Diffusion Imaging and White Matter Parcellation
Diffusion Tensor Imaging: Examples of Pathology

• Stroke: Case 1

• Stroke: Cases 2 & 3, compared
Conventional MRI and DWI in acute stroke
Stroke Patient - Anatomic Lesion
Diffusion Tensor Imaging: Technical Topics

- Tract Tracing
- Diffusion Spectrum Imaging
- Spatial Coverage
- SNR
- Visualization
Overview of WM - Microstructure

W. Krieg, 1973
Traditional Methods to Observe White Matter Structure

• **Myelin Staining Methods** (usually potassium dichromate as mordant)
  – Hematoxylin-based
  – Osmium-based
  – Silver-based

• **Experimental Methods**
  – **Retrograde Methods**
    • Horseradish peroxidase
  – **Anterograde Methods**
    • Nauta Technique: Marchi Technique: Electron Microscopy
    • Radiolabeled aminoacids
    • Neurotransmitter-related Techniques
Example Anterograde Tracing -
SLF

Petrides & Pandya, ‘84
Example Anterograde Tracing - SLF

Petrides & Pandya, ‘84
Diffusion Spectrum Imaging (DSI)
High-Resolution Diffusion Imaging
(1.5 x 1.5 x 3 mm)
Diffusion Tensor Imaging
Effect of Averaging
Diffusion Tensor Imaging

Resolution = 1.5 x 1.5 x 3 mm

12 Averages

48 Averages
3D Visualization

corpus callosum (body)
corpus callosum (splenium)
right cingulum bundle
crossing pontocerebellar fibers
internal capsule (post. limb)
right cingulum bundle
left cingulum bundle

3D Visualization
Cingulum Bundle
Cortical Spinal Tract/ Internal Capsule
Corpus Callosum
How The Brain Works