Metabolism Core

The Metabolism Core was designed to provide state-of-the-art assessments of human energy expenditure, substrate metabolism, body composition, body fat distribution, and bone quality; to provide cost-effective, centralized analytical services to ongoing funded and pilot research projects; to promote multi-disciplinary research and training in clinical nutrition and obesity across the UAB campus; and to offer training, advice, and instruction to students, fellows, and investigators.

History:

The Department of Nutrition Sciences established the “Energy Metabolism Research Unit” (EMRU) in 1994 to provide comprehensive assessment of human body composition, energy expenditure, and substrate metabolism. Services offered were body composition by dual-energy X-ray absorptiometry (DXA); body volume/density by underwater weighing; free-living energy expenditure by doubly-labeled water; 24-h energy metabolism using whole-room indirect calorimetry; and resting and exercise energy metabolism by portable metabolic monitor (indirect calorimetry). In 1997, the EMRU added the BodPod to supplement underwater weighing in response to investigator request for a simpler measure of body volume/density. In 2000, the EMRU became the “Energy Metabolism / Body Composition Core” of the NIDDK-funded Clinical Nutrition Research Center (CNRC). During the 2005 CNRC renewal, the name was changed to the “Metabolism Core.” The DXA was updated to a wider scanning bed and a table that could accommodate patients up to 450 lbs. In 2011, the Metabolism Core continued under the newly funded Nutrition Obesity Research Center (NORC). A PeaPod was added for assessment of infant body composition, and a Peripheral Quantitative Computed Tomography (pQCT) instrument was added for assessment of bone quality and fat infiltration of leg muscle.

Services:
The PeaPod can analyze body composition in infants aged 0-6 mo.

**Energy Expenditure/Substrate Metabolism**

- Total energy expenditure by doubly-labeled water
- Resting energy expenditure by indirect calorimetry
- 24-h energy expenditure by whole-room indirect calorimetry
- Design consultation

**Body Composition**

- Dual-energy X-ray absorptiometry
- Body density by BodPod (Adult/child)
- Body density by PeaPod (Infant)
- Total body water by isotope dilution
- Multi-compartment models
- Bone/muscle quality by pQCT
- MRI/CT scan analysis

**Resources:**
**Isotope Ratio Mass Spectrometer (IRMS):** The Core is equipped with two IRMS (Optima and Delta-V) for measurement of enrichment of deuterium and oxygen-18 in biological samples. Stable isotope dilution and metabolism can be used to assess body composition and free-living energy expenditure.

**Indirect Calorimetry (resting):** Two open-circuit metabolic monitors are available for assessment of resting energy expenditure (REE) and substrate oxidation (fat, carbohydrate) (Vmax ENCORE 29N Systems, SensorMedics Corporation, Yorba Linda, CA).
• **Indirect Calorimetry (whole-room):** Room indirect calorimetry is used for evaluation of 24-h energy metabolism. The calorimeter has a gross volume of 17,500 liters (3.4m long, 2.1m wide, and 2.6m high). It is equipped with a fold-out bed, desk, chair, refrigerator, toilet, sink, television, video player, telephone, and airlock for the passage of food and materials in and out of the room. Data can be collected for sleeping energy expenditure, resting energy expenditure, physical activity-related energy expenditure, and diet-induced thermogenesis. Activity is monitored by a short-range, precision microwave motion detector.

• **Bod Pod:** The BodPod (Life Measurement, Inc., Concord, CA) consists of a two-chamber plethysmograph for assessment of body volume and density in children and adults. The unit contains a pediatric insert that allows for determination of body composition in children. The test requires ~30 minutes.

• **PeaPod:** The portable PeaPod® (LMI) consists of a two-chamber plethysmograph. Infant body volume and density are used to calculate body composition. The test requires ~30 minutes.

• **Dual-Energy X-ray Absorptiometry (DXA):** The Core houses two iDXA instruments (GE-Lunar Radiation Corp. Madison, WI) for assessment of total and regional body composition. The new CoreScan software includes an estimate of visceral fat that is produced by subtracting measured subcutaneous abdominal fat from measured total abdominal fat. Bone density of the spine and hip also can be assessed. Whole-body scans require ~10-15 min. Additional hip or spine scans require re-positioning and re-scanning.

• **Magnetic Resonance Imaging (MRI):** MRI scanning is conducted on clinical scanners in the Departments of Radiology and Cardiology at UAB. The Department of Radiology offers MRI scans on a Philips 1.5 Tesla Ingenia Omega HP; Cardiology uses a Philips Intera 3 Tesla scanner (Philips Medical Systems, Best, The Netherlands). Scanning is not offered as a NORC Core service; rather, each investigator makes his/her own arrangements with the appropriate departmental personnel, and arranges for faculty in Radiology/Cardiology to provide assistance with determining appropriate acquisition parameters. The Core provides scan analysis, and assistance with making necessary contacts.

• **Peripheral Quantitative Computed Tomography (pQCT):** The XCT 3000® (Stratec, Germany) is a fully automated X-ray system for the determination of bone density and muscle composition. The pQCT offers an alternative to computed tomography (CT) and MRI for investigators who do not wish to, or cannot accommodate, the time constraints, expense, subject burden, or radiation exposure associated with CT or MRI. Study participants insert either the distal forearm (radius) or the lower leg (tibia) into the instrument. Scan time differs per location, but is typically 3 min.

---

**Fees:**

<table>
<thead>
<tr>
<th>Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLW (IRMS analysis/calculations)</td>
<td>$210 per patient</td>
</tr>
<tr>
<td>REE</td>
<td>$75 per patient</td>
</tr>
<tr>
<td>Room calorimeter</td>
<td>$500 per patient</td>
</tr>
<tr>
<td>BodPod® (measured thoracic volume)</td>
<td>$60 per patient</td>
</tr>
<tr>
<td>BodPod® (est. TV)</td>
<td>$55 per patient</td>
</tr>
<tr>
<td>PeaPod®</td>
<td>$100 per patient</td>
</tr>
<tr>
<td>DXA</td>
<td>$75 (whole-body)</td>
</tr>
<tr>
<td></td>
<td>$75 (hip and spine) per patient</td>
</tr>
</tbody>
</table>
Total body water (IRMS analysis /calculations) | $60 per patient
---|---
MRI/CT scan analysis | Based on slice number and location
Seca mBCA | $15 per patient
Ultrasound | $5 per day

All Core users are asked to complete and submit a “Core Use Request Form [1]” when applying for Core services. This form requests information concerning investigator funding, and the types and numbers of services requested.

**Contact:**

**Barbara A. Gower, PhD**  
**Director, Metabolism Core**  
Professor  
Department of Nutrition Sciences  
School of Health Professions  
Phone: (205) 934-4087  
Email: bgower@uab.edu [2]

**Source URL:** [http://www.norc.uab.edu/corefacilities/metabolism](http://www.norc.uab.edu/corefacilities/metabolism)

**Links:**  
[1] [http://www.norc.uab.edu/sites/norc.uab.edu/files/metabolism_core/Metabolism Core request for services.docx](http://www.norc.uab.edu/sites/norc.uab.edu/files/metabolism_core/Metabolism Core request for services.docx)  
[2] mailto:bgower@uab.edu