

CASE STUDY

Combining respiratory metabolism and waste collection

The Panlab OxyletPro is a versatile system that is designed specifically for studying metabolism in small laboratory animals.

The new waste collection cage option of OxyletPro provides a comprehensive understanding of an animal's body mass phenotype by evaluating both respiratory metabolism and digestive efficiency through the analysis of urine and feces.

The following document presents the data gathered during the validation phase of the system using mice.

Material and Methods:

C57Bl/6 male implanted mice were used under the protocol ACUP-2020-00-003 in an experimental room with a Light Cycle of 12 hours light/12 hours dark (from 7:00 am to 7:00 pm daily).

After a habituation period of 3 days to the food and drink dispenser in home cage conditions, the subjects are placed individually into the experimental chambers (1 per cage): 2 Panlab OxyletPro Waste Collection cages and 1 Panlab OxyletPro Physiocage.

Respiratory metabolism data were collected using the standard Panlab OxyletPro gas analyzer, air flow and switching control unit and METABOLISM V3.0 software application.

In the Physiocage, the METABOLISM software is also used to collect the food/drink intake and activity data. The activity data in the Waste Collection cage are collected through IR bars and the SEDACOM V2.0 software application.

Telemetry data is collected using the DSI HD-X10 implants, the receiver RPC-1 (in the waste collection cages), the receiver RSC-1 (in the Physiocage), the DSI interfaces (MX2) and the PONEMAH Software version 6.51.

Video recordings were performed using Axis IP cameras and the Panlab RECORD-IT! MEDIA software application.

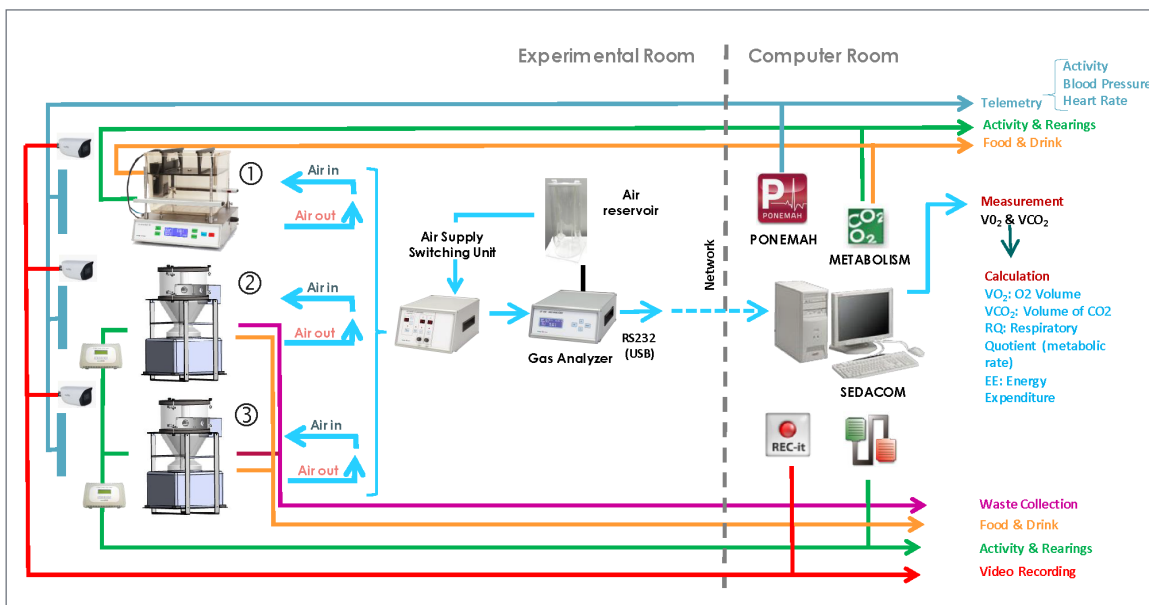
The experiment in the OxyletPro Waste Collection cages consists of 4 consecutive days of data collection by sessions of 24h.

The following activities are carried out every 24 hours:

- The subjects are removed from the cage, weighed, then placed again in the cage for the next session.
- The food/drink consumption is evaluated by weighing the food and drink dispenser, which are then refilled and mounted again on the waste collection cage for the next session.
- Urine and feces are collected each day and visually checked. The volume of the urine is evaluated using a syringe. The feces are weighed between each experimental day.

In both Waste Collection cages and Physiocage, as index of animal wealth, the status of the animal fur is manually scored each day using standard scoring metrics.

