Brief Report on Participation in the Defining White Matter Project

Nagesh Adluru[1], **Veena A. Nair**[1], **Vivek Prabhakaran**[1], **and Andrew L. Alexander**[1]

[1]University of Wisconsin-Madison

Essential details of the approach used in defining and dissecting the fourteen white matter pathways from a given whole brain tractography are presented in this report. The core strategy used is to filter the whole brain tractograms using available atlas regions and slices of the brain, without using any manually traced filter regions. This is to minimize human tracer variability in the dissections. The quality of the dissections are thus solely affected by (1) the quality of the input tractogram(s), (2) quality of atlas registrations and (3) atlas region definitions. The details of the filtering process for each of the fourteen pathways are presented in the following sections in the body. Another key aspect is that the majority of the filter regions are primarily restricted to the gray matter, except for a couple of regions such as the splenium of the corpus callosum and brain stem, and slice/slab filters which include both gray and white matter. Even the slice/slab filters are defined using bounding boxes of relevant atlas regions. This minimizes circular dependencies in dissecting the pathways. This also eliminates the inter-subject variability present in manual tracing of the filter regions. Most of our understanding of these fourteen tracts is based on the information available on the Wikipedia and the definitions presented in (1).

Harvard Oxford cortical and sub cortical atlases, MNI, Talairach, Juelich, JHU white matter atlas, Destrieux gray matter atlas, `Camino/procstreamlines`

Correspondence: ***adluru@wisc.edu***

1. Superior Longitudinal Fasciculus (SLF)

Definition. The superior longitudinal fasciculus is a massive bundle of association fibers that sweeps along the superior margin of the insula in a great arc, gathering and shedding fibers along the way to connect frontal lobe cortex to parietal, temporal, and occipital lobe cortices. The superior longitudinal fasciculus sweeps along the superior margin of the claustrum in a great arc and is the largest association bundle. For dissection we used protocol from, (2) which suggests in humans, the first branch of the superior longitudinal fasciculus (SLF-I) connects the superior parietal lobule and precuneus (BA 5 and 7) with the superior frontal gyrus (BA 8, 9 and 32) and perhaps to some anterior cingulate areas (BA 24). The second branch (SLF-II) originates in the anterior intraparietal sulcus and the angular gyrus (BA 39) and terminates in the posterior regions of the superior and middle frontal gyrus (BA 6, 8, 9). The third branch (SLF-III) connects the intraparietal sulcus and inferior parietal lobule to the inferior frontal gyrus (BA 44, 45, 47) (2, 3).

Dissection.

SLF-I

```
# filter regions
frontal_precuneous_ep=Frontal_Precuneous_EP.nii.gz
left_thalamus=HarvardOxford-sub_Left-
    ↪ Thalamus_dil3.nii.gz
left_putamen=HarvardOxford-sub_Left-
    ↪ Putamen_dil3.nii.gz
brain_stem=HarvardOxford-sub_Brain-
    ↪ Stem_dil3.nii.gz
paracingulate_gyrus=HarvardOxford-
    ↪ cort_Paracingulate-Gyrus_dil4.nii.gz
insular_cortex=HarvardOxford-cort_Insular-
    ↪ Cortex_dil3.nii.gz

# piping tractogram through the filters
cat tracking-deterministic-left.Bfloat |
    ↪ procstreamlines -endpointfile
    ↪ $frontal_precuneous_ep | procstreamlines -
    ↪ exclusionfile $left_thalamus |
    ↪ procstreamlines -exclusionfile
    ↪ $left_putamen | procstreamlines -
    ↪ exclusionfile $brain_stem | procstreamlines
    ↪  -exclusionfile $paracingulate_gyrus |
    ↪ procstreamlines -exclusionfile
    ↪ $insular_cortex -maxtractlength 160 -
    ↪ discardloops > SLF-I.Bfloat
```

