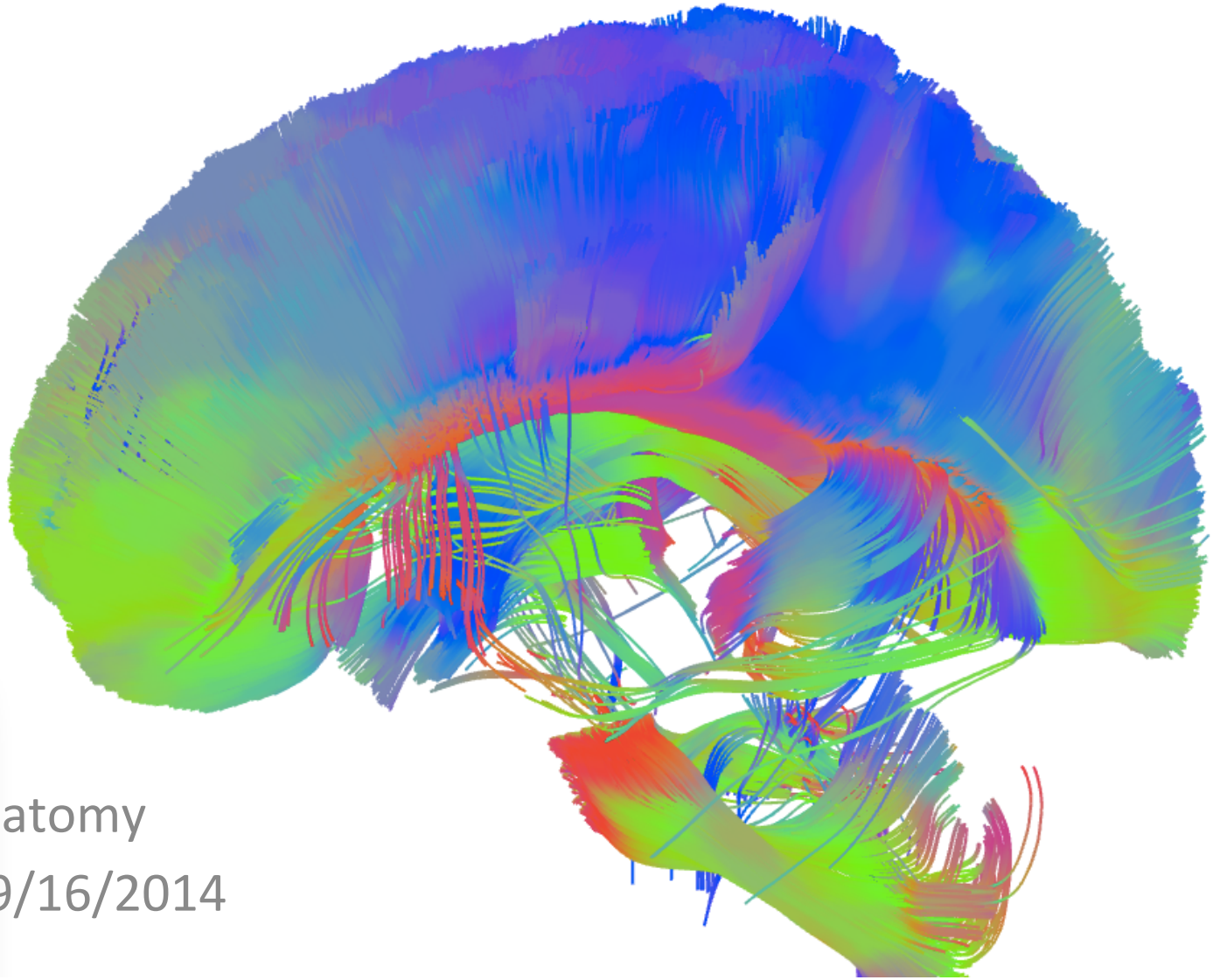
Applied Tractography – Part 4



Virtual Neuroanatomy

Lecture Date: 09/16/2014

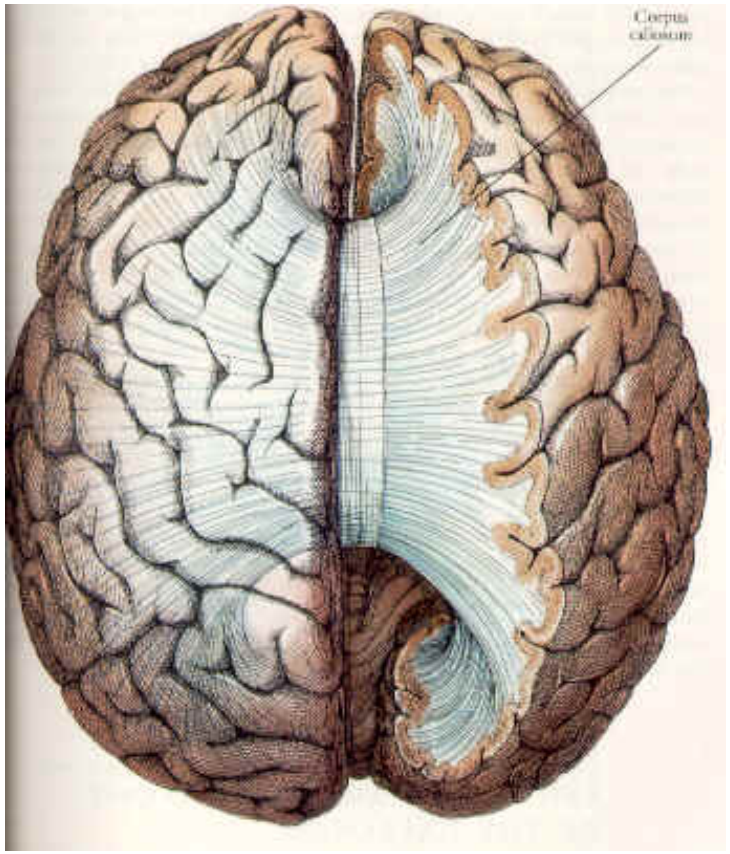
Announcements

