



MMMP
Melbourne Mouse Metabolic
Phenotyping Platform



Metabolic cage system (Promethion)

1. Experiment

Metabolic cage analysis

2. Aim

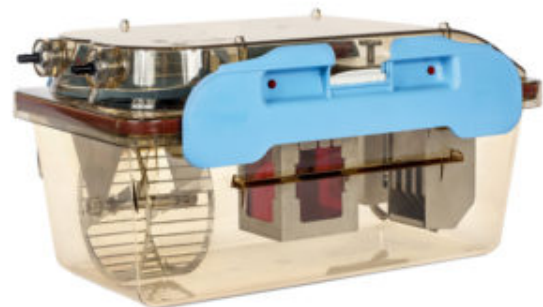
To use the 16x Promethion metabolic cage system to measure food intake, water intake, activity (plus optional wheel running), oxygen consumption and carbon dioxide production in individual mice over a 48 hour period.

3. Equipment

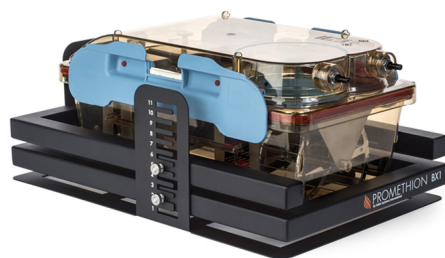


The Promethion Metabolic System from Sable (Nevada, USA) is a comprehensive lab animal metabolic activity monitoring system. It incorporates sub-systems for open circuit gas exchange calorimetry, movement, body mass, feeding, drinking, and running wheel activity in an environmental chamber.

Each of the 16 individual cages contains a water bottle, food hopper, body mass house and optional wheel.



Each cage is connected to a flow regulator and gas analyser to measure oxygen consumption and carbon dioxide production.



Cages are situated within an X, Y, Z beam-break matrix which detects activity.

Outcome variables:

- Room environment (light on/off, sound level, temperature, room humidity)
- Rate of oxygen consumption (VO_2) in ml/min
- Rate of carbon dioxide emission (VCO_2) in ml/min
- Mean respiratory exchange ratio (RER), VCO_2/VO_2 . The RER reflects the percentage use of each substrate at the cellular level at any time: 0.7 for fats, 0.8 for proteins and 1.0 for carbohydrates.
- Mean energy expenditure (EE) in kcal/hr (calculated using the Weir equation, see references below)
- Mass of food consumed (g)
- Mass of water consumed (g)
- Pedestrian meters (sum of all directed ambulatory locomotion of 1 cm/second or above within the x, y, z beam-break system. Excludes wheel activity).

- All meters (sum of all distances traveled within the x, y, z beam-break system, including fine movements such as grooming and scratching as well as directed ambulatory locomotion. Excludes wheel activity).
- Optional: Wheel meters and wheel speed (m/s)

Data for each variable is recorded per second by the Promethion software, MetaScreen and ExpeData. This data is then exported into an excel format in 5-min slices at the conclusion of the run.

4. Training requirements

Researchers who need to perform monitoring are required to complete adequate training prior to handling the Promethion cages. Refer to SOP 'Promethion_Monitoring_MMMPP_SOP_005_v1.0'. Training takes approximately 30 min.

5. Experiment design considerations

- Platform staff will transfer mice in and out of the cages, start and finish the runs and export the data.
- Platform staff will perform daily monitoring for runs that are during the week, but researchers that have runs over a weekend or public holiday will need to perform their own daily monitoring. For this reason, only 'Internal' researchers with access to the animal facility can book the Promethion for weekend runs.
- When making a booking please specify number of mice, diet, and whether you would like to include wheel access.

6. Monitoring

Holding/Allocations room

Mice in holding rooms will be observed daily for signs of discomfort and/or distress (grooming, coat condition and behaviour changes) by the animal facility staff. Monitoring, including body mass changes, will be performed by the investigator. Following a Promethion run the mice will be returned to the group housing and will continue to be monitored daily for evidence of fighting (cuts, sores, abrasions). If this is seen, animals will be housed separately.

Promethion metabolic cage room

The mice are weighed as they are placed in the Promethion system and again when they are removed at the conclusion of the experiment. While mice are housed within the Promethion cages they ideally should not be disturbed, so daily monitoring is performed without handling the mice to check they are active, eating and drinking and not showing signs of distress.

7. References

<https://www.sablesys.com/products/promethion-line/>

WEIR JB. New methods for calculating metabolic rate with special reference to protein metabolism. *J Physiol.* 1949 Aug;109(1-2):1-9. doi: 10.1113/jphysiol.1949.sp004363. PMID: 15394301; PMCID: PMC1392602.

Speakman JR. Measuring energy metabolism in the mouse - theoretical, practical, and analytical considerations. *Front Physiol.* 2013 Mar 14;4:34. doi: 10.3389/fphys.2013.00034. PMID: 23504620; PMCID: PMC3596737.