

A simple and inexpensive device for collecting urine samples from rats

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Many studies require collection of metabolic wastes from laboratory animals, and oftentimes it is important that feces and urine be collected separately. The authors describe an easily assembled and inexpensive device that can be used to collect urine samples from rats without any invasive operations. The device affords reasonable separation of feces and urine.

The need for urine sample collection from laboratory animals in many experiments is well-recognized. It is often difficult, however, to collect uncontaminated samples without wasting any urine, as mentioned by Jackson and Sutherland¹. Many urine collection methods for rats, such as vesicle puncture or catheterization, are invasive and can affect the animals in sundry unanticipated ways following the procedure^{2,3}. Urine samples obtained by these methods, for instance, may contain blood cells. Metabolic cages can also be used for urine collection, but are expensive and usually require more than one cage per study⁴. To solve these problems, we devised a simple mechanism for urine collection from rats described below.

MATERIALS AND ASSEMBLY

The device is constructed from inexpensive, easily obtained materials and consists of a cage, an upper chamber with a collection funnel, a small plastic shield, a lower chamber, collecting tubes, and a simple stand. All parts of the device can be disassembled and cleaned with warm soapy water or detergent solution.

Cage and cover

The cage and cover are assembled using simple fireplace and stove materials. The cage has grids at the bottom so that animal excreta can pass directly through the bottom (Fig. 1). A large, vented cover keeps the animal securely contained, but is removable with a single twist for easy access. Animals may be accessed without disassembly of the device. The cage also has a handle for carrying and is easily separated from the other components of the device without disturbing the animals.



FIGURE 1 | The cage has grids at the bottom so that animal excreta can pass directly through the bottom. The spill canal collects any water that animals spill and facilitates measurement of the actual water intake.

Water bottle, bottle support, and spill canal

The hydration system is located outside the cage and designed to prevent water from entering the cage and diluting the urine sample. The glass water bottle has a sipper tube on the cap. A spill canal collects any water that dribbles from the animal's mouth while drinking and facilitates measurement of actual water intake.

Upper chamber

A simple plastic collection funnel and some plastic wash-basin siphon parts separate feces and urine (Fig. 2). A siphon cone is placed in the center of the funnel and

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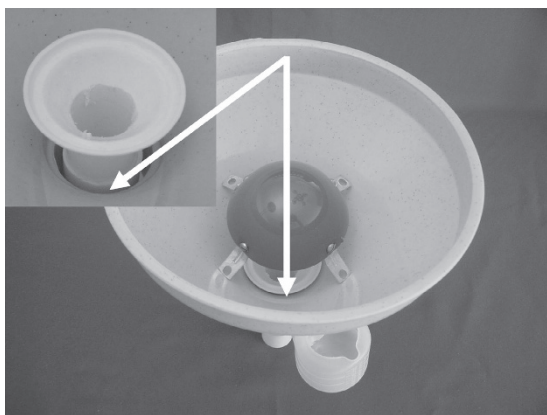


FIGURE 2 | Urine flows along the slot and is directed into the urine tube. Pellets roll down the sides of funnel over the urine slot and are collected in the tube in the center of the upper chamber. Lines indicate the direction of urine flow.

forms a small slot for urine separation. The opening of the slot can be adjusted by moving the cone up and down. A plastic shield prevents urine washover and does not allow urine to enter the feces collection tube. Urine flows along the slot and is directed into the urine collection tube. Fecal pellets roll down the sides of the funnel over the urine slot to the tube in the center of the upper chamber.

Lower chamber

The lower chamber is assembled using plastic washbasin siphon parts (Fig. 3). It enables feces and urine to be collected in different containers after separation.

Collection tubes

The device is suitable for the use of any kind of collecting tube. We used simple plastic tubes for collecting separated urine and feces. Each excreta tube can be easily removed.

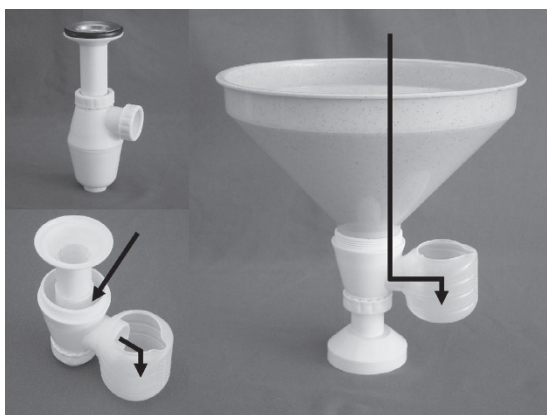


FIGURE 3 | The lower chamber enables collection of feces and urine in different containers after the separation. Lines indicate the direction of urine flow.

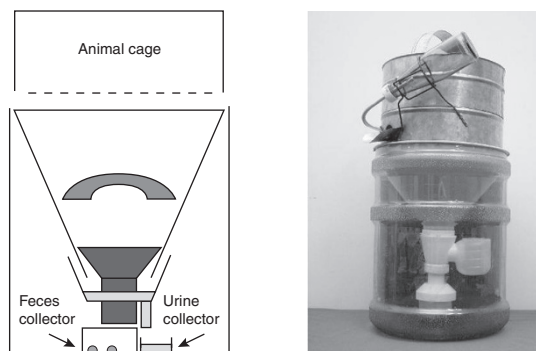


FIGURE 4 | The stand, constructed using a standard plastic 10-liter water bottle, provides easy access to all parts.

Stand

We used a plastic 10-liter water bottle to support our device (Fig. 4). It provides easy access to all parts.

DEVICE USE

We assembled 10 devices and tested them with 10 albino Wistar rats (150–200 g) in different experiments. All animals received humane care according to the *Guide for the Care and Use of Laboratory Animals*⁵ as well as institutional guidelines. We left the animals in the cages at least one night without food and with restricted water access, then fixed the cages over the collection devices for experimental use. We collected urine samples over six hours, during which time the animals had *ad libitum* access to water but no food.

RESULTS AND DISCUSSION

The cage is suitable for use with rats weighing 150–200 g. The animals did not show any abnormal behavior in the cage and they appeared to walk normally. Our device successfully demonstrated immediate and reasonable separation of feces and urine. We obtained uncontaminated urine samples. In one or two urine collecting tubes, we did find some very small particles of feces. It is important to house animals at room temperature to avoid temperature-related alteration in the excretion of urine.

The device is designed to allow noninvasive collection of urine samples from rats. Although we only collected urine samples, the device can also be used in many different experiments and is able to collect feces uncontaminated with urine or drinking water⁶. The device is designed for rats, but can be refitted for mice by using smaller-scale materials.

It is necessary to leave the animals in the cages at least one night before the experiment because a new environment can affect their normal urine excretion. In cases where some fecal particles appear in the urine collecting tube, the size of the urine slot opening can be decreased. The device may not work properly in situations in which animals are given certain medications that change the consistency of the feces.

This simple device can be used instead of an expensive metabolic cage for some experiments if collection of urine and feces samples is all that is required.

ACKNOWLEDGEMENTS

The authors thank Ercument Kuterdem for his comments and suggestions.

COMPETING INTERESTS STATEMENT

The authors declare that they have no competing financial interests.

Received 20 June 2006; accepted 22 September 2006.

Published online at <http://www.labanimal.com>

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