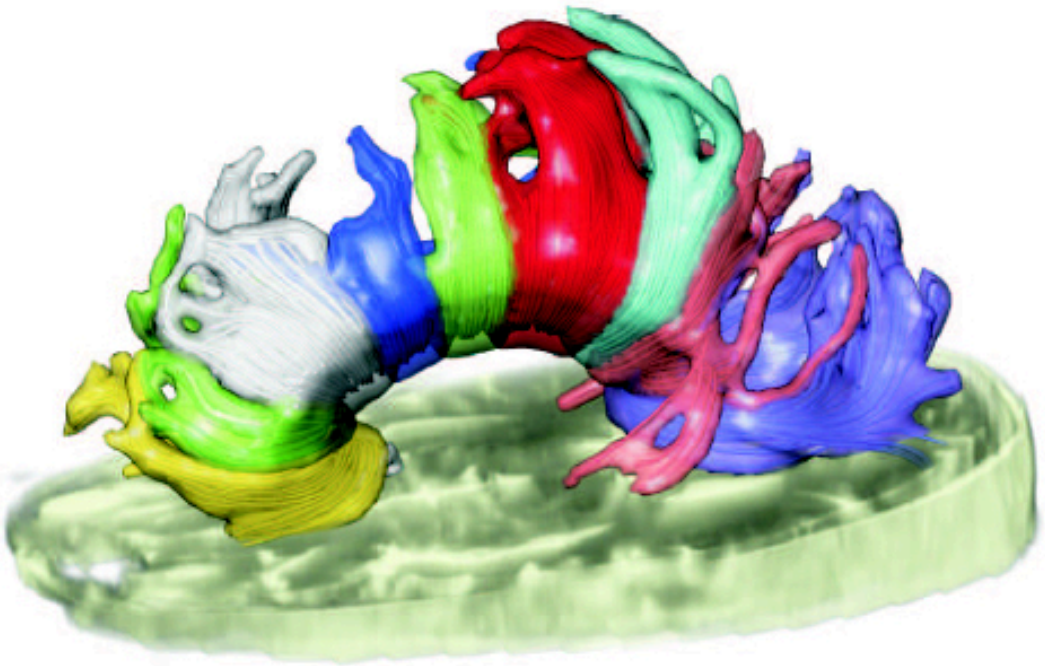
Please send me the required readings (2 papers, preferably one a review) on the anatomy of the system you are presenting no later than 1 week prior to your overview lecture.