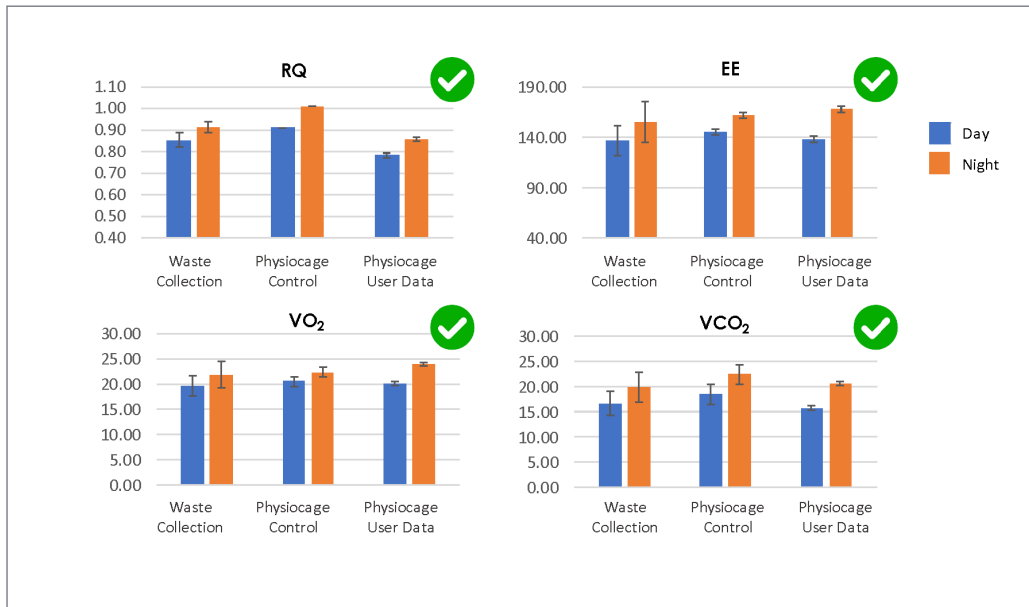
The data files for respiratory metabolism, food/drink intake (Physiocage), activity and telemetry, and the experiments' video are recorded, saved and stocked each day for further analysis.



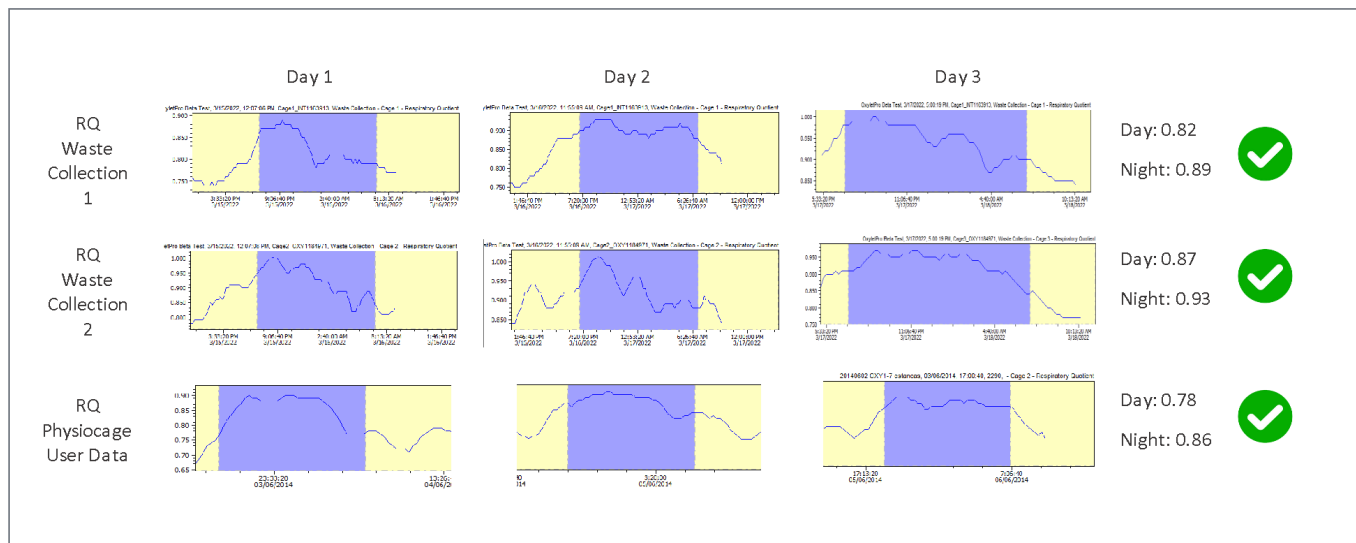
Experimental set-up overview

The OxyletPro Waste Collection cage is suitable for studying respiratory metabolism in mice. The respiratory metabolism data obtained in the OxyletPro Waste Collection cage are in the expected range for mice and similar to values obtained in the OxyletPro Physiocage.

