Small Animal Phenotyping Core

(part of NORC Animal Models Core, DRC Animal Physiology Core and Nathan Shock Center Comparative Organismal Energetics Core)

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Body Composition Analysis

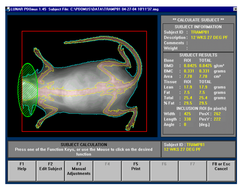
Chemical Carcass Analysis (CCA) Ex vivo

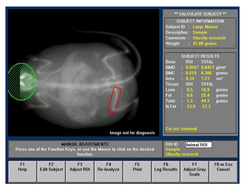
CCA remains the "gold standard" for the determination of body composition. The Core uses CCA as the standard for validating new instruments and techniques. In addition, this method is useful when carcasses have been collected and frozen prior to analysis. Carcasses undergo drying (to constant weight) to determine water content, followed by the extraction of fat using either petroleum ether or a chloroform/methanol extraction. Finally, the ash content is determined by burning the remaining dry fat-free residue at 600˚ C. Using this method, fat mass, fat-free mass, water content and ash content can be determined. May also be available for *ex vivo* tissues.

Soxhlet apparatus

Dual-energy X-ray Absorptiometry (DXA) In vivo

DXA uses two X-rays of differing intensity for the rapid determination of fat, soft-lean tissue, and bone (bone mineral content and density) *in vivo* in small animals. This allows for longitudinal measures of body composition in the same animal. Animals are anesthetized (required) using isoflurane and the scan takes approximately 5 minutes. The Core DXA can measure animals from 12g to ~70g.





Quantitative Magnetic Resonance (QMR) In vivo

With the EchoMRI™ 3-in-1 and rat systems the Core is able to offer the determination of fat and lean tissue (and total water) *in vivo* in animals/tissues from ~100mg up to 900g. The organism/tissue of interest is placed into one of the four differently-sized holders (biopsy up to 300mg, tissue up to 7g, mouse 15-100g, rat (100-900g) for measurement (no anesthesia required). The duration of measurements range from 30 seconds to 3.2 minutes.

Bomb Calorimetry

The Core is able to determine the energy content (calories) of samples by bomb calorimetry. Samples are dried and then combusted in pure oxygen. The heat produced is measured and allows for the calculation of the energy content of the sample. Common types of samples measured include food or fecal samples.

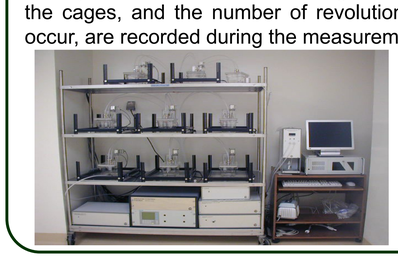
Digestive efficiency can be obtained using bomb calorimetry. Food intake and fecal output are measured over a period of several days by the PI's lab. Energy intake is determined from the energy content of the food together with the amount eaten. The energy content of the feces together with the amount of feces produced gives an estimate of energy not digested. The difference between these values divided by the energy intake, gives an estimate of the digestive efficiency, i.e. how much of the energy consumed is digested/absorbed.

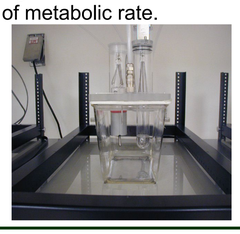
Metabolic Rate and Activity

The Core has complete mouse and rat metabolic phenotyping setups (TSE Systems) for the determination of oxygen consumption, carbon dioxide production, locomotor activity and food intake in up to 8 animals at a time. The systems are housed in environmental chambers that allow for the manipulation of temperature and photoperiod. Total energy expenditure (TEE), resting energy expenditure (REE) and the respiratory exchange ratio (RER) can be calculated from the oxygen and carbon dioxide values.

In addition, constant monitoring of food intake from the feed hopper attached to a weight sensor is possible. This allows for the assessment of timing of meals and the amount of food eaten at each meal. Access to the food hopper can be controlled/restricted and set to specific hours during the day/night or restricted to a set amount of food eaten.

An infra-red beam grid, mounted outside the cage, monitors locomotor activity in the x and y directions. This activity can be further divided into activity in different areas of the cage. Running wheels can be added to the cages, and the number of revolutions, together with the time they occur, are recorded during the measurement of metabolic rate.



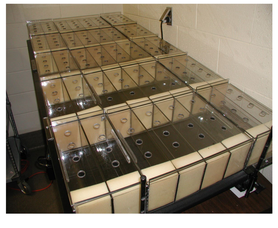


Activity / Exercise

The Core has equipment to measure both voluntary activity and forced exercise, in addition to the general activity measured with the TSE system.

Voluntary running activity can be measured with the running wheel cages. The core has 16 mouse and 16 rat cages with wheels that capture data on the number of revolutions per unit time.

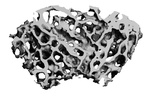
In addition to these measures of voluntary activity, the Core has two systems for forced exercise. The modified treadmill with plexiglass lanes allows for up to 20 mice to be exercised at modifiable speeds and inclines, with additional lanes at the sides for control animals. The forced exercise/walking bed has up to 20 wheels to force mice to walk at varying speeds with intermittent rest stops if necessary. The speed and time can be set by the user.

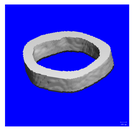


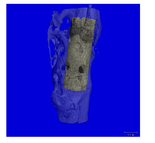
Bone Imaging

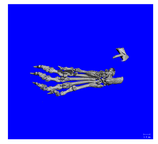
Scanco µCT40 Ex vivo

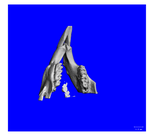
With the Scanco µCT40 instrument, the Core can three-dimensionally image excised bones up to 36 mm in diameter and up to 80 mm in length. Six µm resolution is possible in bones of less than 12 mm in diameter (mouse and rat long bones), with a maximum of 18 µm for the samples scanned in the largest (36 mm diameter) holders. Information on trabecular bone (bone volume, density, trabecular number, separation, density and thickness) and cortical bone (bone volume, density, cortical thickness and moments of inertia) are available from the scans. Whole mice may be scanned in this way if they are within the size limits (36x80mm). Additionally, bones that are fixed in formalin or other preservatives can be imaged prior to more destructive analyses like histomorphometry.

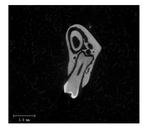








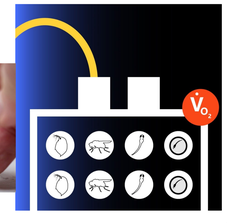




Respirometry

Loligo oxygen consumption systems

With the Loligo® Respirometry systems it is possible to measure oxygen consumption in small model systems, ranging from zebrafish, to *Drosophila*, to *C. elegans*. The Core offers two chamber systems with different volume options from 80ul (microplate reader for single *Drosophila* and *C. elegans*) to 5ml for fish, and groups of *Drosophila*.



Current Pricing*

Chemical carcass analysis	$34.30 mice $50 rats
DXA	$8.26 per animal
QMR	$7.68 per animal
Metabolic rate assessment	price available upon request
Loligo respirometry	$50 per plate (up to 20 samples)
Voluntary activity	$3.62 per cage per day
µCT	$78.63 per hour of scan time
Bomb calorimetry	$25.72 per sample

** Prices subject to change*

Contact

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