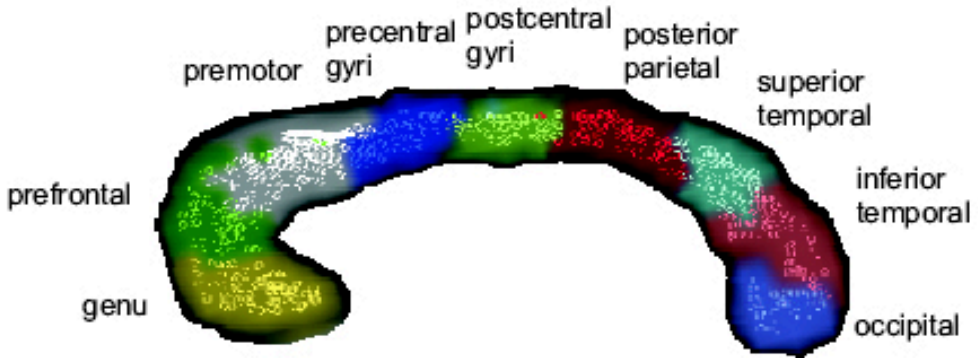
Goals

A. How to use atlas information to guide your tractography.
B. How to summarize connectivity of the target pathway.

The corpus callosum







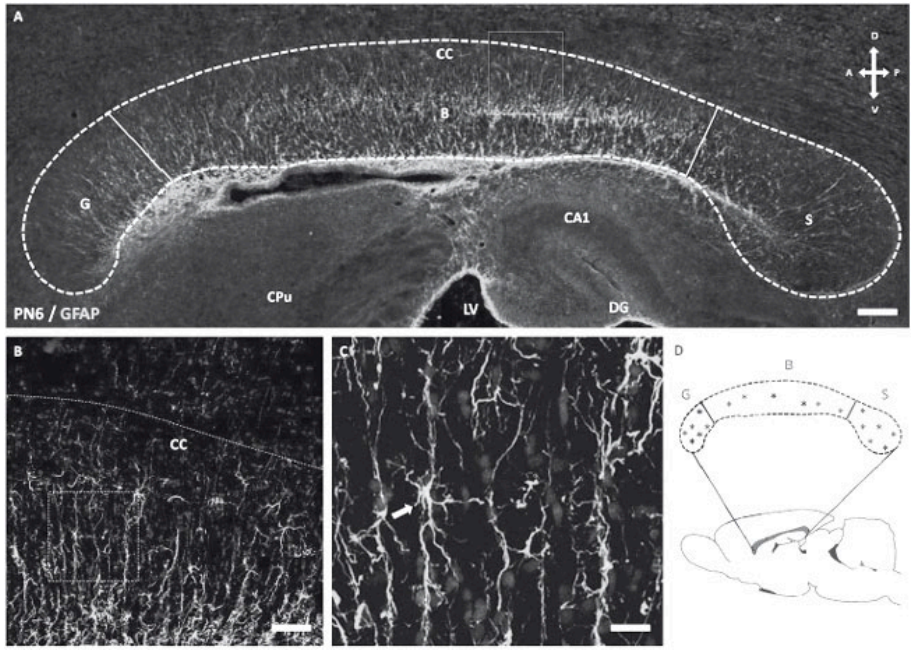
The corpus callosum

Three Major Sections:

1. **Genu**: Connects frontal cortices, primarily orbitofrontal cortex, anterior cingulate and dorsal prefrontal.

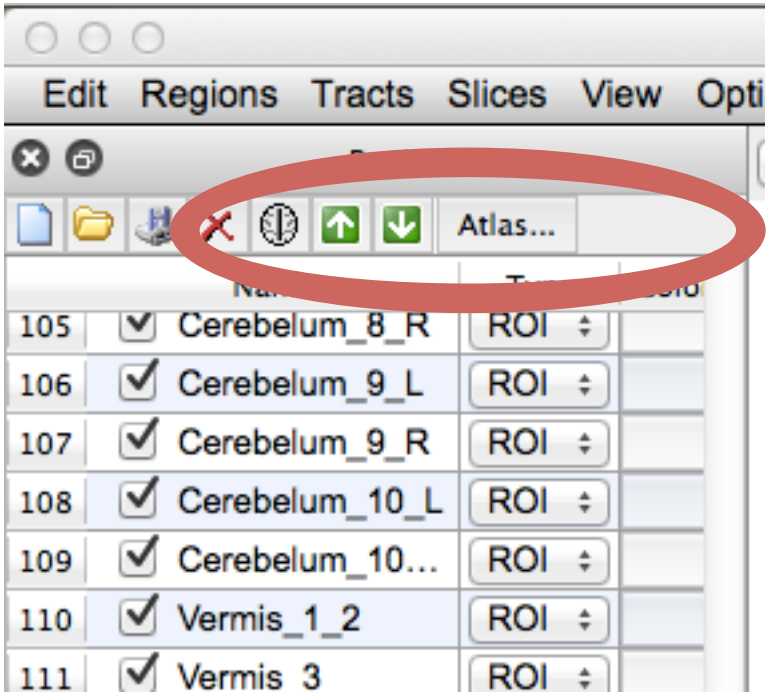
2. **Middle/Body**: Connects caudal frontal, motor and parietal areas.