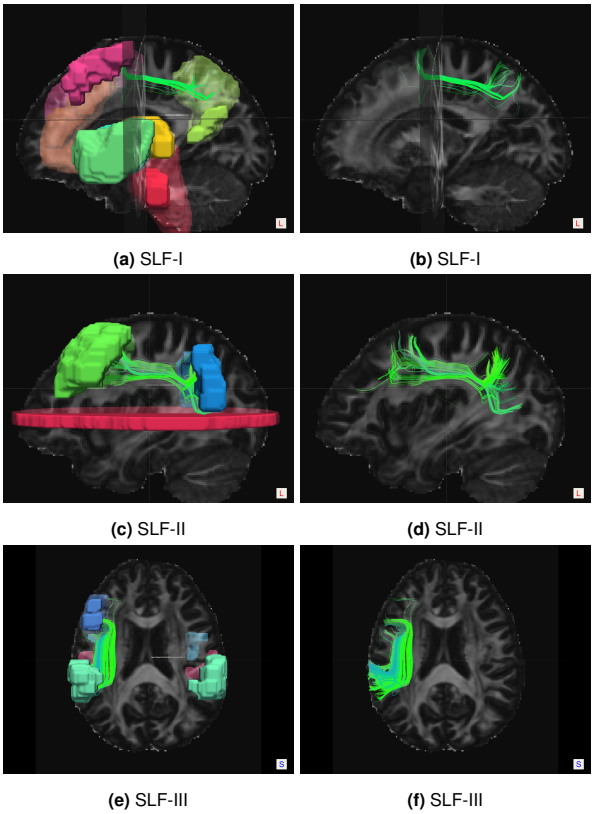
SLF-II

```
# axial filter
bbox=($(fslstats Angular-Gyrus_dil3.nii.gz -w))
slicenum=$(echo ${bbox[4]}-3|bc)
padding=$(echo 181-$slicenum-1-2 | bc)
fslroi {1}/mask-brain.nii.gz {1}/$filterdir/
    ↪ AxialSlab.nii.gz 0 -1 0 -1 $slicenum 3
mrpad AxialSlab.nii.gz -axis 2 $slicenum $padding
    ↪ AxialSlabFilter.nii.gz
fslmaths AxialSlabFilter.nii.gz -dilM -dilM
    ↪ AxialSlabFilter_dil2.nii.gz

# filter regions
angular_gyrus_mfg_ep=Angular_Gyrus_MFG.nii.gz
axialfilter=AxialSlabFilter_dil2.nii.gz

# piping tractography through the filters
cat tracking-deterministic-left.Bfloat |
    ↪ procstreamlines -endpointfile
    ↪ $angular_gyrus_mfg_ep | procstreamlines -
    ↪ exclusionfile $axialfilter -maxtractlength
    ↪ 160 -discardloops > SLF-II.Bfloat
```

SLF-III

```
# filter regions
operctrainsupra_ep=
    ↪ OpercTriang_SupraMarginal_EP.nii.gz
```

```
porale=HarvardOxford-cort_Planum-
    ↪ Polare_dil2.nii.gz
temporale=HarvardOxford-cort_Planum-
    ↪ Temporale_dil2.nii.gz

# filter pipe
cat tracking-deterministic-left.Bfloat |
    ↪ procstreamlines -endpointfile
    ↪ $operctrainsupra_ep | procstreamlines -
    ↪ exclusionfile $porale | procstreamlines -
    ↪ exclusionfile $temporale -maxtractlength
    ↪ 140 -discardloops > $finaltract.Bfloat
```



(a) SLF-I **(b)** SLF-I

(c) SLF-II **(d)** SLF-II

(e) SLF-III **(f)** SLF-III

Fig. 1. Superior Longitudinal Fasciculus. Left column shows the dissection scene with the filter ROIs and the the right column shows the filtered tracts.

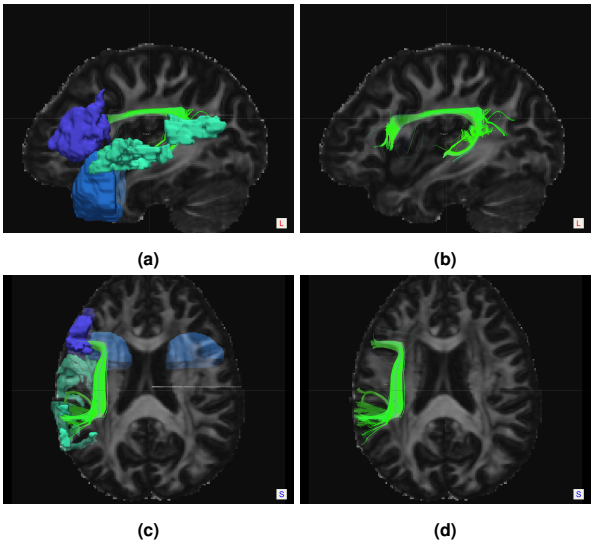
2. Arcuate Fasciculus (AF)

Definition. Our definition is based on the information available in Wikipedia[1]. The arcuate fasciculus connects two important areas for language use, Broca's area in the inferior frontal gyrus and Wernicke's area in the posterior superior temporal gyrus. The arcuate has diffuse termination of the fibers, both rostrally and caudally. While the main caudal source of the fiber tract is the posterior superior temporal cortex, the rostral terminations are mostly in premotor cortex, part of Brodmann area 6(4).

Dissection.

