

# Effects of Smoking on Mouse Adipose Tissue Volumes Measured by IDEAL at 11.7T

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Declaration of Conflict of Interest or Relationship  
David Johnson: I have no conflicts of interest to disclose  
with regard to the subject matter of this presentation.

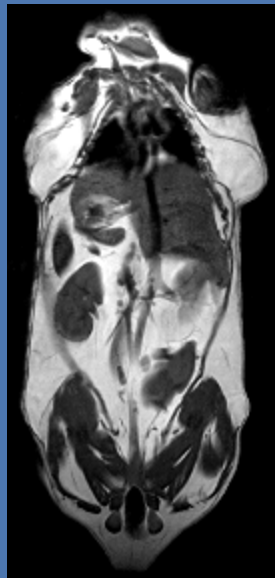


# Significance of Cigarette Smoking

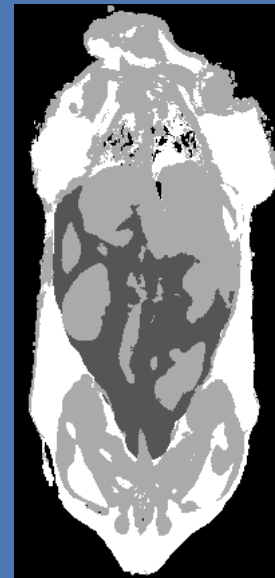
- Differential role for adipose tissue depots
  - Smoking causes increased lipoprotein lipase activity and weight loss
  - Lipoprotein lipase is regulated differently in visceral vs. subcutaneous adipose tissue
- Hypothesis: smoking affects adipose tissue volumes differently
- Mouse model to investigate mechanisms

# Image Analysis

- Semi-automatic ratio image analysis method



Input Image



Label Image

Tissue volumes,  
fat concentrations

# IDEAL Reconstruction

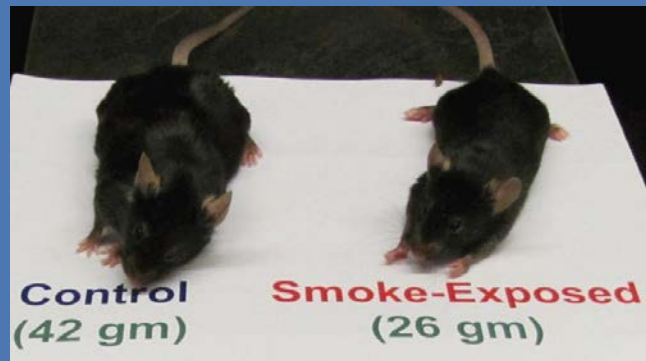
$$S(TE) = e^{j2\pi\psi TE} (W + F e^{j2\pi\Delta f TE})$$

$$J(\psi) = \left\| (I - AA^\dagger) \begin{bmatrix} \exp(-j2\pi\psi TE_1) & 0 & 0 \\ 0 & \exp(-j2\pi\psi TE_2) & 0 \\ 0 & 0 & \exp(-j2\pi\psi TE_3) \end{bmatrix} \begin{bmatrix} S(TE_1) \\ S(TE_2) \\ S(TE_3) \end{bmatrix} \right\|$$

- Iterative Decomposition of Water and Fat with Echo Asymmetric and Least Squares Estimation (IDEAL)
  - Field inhomogeneity ( $\Psi$ ) is estimated in each pixel and removed by minimizing residuals ( $J$ )
  - Spatial smoothness of  $J$  is enforced by region growing planar extrapolation
  - Data processing is expedited by graphics card computation

# Smoking Exposed Mouse Data

- C57BL/6 male mice smoking (N=6), 3 exposures/day, 6 days/week, 50 weeks. Control (N=7) mice were not exposed.
- Shifted spin echo (RARE) on 11.7T MRI

