

Striatum Measurement (Caudate and Putamen)

These instructions assume that the user is familiar with Measure, is using a monitor with correct settings, and is able to locate and open scans.

Files ending with .csd are Coronal SPGR Data files. Files ending with .csh are header files, and contain information about scan acquisition. Refer to the header file (.csh) to get information regarding Field of View, Slice Thickness, and Number of Slices *before* opening the .csd file in Measure.

- \$ Locate the .CSD and .CSH files
- \$ Open the .csh file in Microsoft Word, and verify that:
 - Field of view (FOV) = 240
 - Thickness = 1.5
 - Number of slices = 124 or 128 (*Note*: The header file will report 124 or 128 slices, but when the image is opened in Measure it will usually report 124 slices.)
- \$ To do this, simply click Edit>Find, and type in each variable. Also, check the scan date.
- \$ Open the .csd file in Measure (No image will appear on the screen. You must designate a new measure by selecting File>New Measure.)
- \$ If you are not using a template (for the first time you are doing a measure), click 'No', and then select Occupancy (Paint) Measurement – this allows you to 'paint' on the images. Selecting Occupancy will bring up a dialog box where you enter in the image settings.

Image Settings

Note: If these variables are set incorrectly, Measure will miscalculate the volumes.

- \$ Data Type
 - Type: Signed Word
 - Palette: Gray Scale
 - Header Bytes: 0 (this should be the default entry)
- \$ Image Width
 - Voxels: 256
 - Dimension: 24 *Note*: You must check the FOV in the header file, which should be 240.
- \$ Image Height
 - Voxels: 256
 - Dimension: 24 *Note*: You must check the FOV in the header file, which should be 240.
- \$ Image Depth
 - *Current* tells you what coronal slice you are on (between 1 and 124). Slide the bar to Slice 62 – this is the middle slice where you will set the contrast.
 - *Voxels* tells you the number of total slices. Should be 124 slices.
 - *Dimension* To set the dimension, *multiply the number of slices by the slice thickness*. (e.g., $124 \times 1.5 = 18.6$)
 - *1 Dimension Unit*: Use whatever setting is there. This refers to the magnification, which can be modified after the image is open.

Setting the Contrast

- \$ Remember: The current slice should be 62
- \$ Slide all 3 buttons (Offset, Window, and Middle Gray) to the left
- \$ Move the Offset button to the right until the noise (white dots) disappears and a 'couple' of black dots appear in the brain. Some artifact noise will remain, and this is acceptable.
- \$ Move the Window and Middle Gray buttons all the way to the right.
- \$ Move the Window button to the left until some white spots are seen in the brain, *not* the skull.
- \$ Slide the Middle Gray button all the way to the right.
- \$ Go to the most anterior slice where the caudate and the putamen are separated – usually around Slice 42 – and

move the Middle Gray button to the left until the gray-white contrast ‘looks good.’ To determine what gray-white contrast ‘looks good,’ refer to the reliability brains.

- \$ Select Done.
- \$ Use the + key to enlarge.
- \$ Move cursor to the head of the caudate using right mouse button.
- \$ Select View > Auto Contrast. The program will prompt you to save. Do Not Save just yet.
- \$ The measure settings box will reappear after the computer has calculated middle gray.
- \$ It is permissible to manually adjust middle gray if the auto contrast is too dark.
- \$ In the comments box, type: fov24, date of the scan (not the date of measuring; e.g., 2/25/97), autocontrast set, acpc set.

Scan Orientation

- \$ After setting the contrast (see above) and clicking Done, the scan will take a few seconds to load. Smooth the image by selecting View>Trilinear Zoom.
- \$ You will have 3 views:
 - Coronal view in the upper left box
 - Sagittal view in the upper right box
 - Axial view in the bottom left box
- \$ Check scan orientation by verifying that the subject’s eyes in the axial and sagittal view are ‘looking’ toward the coronal view. If not, then the scan has loaded backwards. To reverse the slices, go to Edit>Measure Settings, select ‘Reverse Slices,’ and click Done.

Tilt Correction

- \$ The scans must be tilt corrected by referring to certain structures in the brain.
- \$ Place cursor on the interhemispheric fissure
- \$ In the midsagittal plane (upper right box), place the cursor on the posterior commissure (PC), which is located at the tip of the superior colliculus. If the crosshair is not aligned with the anterior commissure (AC), located at the tip of the fornix, you will need to rotate the scan in the sagittal plane. To rotate in the sagittal plane, hold down the Control key while clicking on the right mouse button (the cursor must be in the plane in which you wish to rotate). A dialog box will appear that says *Rotating Around Left Axis*. Click on the left or right arrow to tilt the brain by a few degrees or enter a number in the box for larger tilt corrections. Move the brain until the AC (tip of the fornix) and PC (tip of the superior colliculus) are aligned in the sagittal plane. If necessary, realign the scans in the axial and coronal planes. In the axial plane, the crosshair should be in the middle of the eyes. To rotate in the axial plane, simply hold down the Control button while clicking the right mouse button.
- \$ After the tilt correction is complete, save as tilt (e.g., tilt.msr).

Painting the Caudate and the Putamen (Striatum)

- \$ Open the tilt corrected file. Save as caudate or putamen. You will paint both caudates and save as one file, then paint both putamens and save as one file. Later you will split the files into left and right caudate and left and right putamen.
- \$ Always paint the striatum in the axial view (lower left). To view the axial plane full screen, select View > Bottom View.
- \$ Use the up and down arrows on the keyboard to move through the slices to find the point at which the caudate and putamen are separated by the internal capsule. The slice where the AC appears as a white band crossing the hemispheres is a good reference point. Move a few slices up and down to locate a starting point. You will want to use the same starting point for both the caudate and the putamen.
- \$ The caudate is between the internal capsule and the lateral ventricles. The putamen is bordered by the external capsule and the globus pallidus on the sides and the internal capsule at the top. When measuring the putamen it is important to *not* include the globus pallidus.

- \$ After completing the painting in the full screen axial plane, return to the tiled view of the axial, coronal, and sagittal planes. You will need to 'clean up' the painting by referring to the coronal and sagittal views.

Saving the left and right segments

- \$ Finally, you must 'split' both files into left and right segments. Place the crosshair in the middle of the brain so the vertical line splits the left and right hemispheres.
- \$ Select Calculate > Plane Cutaway. In the dialog box select *To the right*, which will leave the paint on the left side. Save – e.g., lcaud.msr (left caudate) or rcaud.msr (right caudate).
- \$ Return to the original, combined measure and repeat for the other hemisphere.
- \$ Repeat for the putamen.
- \$ You should end up with seven Measure files: tilt correct, total caudate, total putamen, left caudate, right caudate, left putamen, and right putamen.

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