

Webinar Q&A Report:

Accurately Measuring Rodent Urinary Voiding Frequency and Volume

1. I assume traditional metabolic cages can be used for overall urinary volume, but for voiding behavior over time it will not suffice. Is this the case for mice? Can you elaborate?

Herrera – Since significant volumes of urine are lost on collection funnels in traditional metabolic cages, they should not be used for quantifying urine volume in mice, whether it be urine volume on a per-void basis, or even total urine volume over a prolonged period of time. However, metabolic cages do offer the opportunity to pool urine samples such that further biochemical analysis may be performed. For larger animals, e.g. rats and guinea pigs, traditional metabolic cages can be used to effectively quantify voided urine volume, both on a per-void basis and total void volume over prolonged time. You still lose some urine volume on the collection funnel, but the lost volume is not a significant proportion of the total void volume.

2. Dr. Tykocki, In the initial control chart that you showed for a control mouse, I saw only 4 micturition cycles in a 24 h period and 7 in a 48 h period. This seems to be too low for mice. Is the time scale really hours? Are the mice not voiding for 20 hours?

Tykocki – Yes, the scale is really in hours. Every once and a while there seems to be a mouse that voids that seldom. This speaks to the variability inherent to voiding behavior. I've seen it several times, but only in full-grown (adult) animals. I found it to be unexpected as well, but not without precedent in the literature. But I also think, to some degree, our picture of normal voiding frequency in mice is skewed by data collection method and duration. The high rate of urination in male mice is in part reflective of marking behavior; if they aren't marking in the UroVoid cage, then frequency will be in line with the 0.5 – 1 ml of urine they produce a day. This would be about 3 – 4 voids per day, given the usual void volumes seen in mice.

3. Can UroVoid be used for larger rodents, such as rats and guinea pigs?

Herrera – Yes, we have UroVoid systems for larger animals, such as rats and guinea pigs. In these cases, we make use of traditional metabolic cages. In species larger than mice, the amount of urine lost on the collection funnel is an insignificant fraction of the total void volume, such that void volumes can be accurately quantified. At least this is the case for the well-designed metabolic cages that we make use of.

4. What uses do you see for this system beyond voiding behavior in genetically modified animals?

Tykocki – I plan to use it to get baseline data on urination behavior for all the mice we use for bladder experiments. Since even housing situations affect micturition behavior, it's important to know exactly how each mouse urinates, and compare any changes relative to that baseline. It also allows us to understand "strange" results, which may be just due to a state of bladder over/underactivity inherent to a specific mouse.

5. Can the collected urine be analyzed for biochemical analysis?

Herrera – In our mouse UroVoid system, the urine collected would not be well-suited for biochemical analysis, because of evaporative loss. Our larger systems for rats, however, do allow for the possibility of subjecting collected urine to further analyses, since the urine can be collected in special devices that minimize evaporation.

6. Would it be possible to modify the catch pan so that the conductivity of the urine could be recorded at voiding onset?

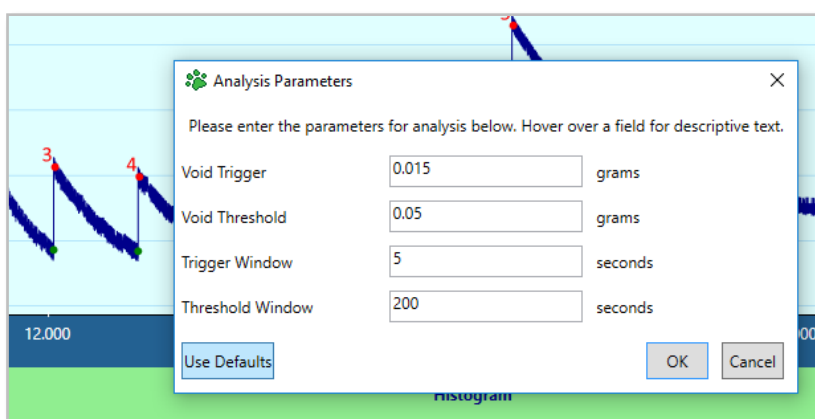
Herrera – I suppose this may be possible. If you are interested to discuss this concept please contact me directly at gerry.herrera@med-associates.com

7. What's the smallest volume of urine that can be detected from a mouse?

Herrera – The smallest volume of urine that can be detected from a mouse depends upon the environmental conditions. The analytical balance used in our system has a readability of 0.001 g (1 mg), so in a well-equipped space, which would be free from large changes in temperature/humidity, no air currents disturbing the scale, no mechanical vibrations disturbing the recording scale, and so on, it is possible to resolve very small void volumes.

The UroVoid analysis software allows the user to set detection threshold parameters. The "Void Trigger" determines the minimum change in the signal from the analytical balance that must occur for a potential void to be counted. If the scale signal changes by at least the "Void Trigger" amount from one point to the next, the software next looks to see if the "Void Threshold" has been met within the "Trigger Window" amount of time. The analysis software then advances ahead by the "Threshold Window" amount of time to begin searching for the next void event.

This detection strategy allows you to define parameters that detect very small voids, while eliminating brief deviations in the scale signal, or excluding small drips that may be part of a prior void.



8. Can more than one animal be put in the cage at a time?

Herrera – Only a single animal should be placed in each UroVoid cage at a time. If more than one animal is in the cage, it would not be possible to determine which animal the void derived from. However, the cages are clear and have vent holes on top, which allows cage mates or cohorts of animals to be able to see, smell and hear each other.

9. Can UroVoid be configured for high-throughput data collection?

Herrera – Yes, the UroVoid cages allow for high-throughput. You can monitor up to 12 UroVoid cages from a single data acquisition computer.

If you have additional questions for Dr. Tykocki and Dr. Herrera regarding content from their presentations or wish to receive additional information on urinary voiding technology, please contact him by email:

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