Arcuate Fasciculus

```
# filter regions
ba_brodmann_ep=BA_Brodmann_EP.nii.gz
temporal_pole=HarvardOxford-cort_Temporal-
    ↪ Pole_dil2.nii.gz

# filtering pipe
cat tracking-{deterministic,probabilistic}-
    ↪ left.Bfloat | procstreamlines -endpointfile
    ↪  $ba_brodmann_ep -exclusionfile
    ↪ $temporal_pole -maxtractlength 125 -
    ↪ discardloops > AF.Bfloat
```



(a) **(b)**

(c) **(d)**

Fig. 2. Arcuate Fasciculus. Sagittal and axial views.

3. Optic Radiations (OR)

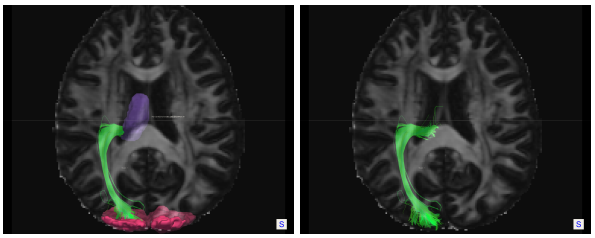
Definition. The optic radiation (a.k.a. geniculocalcarine tract) mingles with the inferior fronto-occipital fasciculus, inferior longitudinal fasciculus, and the inferior aspect of superior longitudinal fasciculus to form much of the sagittal stratum in the occipital lobe. The optic radiation connects the lateral geniculate nucleus to occipital (primary visual) cortex. The more inferior fibers of the optic radiation sweep around the posterior horns of the lateral ventricles and terminate in the calcarine cortex; the more superior fibers take a straighter, more direct path. The optic radiation mingles with the inferior fronto-occipital fasciculus, inferior longitudinal fasciculus, and inferior aspect of the superior longitudinal fasciculus to form much of the sagittal stratum in the occipital lobe (1).

Dissection.

Optic Radiations

```
# filter regions
thalamus_occipital_pole=Thalamus-
    ↪ Occipital_Pole.nii.gz

# filtering
cat tracking-{deterministic,probabilistic}-
    ↪ left.Bfloat | procstreamlines -endpointfile
    ↪  $thalamus_occipital_pole -maxtractlength
    ↪ 135 -discardloops > OR.Bfloat
```

[1] https://en.wikipedia.org/wiki/Arcuate_fasciculus



(a) (b)

Fig. 3. Optic Radiations.

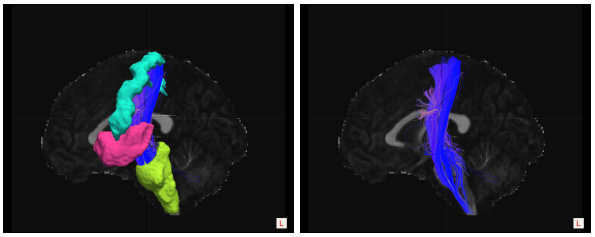
4. Corticospinal Tract (CST)

Definition. Corticospinal fibers originating along the motor cortex converge through the corona radiata and posterior limb of the internal capsule on their way to the lateral funiculus of the spinal cord. The corticospinal and corticobulbar tracts are major efferent projection fibers that connect motor cortex to the brain stem and spinal cord. Corticospinal fibers converge into the corona radiata and continue through the posterior limb of the internal capsule to the cerebral peduncle on their way to the lateral funiculus (1).

Dissection.

Cortico-Spinal Tract

```
# filters
brainstem_precentralgyrus=Brain_Stem-Precentral_Gyrus.nii.gz
insularcortex=HarvardOxford-cort_Insular-Cortex.nii.gz

# pipe
cat tracking-{deterministic,probabilistic}-left.Bfloat | procstreamlines -endpointfile $brainstem_precentralgyrus -exclusionfile $insularcortex -discardloops > CST.Bfloat
```



(a) (b)

Fig. 4. Cortico-Spinal Tract.

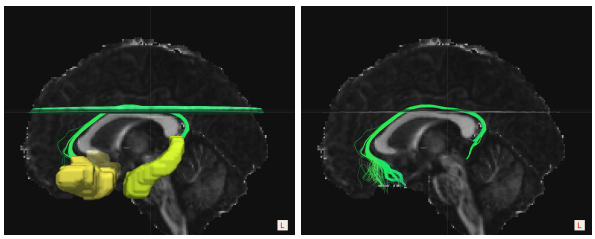
5. Cingulum Bundle (CB)

Definition. The cingulum begins in the parolfactory area of the cortex below the rostrum of the corpus callosum, then courses within the cingulate gyrus, and, arching around the entire corpus callosum, extends forward into the parahippocampal gyrus and uncus. It interconnects portions of the frontal, parietal, and temporal lobes. Its arching course over the corpus callosum resembles the palm of an open hand with fingertips wrapping beneath the rostrum of the corpus callosum. The paired cingulum bundle is obtained just cephalad to the corpus callosum (1).