3. **Splenium**: Connects occipital striate areas.



The value of using a template

DSI-Studio comes with a set of pre-loaded anatomical templates that can be used to optimize your tractography.

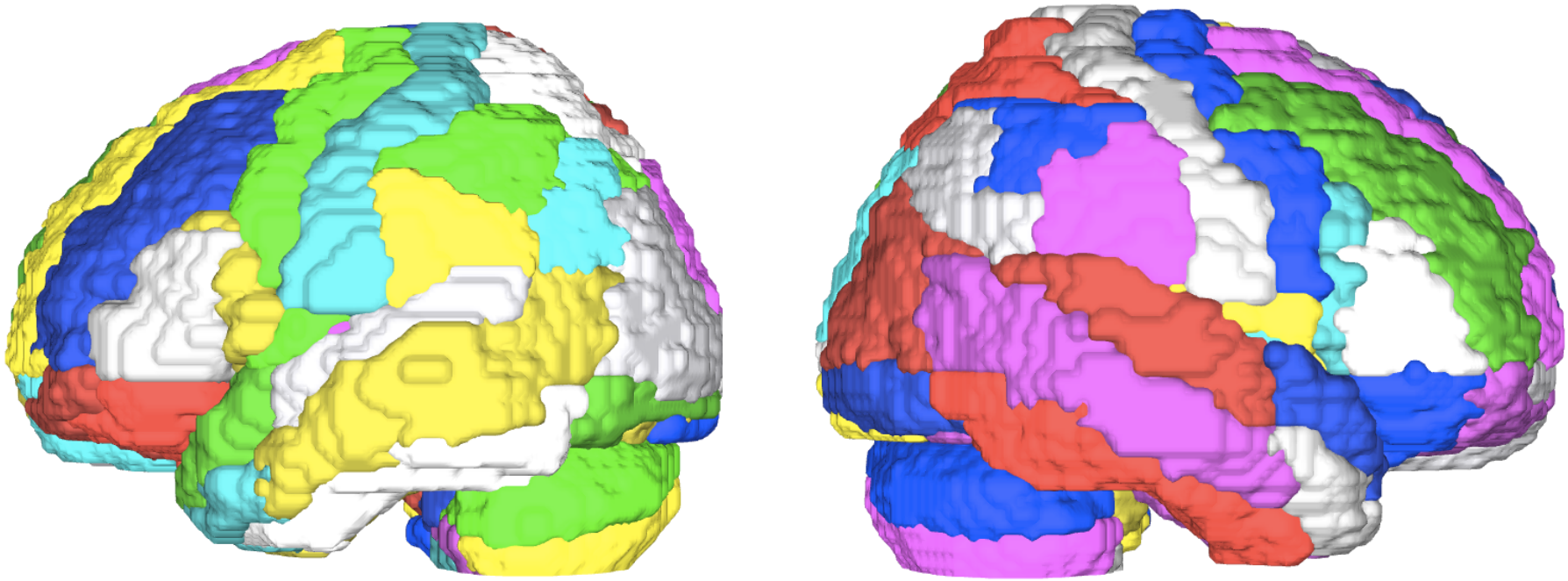


The Automated Anatomical Labeling (AAL) Atlas

An anatomical segmentation of gray matter structures using regional variation in sulcal/ gyral geometry.

N. Tzourio-Mazoyer, B. Landeau, D. Papathanassiou, F. Crivello, O. Etard, N. Delcroix, Bernard Mazoyer and M. Joliot (January 2002). "Automated Anatomical Labeling of activations in SPM using a Macroscopic Anatomical Parcellation of the MNI MRI single-subject brain". NeuroImage 15 (1): 273–289

