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Human Brown Adipose Tissue Detection

Application

- **Driver:** Adults have brown adipose tissue (hBAT) which burns calories; activating molecules may be good obesity drugs.
- **Market Size:** Obesity/overweight affects >2/3 of Americans, creating high health costs
- **Need:** A cheap, reliable, quantitative, safe way to monitor hBAT mass/activity would help identify people that would benefit from therapies aimed at activating it.

Research Needs

Scientific/technological problems and barriers:

- Novel tissue only recently found in neck, below clavicles, along spine in lean, young adult humans.
- Not clear if elderly, obese have hBAT
- Activated by cold
- Few non-invasive approaches to measuring mass and function of this tissue exist.

Advantages

Impact:

- Identify conditions which activate hBAT
- Measure contribution of hBAT to energy balance/protection from obesity
- Improved endpoints for obesity clinical trials

Benefits/ advantages over current capabilities

- ¹⁸F-Deoxyglucose PET is only way to monitor (expensive, radiation exposure, nonspecific)

Metric(s) of Progress

Short term goals:

- Detect hBAT mass and activity
- Test in animals and people

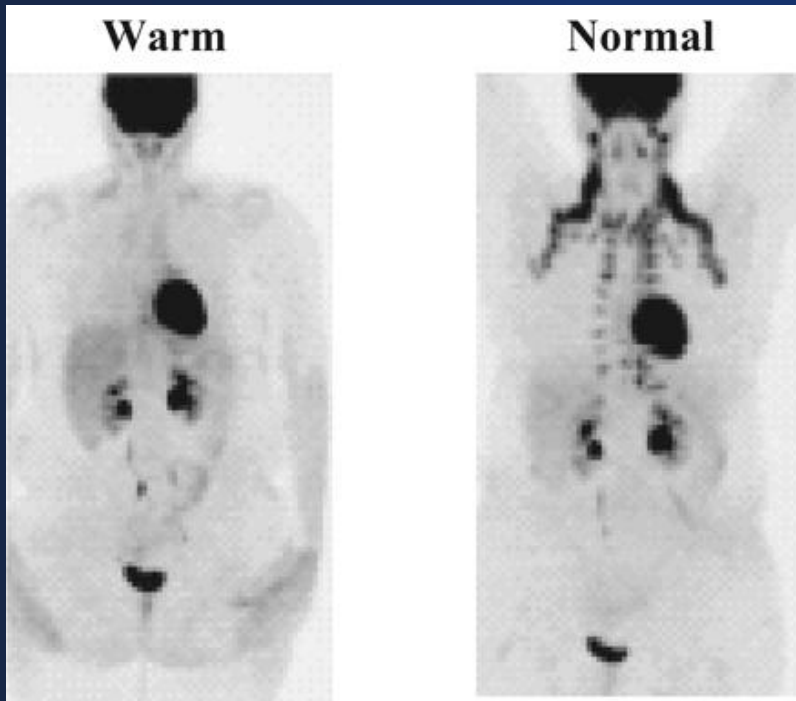
Long term goals:

- Determine hBAT prevalence in population
- Study large clinical populations to prove robustness
- Use in clinical trials of obesity drugs

Resource requirements: - Test existing or develop new technologies; ~1M/year for 5 years. Need interdisciplinary teams (technical and biology/medical).

Brown Adipose Tissue in Adult Humans (hBAT)

Recent Finding



- ◆ Do adults have BAT?
- ◆ What is the incidence?
- ◆ What is its role in energy balance?
- ◆ Do we need new tools to measure hBAT incidence and activity?

FDG PET image showing uptake into brown fat under cool conditions



Why image the pancreatic beta cell?

Early Detection of Diabetes

Inflammation

Reduced beta cell mass and function

Monitor Therapy--Surrogate Marker for Clinical Trials

Islet transplantation

Beta cell rescue / regeneration therapies

Prevention trials

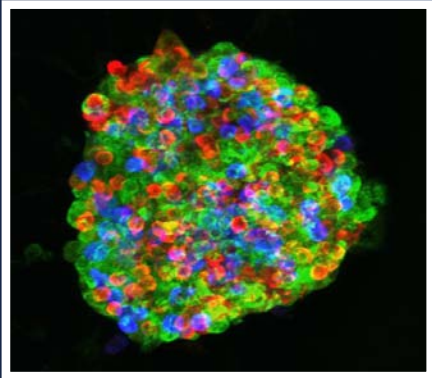
Natural History and Pathogenesis

Mechanism & timecourse of beta cell failure

Correlation between mass & secretion

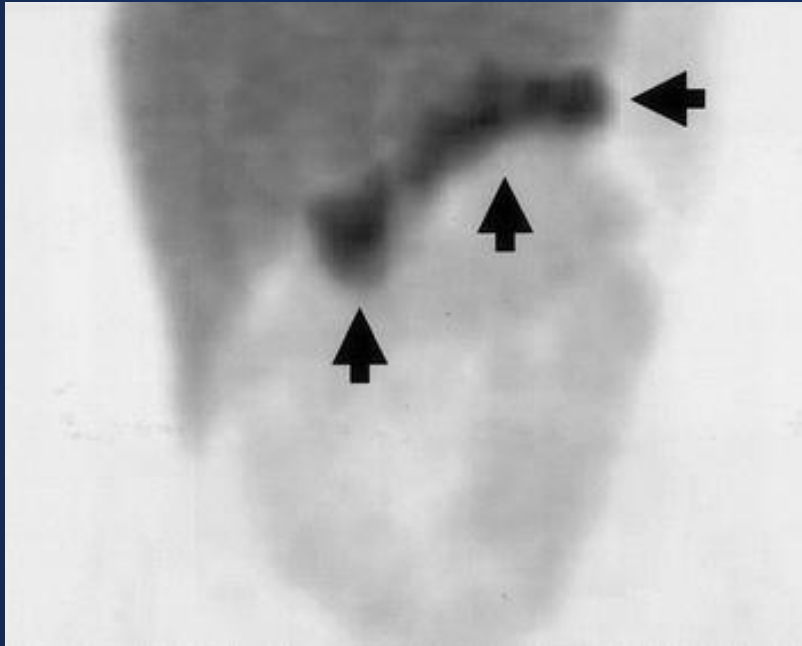
Beta cell turnover

Progenitor cells





Imaging Mass Innervation in Pancreas



Adult male volunteer

PET imaging using
[18F]FBT, ligand for
presynaptic vesicular
acetylcholine transporter

Arrows indicate pancreas

P. B. Clark, H. D. Gage, C. Brown-Proctor, N. Buchheimer, J. Calles-Escandon, R. H. Mach and
K. A. Morton Eur J Nuc Med Mol Imag, 2004, 31:258-260