Dissection.

Cingulum Bundle

```
# axial filter
bbox=($(fslstats JHU_*Body* -w))
slicenum=$(echo ${bbox[4]}+${bbox[5]/2}|bc)
padding=$(echo 181-$slicenum-1-2 | bc)
fslroi mask-brain.nii.gz AxialSlab.nii.gz 0 -1 0 -1 $slicenum 3
mrpad AxialSlab.nii.gz -axis 2 $slicenum $padding AxialSlabFilter.nii.gz
fslmaths AxialSlabFilter.nii.gz -dilM -dilM AxialSlabFilter_dil2.nii.gz

# filter regions
frontal_orb_cortex_hippo=Frontal_Orb_Cortex_Hippo.nii.gz
axialfilter=AxialSlabFilter.nii.gz

# filtering
cat tracking-{deterministic,probabilistic}-left.Bfloat | procstreamlines -endpointfile $frontal_orb_cortex_hippo | procstreamlines -waypointfile $axialfilter -maxtractlength 155 -discardloops > CB.Bfloat
```



(a) (b)

Fig. 5. Cingulum Bundle.

6. Uncinate Fasciculus (UF)

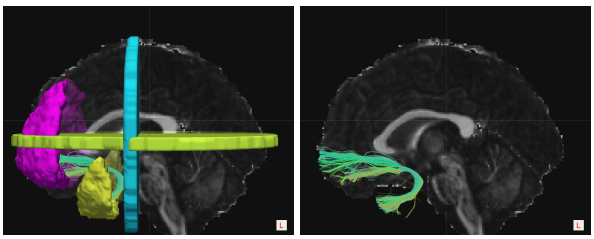
Definition. Uncinate is from the Latin uncus meaning "hook". The uncinate fasciculus hooks around the lateral fissure to con- nect the orbital and inferior frontal gyri of the frontal lobe to the anterior temporal lobe. The anterior aspect of this relatively short tract parallels, and lies just inferomedial to, the inferior occipitofrontal fasciculus. Its midportion actually adjoins the middle part of the inferior fronto-occipital fasciculus before heading inferolaterally into the anterior temporal lobe (1).

Dissection.

Uncinate Fasciculus

```
# axial filter
bbox=($(fslstats *Brain-Stem* -w))
slicenum=$(echo ${bbox[4]}+${bbox[5]}+5|bc)
padding=$(echo 181-$slicenum-1-2 | bc)

fslroi mask-brain.nii.gz AxialSlab.nii.gz 0 -1 0 -1 $slicenum 3
mrpad AxialSlab.nii.gz -axis 2 $slicenum $padding AxialSlabFilter.nii.gz
```

```
fslmaths AxialSlabFilter.nii.gz -dilM -dilM
    ↪ AxialSlabFilter_dil2.nii.gz

# coronal filter
bbox=($(fslstats Left-Amygdala* -w))
slicenum=$(echo ${bbox[2]}+3|bc)
padding=$(echo 218-$slicenum-1-2 | bc)
fslroi mask-brain.nii.gz CoronalSlab.nii.gz 0 -1
    ↪ $slicenum 3 0 -1
mrpad CoronalSlab.nii.gz -axis 1 $slicenum
    ↪ $padding CoronalSlabFilter.nii.gz
fslmaths CoronalSlabFilter.nii.gz -dilM -dilM
    ↪ CoronalSlabFilter_dil2.nii.gz

# filters
frontal_temporal_ep=
    ↪ Frontal_Temporal_Pole_EP.nii.gz
axialfilter=AxialSlabFilter_dil2.nii.gz
coronalfilter=CoronalSlabFilter_dil2.nii.gz

# pipe
cat tracking-{deterministic,probabilistic}-
    ↪ left.Bfloat | procstreamlines -endpointfile
    ↪  $frontal_temporal_ep | procstreamlines -
    ↪ exclusionfile $axialfilter |
    ↪ procstreamlines -exclusionfile
    ↪ $coronalfilter -discardloops > UF.Bfloat
```



(a) (b)

Fig. 6. Uncinate Fasciculus.