The Automated Anatomical Labeling (AAL) Atlas



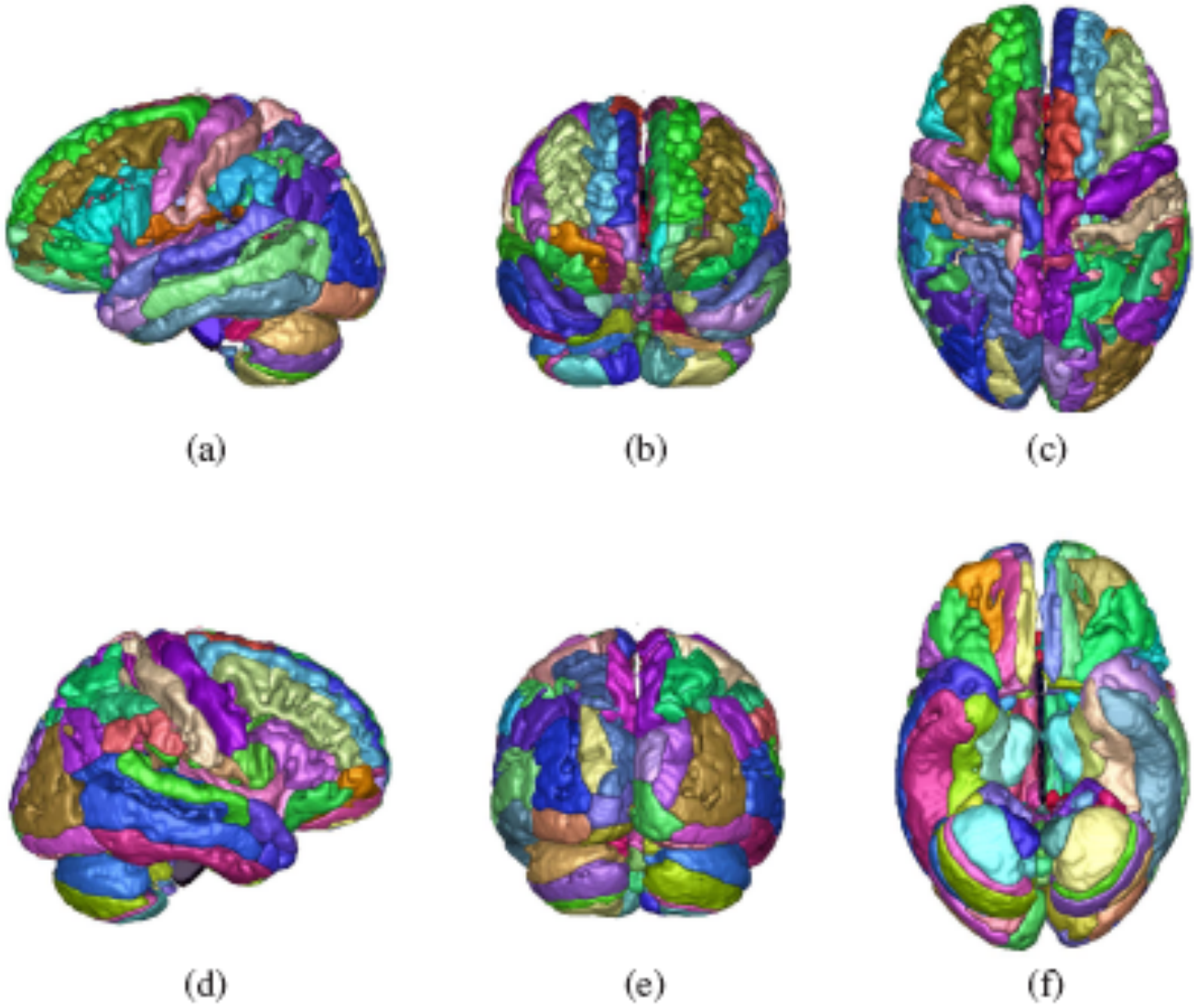
90 cortical & midbrain areas, 27 cerebellar areas

The SRI-24 Atlas

An MRI-based atlas of normal adult human brain anatomy, generated by template-free nonrigid registration from images of 24 normal control subjects.

T. Rohlfing, N. M. Zahr, E. V. Sullivan, and A. Pfefferbaum, "The SRI24 multichannel atlas of normal adult human brain structure," Human Brain Mapping, vol. 31, no. 5, pp. 798-819, 2010.

