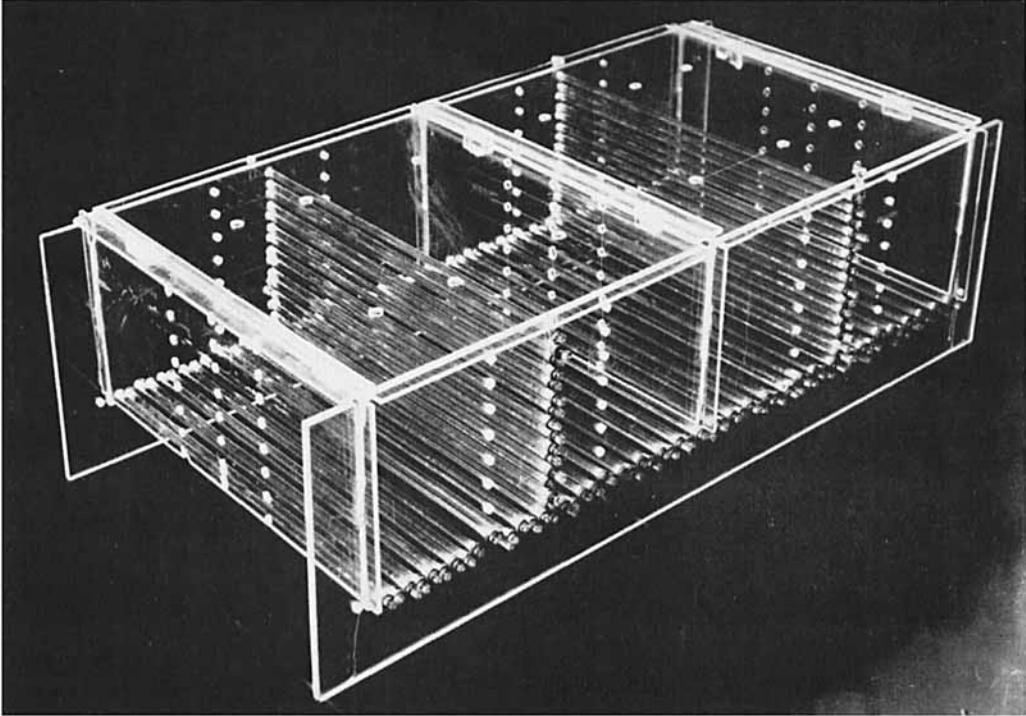
The floor consisted of 11 in. glass rods which passed between the rods of the wall and were supported by two Perspex strips outside the limits of the cage. This cage provides a space, 8 in. in diameter and 6 in. in height, which was adequate for one adult rat for an extended period or two rats for a short period.

Glass or Perspex containers, set on the outside circumference of the cage, were used to provide food and water.

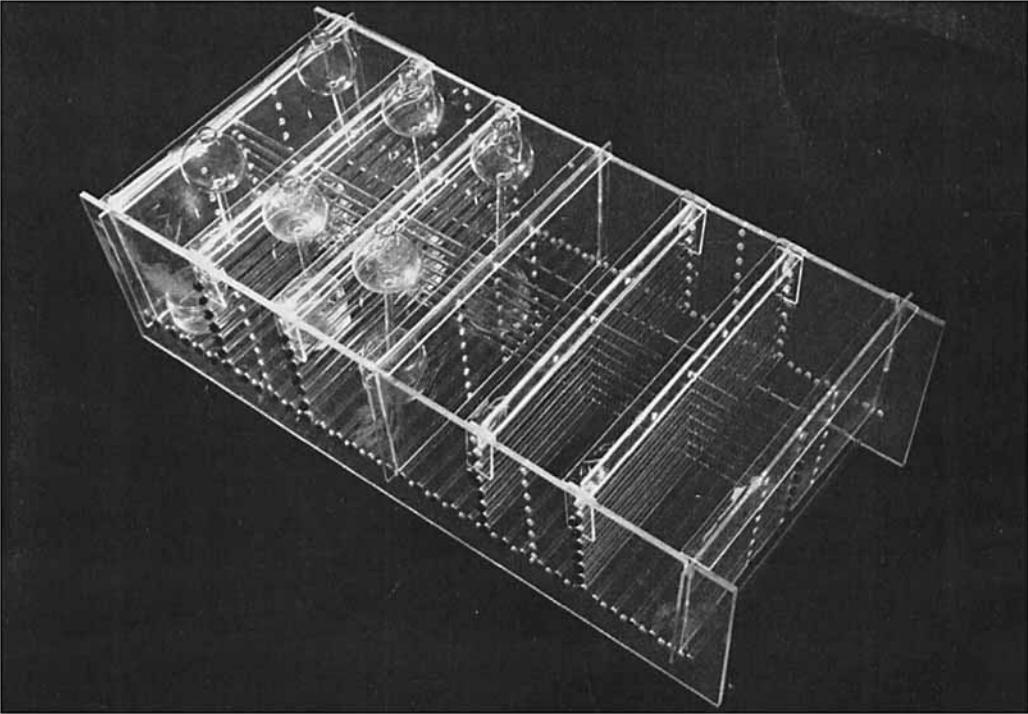
I wish to thank Dr J. Keilin for advice and the Animal Health Trust for a Junior Wellcome Fellowship. This paper in substance forms part of a thesis submitted to the University of Cambridge for the degree of Ph.D.

