NEW APPARATUS

AN APPARATUS FOR THE LONG-TERM COLLECTION OF URINE FREE FROM FAECAL AND FOOD CONTAMINATION

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An apparatus for the long-term collection of urine free from faecal and food contamination has been constructed using a galvanised wire cage suspended above a smooth glass plate inclined at an angle such that food and faeces are deflected from the urine collector.

DURING acute, sub-acute and chronic investigations of toxicity in small laboratory animals, it is often necessary to collect urine continuously for 24 hr. or longer to enable electrolyte, protein and urea excretion patterns to be determined. At the same time, it is essential that the animals should be maintained under normal laboratory conditions and allowed free access to food and water. The separation of urine from faeces by means of urino-faecal separators has been described by Harned, Cunningham and Gill (1949), Draper and Robins (1956), Brittain (1959) and others. However, the devices described are generally suitable for short-term experiments only and the animals are usually deprived of food and water. During the course of a sub-acute toxicity test in rats, an apparatus has been developed that is suitable for the long-term collection of urine, relatively free from contamination.

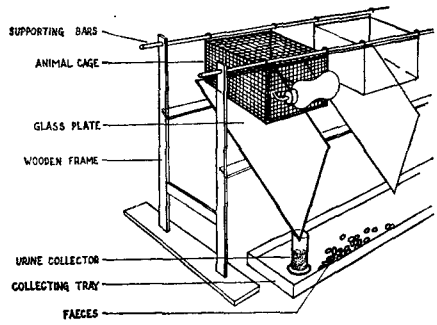

FIG. 1. Apparatus for the collection of urine free from food and faecal contamination.

The apparatus is shown in Fig. 1. A conventional galvanised wire mesh cage, dimensions 10 in. × 10 in. × 7 in., is suspended above a smooth glass plate inclined from front to back at 45°. The glass plate is 13 in. wide, the two parallel sides are 19 in. and 13 in. long respectively, whilst the diagonally cut side is about 14 in. long and has been ground smooth, rounded and annealed. Urine, food and faeces fall from the cage onto the glass plate, but because of the incline most of the food

and faecal matter rolls off the plate and is collected underneath the apparatus in a flat metal tray. Urine runs down the glass plate until it reaches the lower edge and because of a second incline on this edge, flows along it towards the glass container. Bacterial growth in the urine is prevented by the prior addition of 0·2 ml. of a 1 per cent thiomersal solution. Occasionally, faecal pellets find their way into the collecting vessel, but this can be avoided by making the glass plate slightly oversize and placing the collecting vessel out of direct line to the cage. Because of the shape and size of the apparatus, it is convenient to use 4 or 5 cages and separators together in a battery. A wooden frame at each end of the battery carries metal rods which pass through and support the cages; the glass plates are attached by screws to wooden bearers also running the length of the battery. In this manner, 5 cages and separators can be accommodated in a space 6 ft. by 3 ft.

The cages described are suitable for groups of 4 rats (up to 150 g. body weight). Larger groups would obviously require a larger cage, but the design of the apparatus is adaptable for this. Food is presented as a paste (equal parts food and water) in a metal box attached to the inside of the cage; water is allowed *ad libitum*. In the average 24 hr. collection of urine, no more than a dozen faecal pellets and about 2 per cent of the initial food adhere to the glass plate. If the plate is scraped once or twice each day, the chance of this residue absorbing urine is minimised. It is estimated that approximately 80 per cent of the excreted urine is collected, and this is facilitated by washing the glass plate daily with a 10 per cent solution of a wetting agent (Teepol) and allowing this to dry on the plate.

A disadvantage of this apparatus for separating urine from food and faeces is the large surface area of glass from which evaporation readily occurs. However, by maintaining the temperature of the room at 70° F and ensuring absence of draughts, evaporation losses can be kept to a minimum. Quantitative recovery of urinary constituents left behind on the glass can be effected by washing down the plate with distilled water, and combining the urine and water fractions.

TABLE I

EFFECT OF URANYL ACETATE ON THE EXCRETION OF UREA, PROTEIN AND WATER BY INTACT RATS

Group	Index of kidney function	Day of experiment								
		−6	−3	0	1	2	3	4	11	18
A (Normal saline)	Urine volume, ml./24 hr.	19	19	14	18·5	25	20·5	24	18	18
	Urea g./24 hr.	0·57	0·61	0·50	0·71	0·59	0·63	0·43	0·64	0·80
	Total protein mg./24 hr.	29·9	28·5	23·5	37·7	21·0	38·5	20·2	29·4	22·3
B (Uranyl acetate 5 mg./kg.)	Urine volume ml./24 hr.	21	14	18	20	36	44	44	43	23
	Urea g./24 hr.	0·63	0·58	0·74	0·26	0·05	0·11	0·11	0·58	0·41
	Total protein mg./24 hr.	31·5	22·1	27·8	50·0	56·2	172·5	161·3	150·9	49·7

Table I summarises the results from a typical experiment using this apparatus. Two groups, A and B, each of 4 male rats of initial body

weight 120–130 g., were maintained in the apparatus for several days to obtain urine samples before drug treatment. Group A then received normal saline and group B 5 mg./kg. uranyl acetate subcutaneously, the dose volume injected being 1·0 ml./kg. Cameron, Burgess and Trenwith (1947) have reported that uranyl acetate has a specific damaging effect on the kidney. The results of this experiment show that uranyl acetate causes an immediate fall in urea excretion and an increase in urinary volume (indicating a loss of tubular function) and a marked proteinuria (indicating breakdown of kidney tissue). Because this apparatus allows free access to food and water throughout the period of collection, changes in urinary constituents cannot be due to changes in diet, but to uranyl acetate-induced changes in kidney function.

Using groups of 4 or 5 rats the apparatus has been found to effectively collect urine relatively free from faecal and food contamination. Furthermore this collection of urine can be achieved without transferring animals from their stock cages. This is desirable because animals should not be subjected to a change of environment during sub-acute or chronic toxicity tests. The apparatus is simple, cheap, compact, easy to clean and easily reproducible for experiments using larger numbers of animals.

References

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