The SRI-24 Atlas

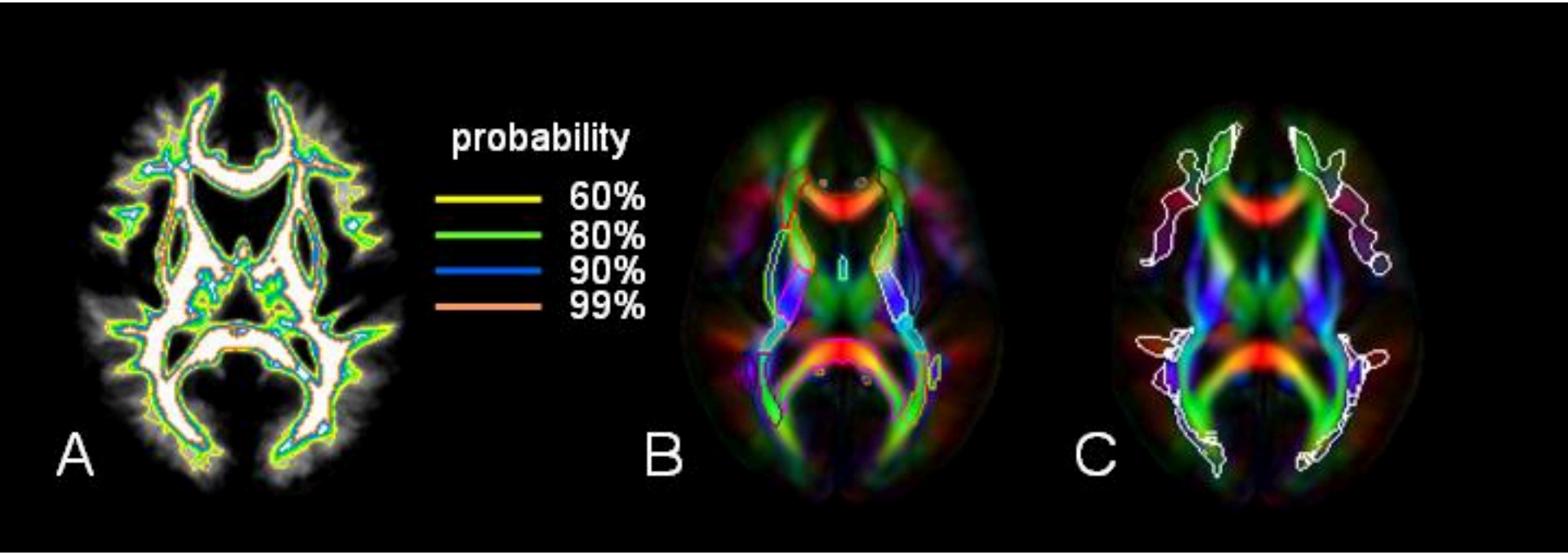


The JHU White Matter Atlas

A DTI-based atlas of the core white matter tracts (hand segmented by a neuroanatomist).

Hua et al., Tract probability maps in stereotaxic spaces: analysis of white matter anatomy and tract-specific quantification. NeuroImage, 39(1):336-347 (2008)

The JHU White Matter Atlas



Tractography Test 1

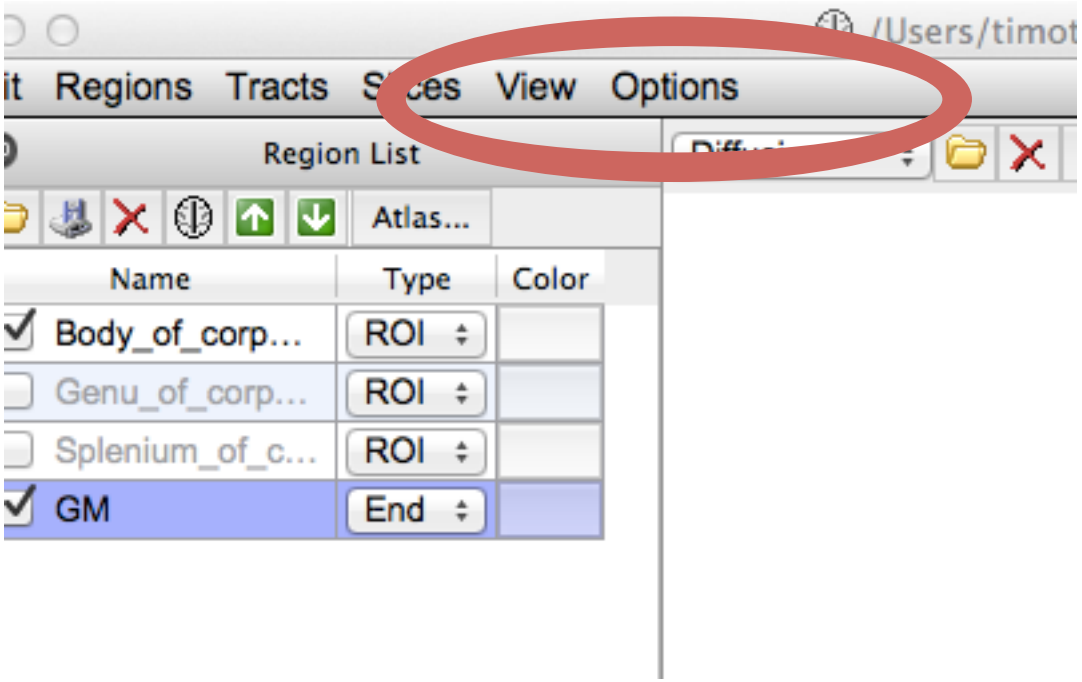
Use the atlases to aid in coverage of corpus callosum fibers