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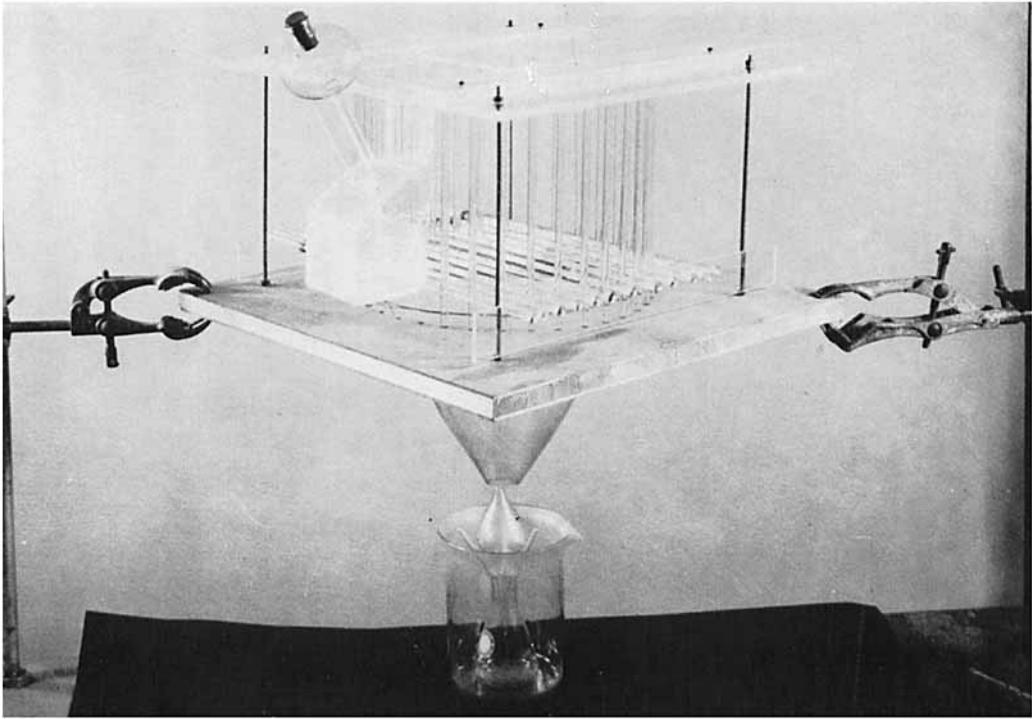
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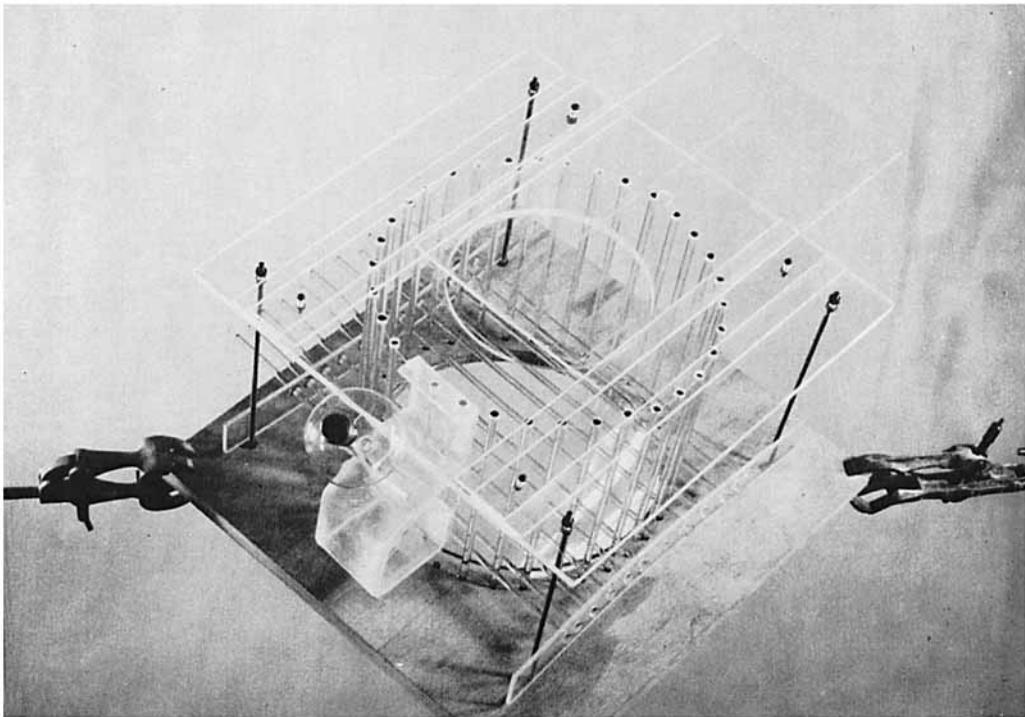
*a*



*b*



*a*



*b*

## EXPLANATION OF PLATES

## PLATE I

Two different stock cages for copper-deficient rats. (a) Arranged to provide four cages each 12 in. × 6 in. × 6 in.: in this illustration is shown the extra series of glass rods used for rearing rats still on the dam. (b) Arranged to provide twelve cages each 6 in. × 4 in. × 6 in.

## PLATE 2

Construction of metabolism cages for copper-deficient rats. (a) Side view showing funnel and method of separation of urine and faeces. (b) Top view showing sliding panel in roof and details of construction.