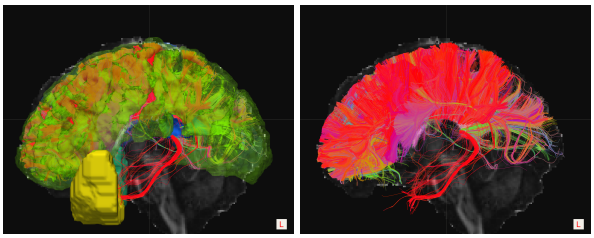
7. Corpus Callosum (CC)

Definition. The corpus callosum is "sandwiched" between the cingulum superomedially and the superior occipito-frontal fasciculus inferolaterally. By far the largest white matter fiber bundle, the corpus callosum is a massive accumulation of fibers connecting corresponding areas of cortex between the hemispheres. Fibers traversing the callosal body are transversely oriented, whereas those traversing the genu and splenium arch anteriorly and posteriorly to reach the anterior and posterior poles of the hemispheres. Near the mid-sagittal plane, all of the corpus callosum fibers are left-right oriented. However, as they radiate toward the cortex, callosal fibers interdigitate with association and projection fibers; resolving these fiber crossings with DTI is a difficult problem and the subject of intensive research (1).

Dissection.

Corpus Callosum

```
# cc sans tapetum
frontal_parietal_occipital_ep=
    ↪ Frontal_Parietal_Occipital_EP.nii.gz
cat tracking-{deterministic,probabilistic}-
    ↪ comm.Bfloat | procstreamlines -endpointfile
    ↪  $frontal_parietal_occipital_ep -
    ↪ maxtractlength 150 -discardloops >
    ↪ CCSansTapetum.Bfloat

# cc tapetum
splenium=JHU_Splenium-of-corpus-
    ↪ callosum_dil3.nii.gz
temporal_pole_ep=$filterdir/
    ↪ Temporal_Pole_EP.nii.gz
cat tracking-{deterministic,probabilistic}-
    ↪ comm.Bfloat | procstreamlines -waypointfile
    ↪  $splenium -endpointfile $temporal_pole_ep
    ↪ -discardloops > Tapetum.Bfloat

# cc
cat CCSanSTapetum.Bfloat Tapetum.Bfloat |
    ↪ procstreamlines -header $fa -discardloops >
    ↪  CC.Bfloat
```



(a) (b)

Fig. 7. Corpus Callosum.

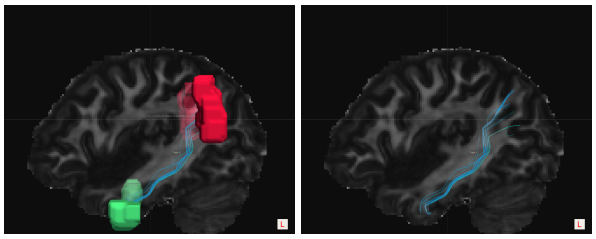
8. Middle Longitudinal Fasciculus (MLF)

Definition. The middle longitudinal fasciculus (MLF) connects the angular gyrus [AG, Brodmann's area (BA) 39] with the superior temporal gyrus (STG, BA 22) up to the temporal pole (BA 38) and courses in the white matter within the STG. Several fascicles are in proximity to the MLF. The MLF is localized medial and ventral with respect to the superior longitudinal fascicle segment II (SLF-II) and arcuate fascicle (AF) (5–7). The MdLF is located lateral and superior from the inferior fronto-occipital fascicle (IFOF). Posterior the MLF and IFOF are closely-related though well differentiated in parallel at the sagittal stratum and anterior the MLF and IFOF are separated by the temporal ramus of the sylvian fissure and the cortex of the insula and the STG. The MLF is located dorsal in relation to the inferior longitudinal fascicle (ILF) (7).

Dissection.

Middle Longitudinal Fasciculus

```
# filters
angular_temporal_ep=Angular_Temporal_EP.nii.gz

# pipe
cat tracking-{deterministic,probabilistic}-
    ↪ left.Bfloat | procstreamlines -endpointfile
    ↪  $angular_temporal_ep -discardloops >
    ↪ MLF.Bfloat
```



(a) (b)

Fig. 8. Middle Longitudinal Fasciculus.

9. Inferior Fronto-occipital Fasciculus (IFOF)

Definition. The inferior fronto-occipital fasciculus (IFOF) connects the occipital and frontal lobes. It extends along the inferolateral edge of the claustrum, below the insula. Posteriorly, the IFOF joins the inferior longitudinal fasciculus, the descending portion of the superior longitudinal fasciculus, and portions of the geniculocalcarine tract to form most of the sagittal stratum, a large and complex bundle that connects the occipital lobe to the rest of the brain. It lies along the inferolateral edge of the claustrum. The IFOF lies in a roughly axial plane and it connects frontal and occipital lobes at the level of the midbrain. Posteriorly, the IFOF mingles with the inferior longitudinal fasciculus, optic radiations, superior longitudinal fasciculus, and other fibers to form the sagittal stratum a vast and complex bundle that connects the occipital lobeto the rest of the brain. The middle portion of the IFOF is bundled together with the middle portion of the uncinate fasciculus (1).
Dissection.