- Corpus callosum masks from JHU atlas as “ROI”
- SRI25 gray matter tissues mask as “END”

Once you've found good tracking parameters

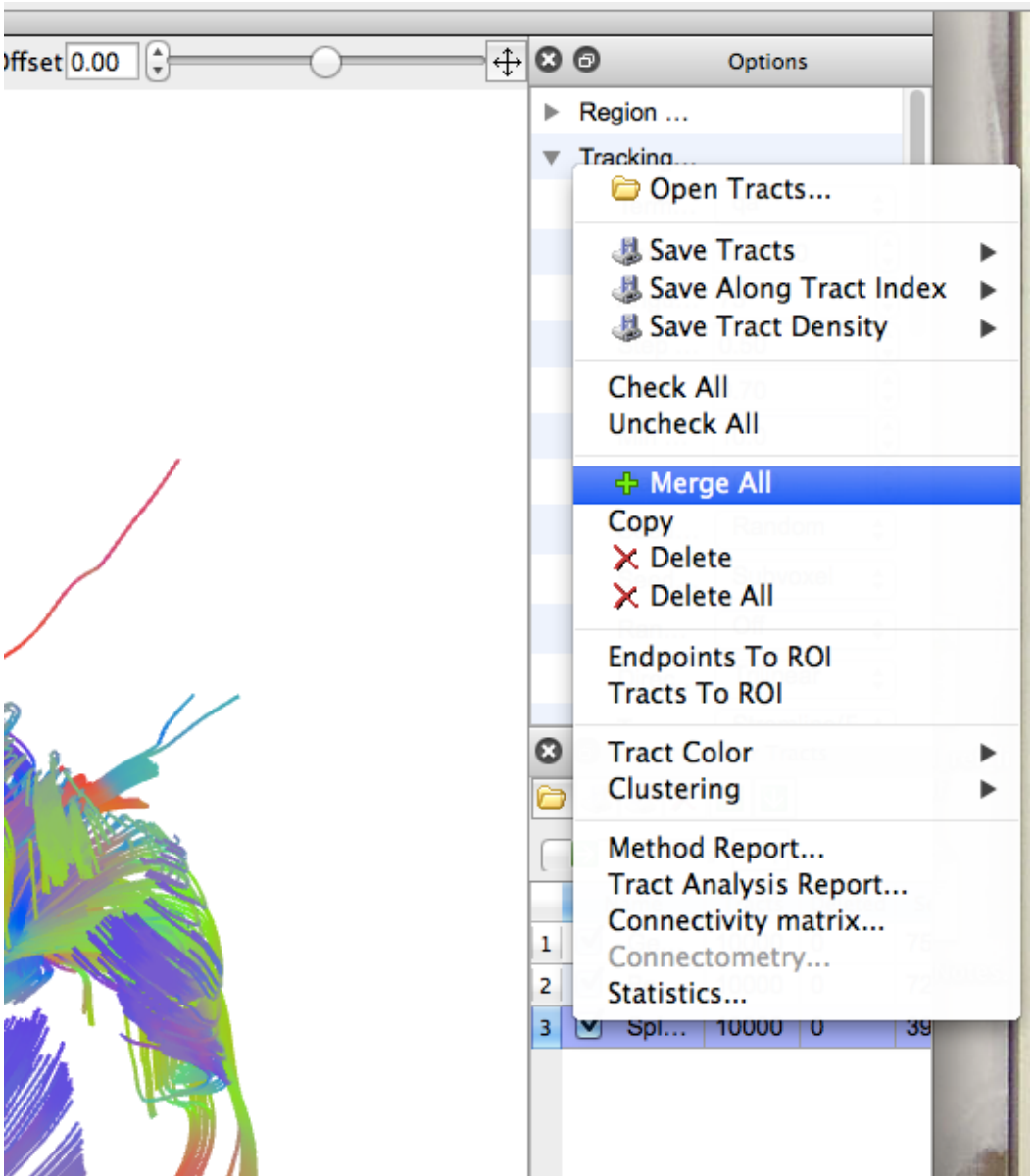
To save good tracking parameters:

Options->Save Tracking Parameters



Tractography Test 2

Merge all three segments you just tracked and calculate the connectivity estimate to the AAL atlas.