As expected in all experimental conditions, the values of the RQ during the night are higher than those of the RQ during the day; data that is consistent with the observation of a higher activity of the mice during the night period.



Respiratory metabolism data during the day and night periods from Waste Collection cage (n=2), Physiocage Control (n=1) and Physiocage User Experimental Data (n=8): Respiratory Quotient (RQ), Energy Expenditure (EE) in Kcal/day/Kg^{0.75}, Volume of O₂ (VO₂) and Volume of CO₂ (VCO₂).



Example of the evolution of the Respiratory Quotient (RQ) value during the day (yellow area) and night (blue area) periods of 3 consecutive days in 2 Waste Collection cages and in the Physiocage (User Data).

The OxyletPro Waste Collection cage is suitable for collecting urine and feces in mice.

The expected quantity of urine and feces have been collected for individual mice in the OxyletPro Waste Collection cage in 24h session duration: Urine \approx 0.5ml, Feces \approx 2 g.

The quality collected with and without using the chiller has no significant difference.

Following an appropriate cleaning procedure and assembly of the collection funnels/cones is critical for collecting of a consistent quantity of urine and feces.

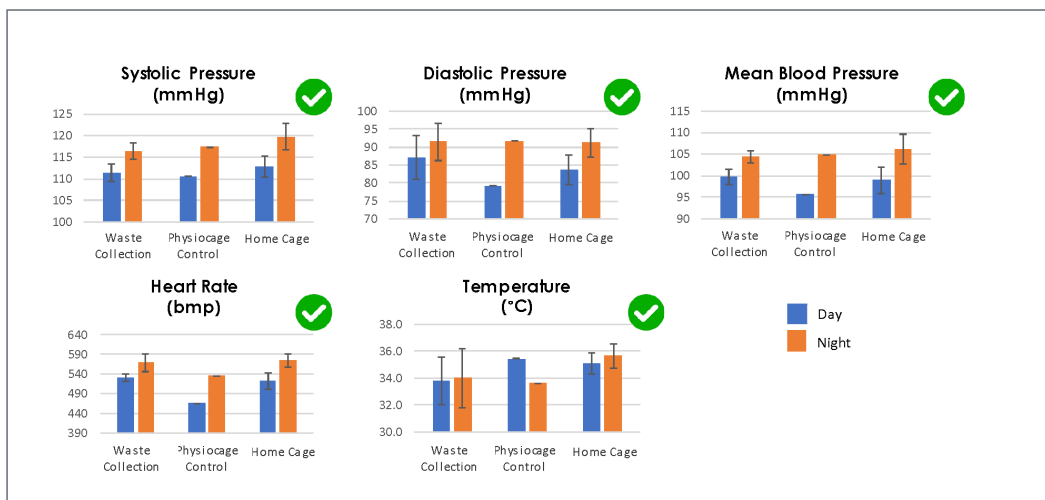


Image of the urine and feces collection tubes after 24h of experiment (individual mouse).

Optimized environment for maximum animal comfort.

The OxyletPro Waste Collection cage features a smooth grid floor and resting tube for minimizing stress and ensuring maximum animal comfort during the experiment.

The value of physiological parameters such as heart rate, blood pressure and temperature evaluated through the telemetry technique shows similar values to those collected in the OxyletPro Physiocage and standard control home cage environment.



Physiological data obtained using DSI Telemetry during the day and night periods from the Waste Collection cages (n=2), Physiocage Control (n=1) and Home Cage Controls (n=3): Blood pressure (systolic, diastolic, mean blood pressure), Heart rate and temperature.

Conclusions

The OxyletPro Waste Collection cages are a reliable way to measure both respiratory metabolism and digestive efficiency in mice by collecting urine and feces. They can also be paired with DSI implantable telemetry solutions to provide a more complete understanding of the animal's metabolic and cardiovascular health.

The different configurations of the OxyletPro system (Physiocage, Waste Collection and Treadmill) can be used in various studies including: obesity, diabetes, metabolic disorders, nutrition studies, drug screening, and phenotyping.

Contact us for more information on which configuration would best fit your research needs.