Inferior Fronto-Occipital Fasciculus

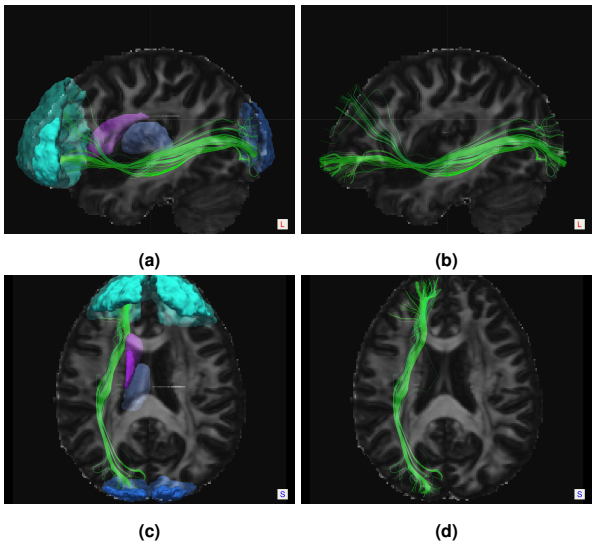
```
# filters
frontal_occipital_pole=Frontal_Pole-
    ↪ Occipital_Pole.nii.gz
caudate=HarvardOxford-sub_Left-Caudate.nii.gz
thalamus=HarvardOxford-sub_Left-Thalamus.nii.gz

# pipe
cat tracking-{deterministic,probabilistic}-
    ↪ left.Bfloat | procstreamlines -endpointfile
    ↪  $frontal_occipital_pole -exclusionfile
    ↪ $caudate | procstreamlines -exclusionfile
    ↪ $thalamus -discardloops > IFOF.Bfloat
```

10. Inferior Longitudinal Fasciculus (ILF)

Definition. The inferior longitudinal fasciculus connects temporal and occipital lobe cortices. This tract traverses the length of the temporal lobe and joins with the inferior fronto-occipital fasciculus, the inferior aspect of the superior longitudinal fasciculus, and the optic radiations to form much of the sagittal stratum traversing the occipital lobe (1).
Dissection.

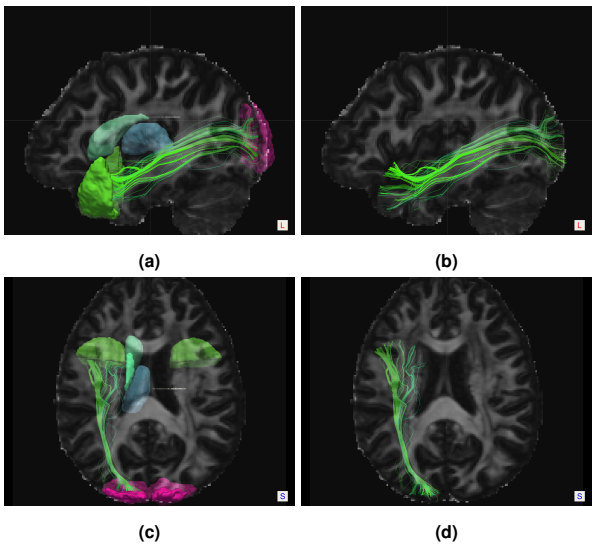
Inferior Longitudinal Fasciculus

```
temporal_occipital_pole=Temporal_Pole-
    ↪ Occipital_Pole.nii.gz
caudate=HarvardOxford-sub_Left-Caudate.nii.gz
thalamus=HarvardOxford-sub_Left-Thalamus.nii.gz

cat tracking-{deterministic-probabilistic}-
    ↪ left.Bfloat | procstreamlines -endpointfile
    ↪  $temporal_occipital_pole -exclusionfile
    ↪ $caudate | procstreamlines -exclusionfile
    ↪ $thalamus -discardloops > ILF.Bfloat
```



(a) (b) (c) (d)

Fig. 9. Inferior Fronto-Occipital Fasciculus.



(a) (b) (c) (d)

Fig. 10. Inferior Longitudinal Fasciculus.