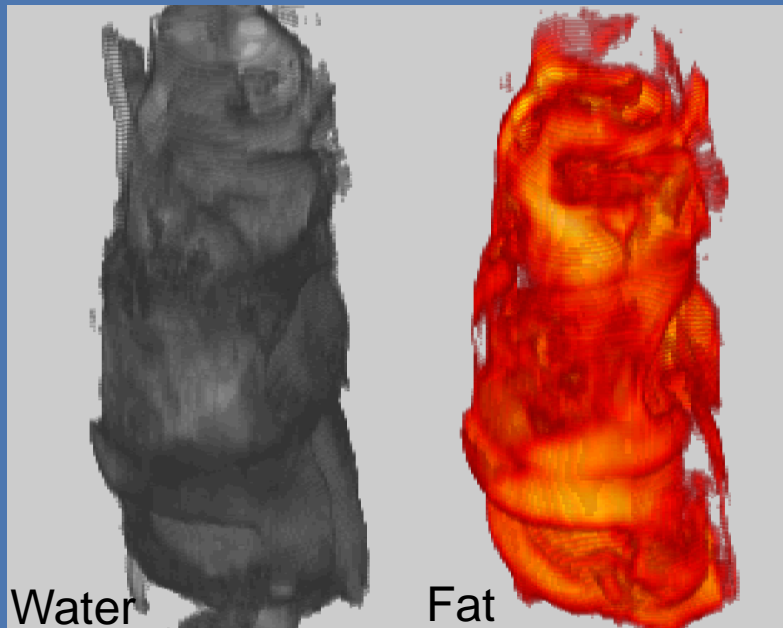


Control

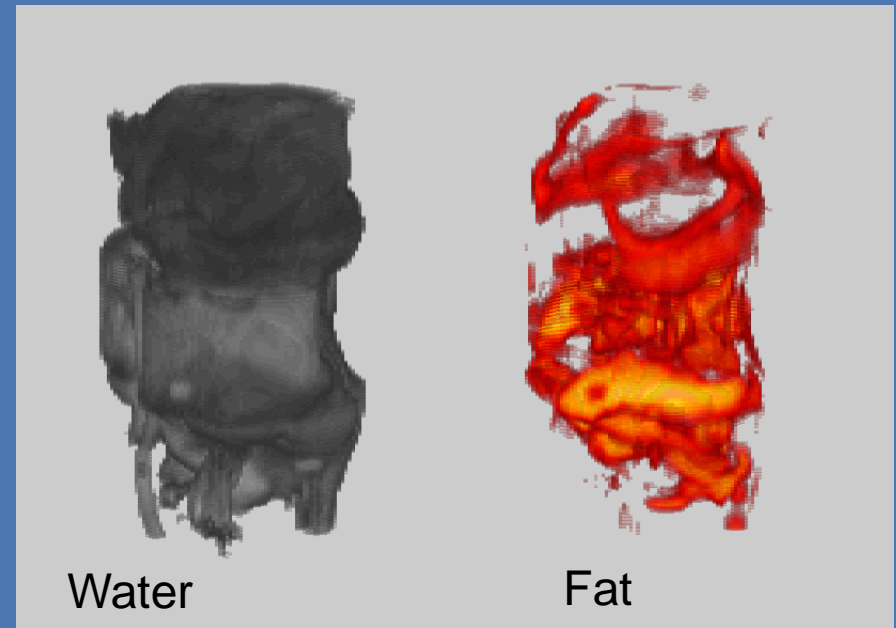
Smoking Exposed



# Visualization



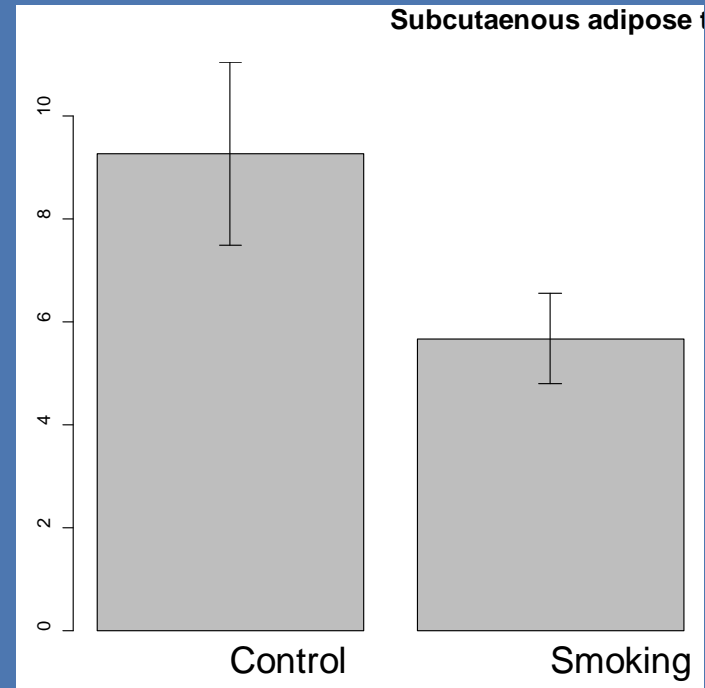
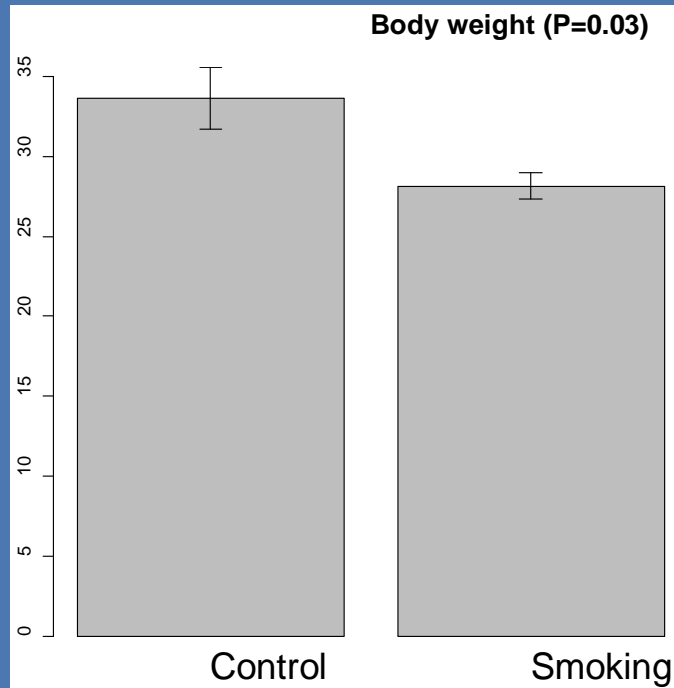
Control mouse



Smoking exposed mouse

- Subcutaneous adipose tissue appears to be reduced by smoking
- Visceral inguinal adipose tissue appears unchanged

# Results



- Significant differences in subcutaneous (non-visceral) fat and body weight
- Visceral fat and non-adipose tissues are not different (P=0.15, P>0.50)

# Discussion

- Data support the hypothesis of different roles for visceral and subcutaneous adipose tissues
- Non-adipose tissue volumes were unchanged, confirming that the effect of smoking is specific to fat storage
- The method is applicable to measuring other effects (e.g., diet + smoking)

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See also Dr. Caia's talk Friday 12:06pm room A5