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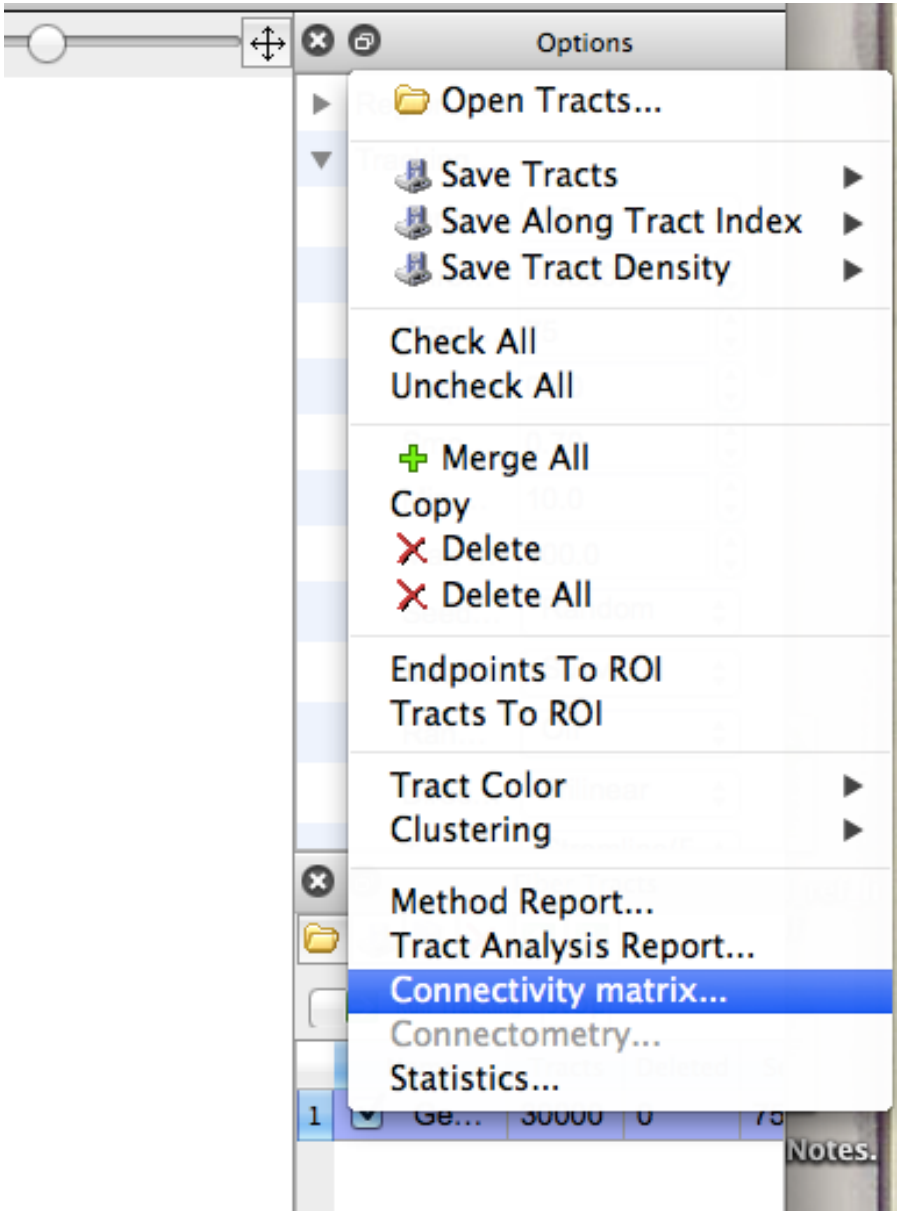

Homework

In a word document, provide a set of images of the 3 segments of the corpus callosum that have 1) the best lateral coverage you can find, 2) streamlines that only end in cortical areas, & 3) have minimal noise. Describe verbally which area each segment connects.

Due at the beginning of class on Tuesday(9/23)