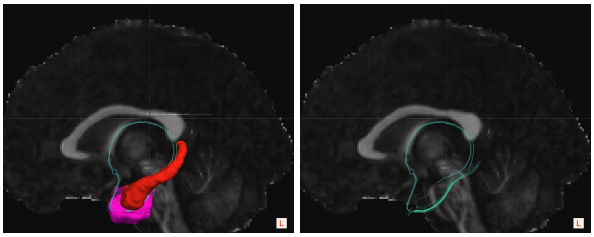
11. Fornix

Definition. We used the definition from Wikipedia[2]. The fornix is a C-shaped bundle of nerve fibers in the brain that acts as the major output tract of the hippocampus.
Dissection.

Fornix

[2] https://en.wikipedia.org/wiki/Fornix_(neuroanatomy)

```
# filters
parahippant_hipp=Parahipp_Anterior-
    ↪ Hippocampus.nii.gz

# pipe
cat tracking-{deterministic,probabilistic}-
    ↪ left.Bfloat | procstreamlines -endpointfile
    ↪  $parahippant_hipp -maxtractlength 135 -
    ↪ discardloops > Fornix.Bfloat
```



(a) (b)

Fig. 11. Fornix.

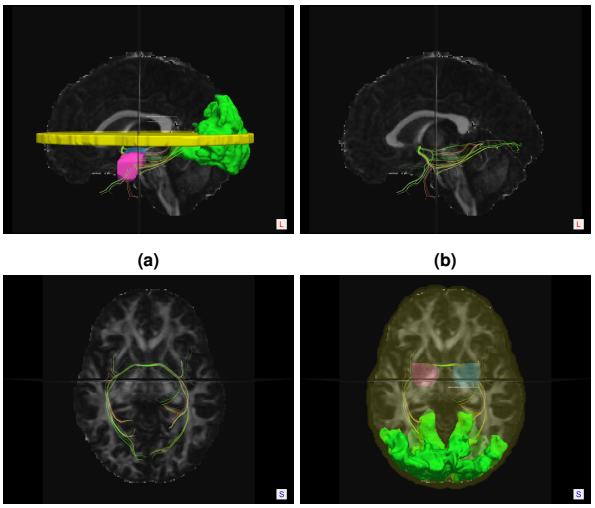
12. Anterior Commissure (AC)

Definition. Like the corpus callosum, the commissural fibers of the anterior commissure (AC) are left-right oriented toward the midline. The anterior commissure crosses through the lamina terminalis. Its anterior fibers connect the olfactory bulbs and nuclei and its posterior fibers connect middle and inferior temporal gyri (1).

Dissection.

Anterior Commissure

```
# axial slab filter
bbox=($(fslstats Temporal-Pole_dil3.nii.gz -w))
slicenum=$(echo ${bbox[4]}+${bbox[5]}+1|bc)
padding=$(echo 181-$slicenum-1-2 | bc)
fslroi mask-brain.nii.gz AxialSlab.nii.gz 0 -1 0 -
    ↪ 1 $slicenum 3;
mrpad AxialSlab.nii.gz -axis 2 $slicenum $padding
    ↪ AxialSlabFilter.nii.gz
fslmaths AxialSlabFilter.nii.gz -dilM -dilM
    ↪ AxialSlabFilter_dil2.nii.gz

# atlas filters
leftamyg=HarvardOxford-sub_Left-
    ↪ Amygdala_dil3.nii.gz
rightamyg=HarvardOxford-sub_Right-
    ↪ Amygdala_dil3.nii.gz
occipital_ep=MNI_Occipital-Lobe_EP.nii.gz
axialfilter=AxialSlabFilter_dil2.nii.gz

# pipe
cat tracking-{deterministic,probabilistic}-
    ↪ comm.Bfloat | procstreamlines -waypointfile
    ↪  $leftamyg | procstreamlines -waypointfile
    ↪ $rightamyg | procstreamlines -endpointfile
    ↪ $occipital_ep | procstreamlines -
    ↪ exclusionfile $axialfilter -maxtractlength
    ↪ 200 -discardloops > AC.Bfloat
```



(a) (b) (c) (d)

Fig. 12. Anterior Commissure. Sagittal view on the top row and axial view on the bottom row.

13. Posterior Commissure (PC)

Definition. We relied on the definition and figures shown on Wikipedia[3]. The posterior commissure (also known as the epithalamic commissure) is a rounded band of white fibers crossing the middle line on the dorsal aspect of the rostral end of the cerebral aqueduct.

Dissection.

Posterior Commissure

```
left_thalamus=HarvardOxford-sub_Left-
    ↪ Thalamus_dil3.nii.gz
right_thalamus=HarvardOxford-sub_Right-
    ↪ Thalamus_dil3.nii.gz
brain_stem=HarvardOxford-sub_Brain-
    ↪ Stem_dil1.nii.gz
occipital_pole_ep=HarvardOxford-cort_Occipital-
    ↪ Pole_EP.nii.gz

cat tracking-{deterministic,probabilistic}-
    ↪ comm.Bfloat | procstreamlines -waypointfile
    ↪  $left_thalamus | procstreamlines -
    ↪ waypointfile $right_thalamus |
    ↪ procstreamlines -waypointfile $brain_stem |
    ↪  procstreamlines -endpointfile
    ↪ $occipital_pole_ep -maxtractlength 250 -
    ↪ discardloops > PC.Bfloat
```

14. Parieto-occipital Pontine Tract (POPT)

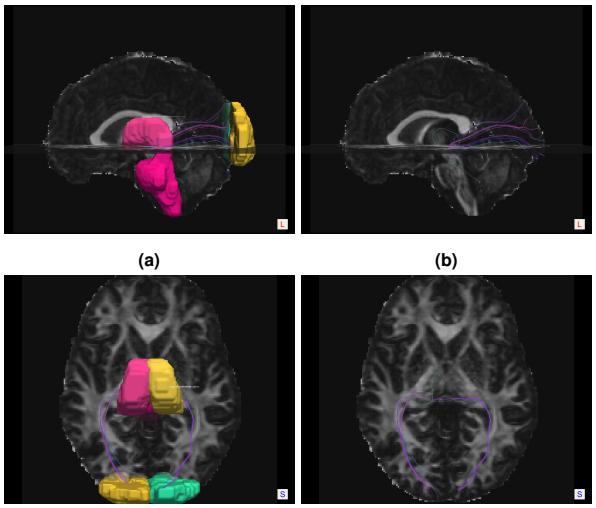
Definition. It was hard to find an exact definition for this one. We used the etymology of the name and defined it as the tract connecting the parietal, occipital cortex and the pontine of the brain stem.

Dissection.

Parieto-Occipital Pontine Tract

```
# coronal slab filter
```

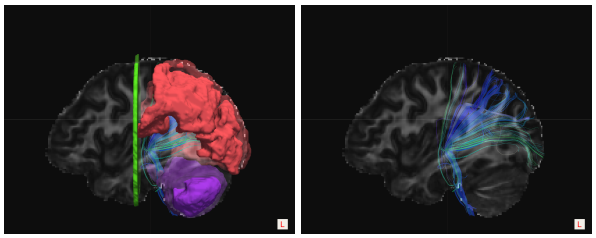
[3] https://en.wikipedia.org/wiki/Posterior_commissure



(a) (b) (c) (d)

Fig. 13. Posterior Commissure.

```
bbox=($(fslstats JHU_Pontine* -w))
slicenum=$(echo ${bbox[2]}+${bbox[3]}+5|bc)
padding=$(echo 218-$slicenum-1-2 | bc)
fslroi mask-brain.nii.gz CoronalSlab.nii.gz 0 -1
    ↪ $slicenum 3 0 -1
mrpad CoronalSlab.nii.gz -axis 1 $slicenum
    ↪ $padding CoronalSlabFilter.nii.gz

# filters
parietal_occipital_ep=MNI_Parietal-Occipital-
    ↪ Lobe_EP.nii.gz
pontine=JHU_Pontine-crossing-tract-a-part-of-
    ↪ MCP.nii.gz
cerebellum=MNI_Cerebellum_ero2.nii.gz
coronalfilter=CoronalSlabFilter.nii.gz

# pipe
cat tracking-{deterministic,probabilistic}-
    ↪ left.Bfloat | procstreamlines -endpointfile
    ↪  $parietal_occipital_ep -waypointfile
    ↪ $pontine | procstreamlines -exclusionfile
    ↪ $cerebellum | procstreamlines -
    ↪ exclusionfile $coronalfilter -discardloops
    ↪ > POPT.Bfloat
```



(a) (b)

Fig. 14. Parieto-Occipital Pontine Tract.

Discussion

The main exercise was in mapping the tract definitions available to us to the filter regions in the publicly available atlases. This was done by loading the deterministic tractogram of `s1` into Trackvis and applying the filters and checking the tract dissections visually. Once this was done on `s1`, the dissections for all the subjects were performed using Camino's `procstreamlines` with deterministic (det), probabilistic (prob) and both (detprob). `procstreamlines` was chosen as our primary tool because of the facility of piping the inputs and outputs which also allows to feed multiple tractograms into the filtering process, the feature of `-endpointfile` which filters tracts joining two regions by clipping the "exiting" tracts. It also has filters such as `-discardloops`. We would like to note that the multiple tractograms need not just be the whole brain ones but also those seeded from waypoint and endpoint regions, for example. The dissections can be modularly improved by refining tractograms, improving the structural to diffusion registration (for example using boundary based registration), and refining definitions of the atlas regions.

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