

Harmonization of protocols for the manual tracing of the hippocampus - an EADC-ADNI joint effort **AUTHOR-CERTIFIED PROTOCOL FEATURES AND TRACINGS**

Jack CR Jr. MRI-based hippocampal volume measurements in epilepsy.
Epilepsia 1994; 35 Suppl 6:S21-9

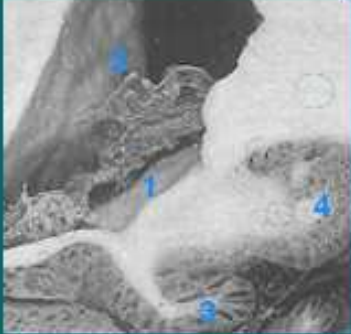

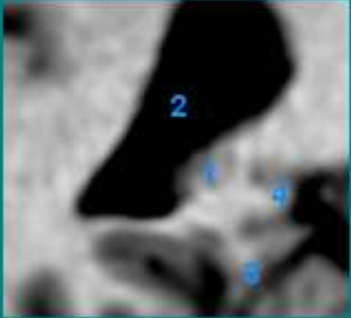
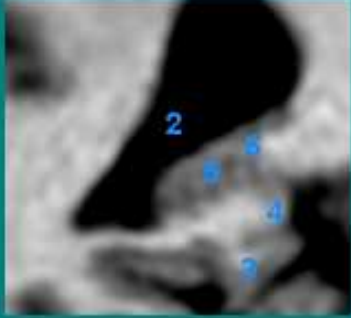
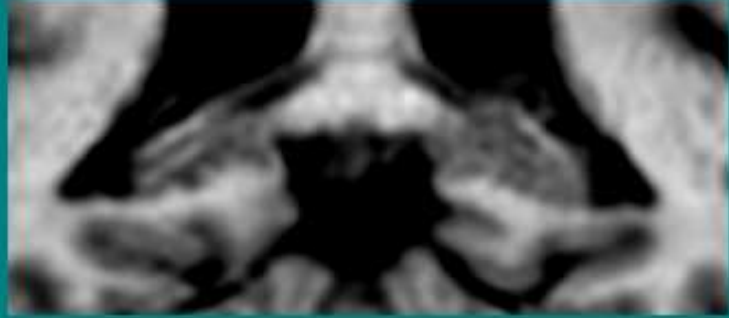
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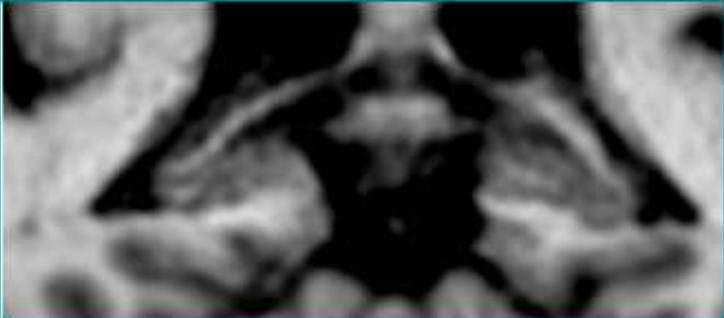
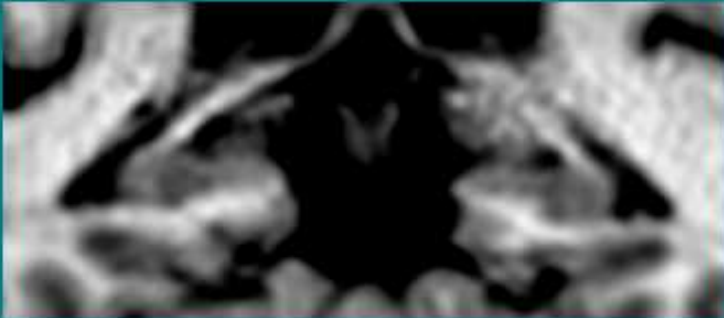
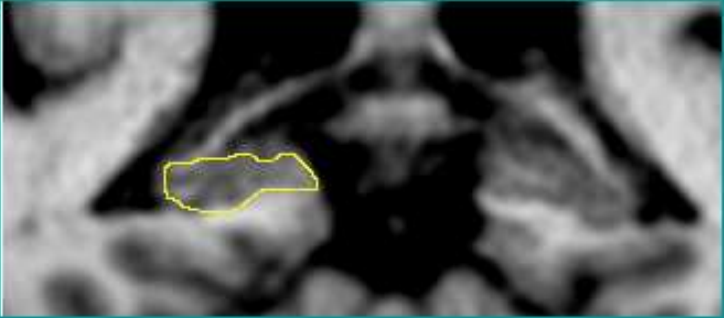
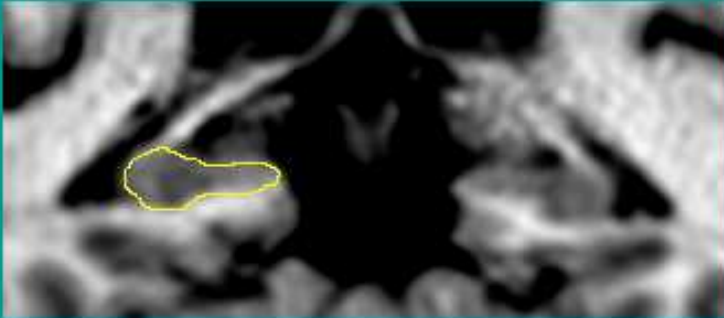
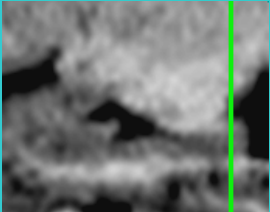
- 1)An excerpt of the Survey of the anatomical landmarks according to Jack et al.'s criteria.
- 2)The hippocampal tracing on consecutive coronal slices of a 1.5T ADNI control subject (**2A**) and AD patient (**2B**).

1) Excerpt of the Survey of the anatomical landmarks according to Jack et al.'s criteria.


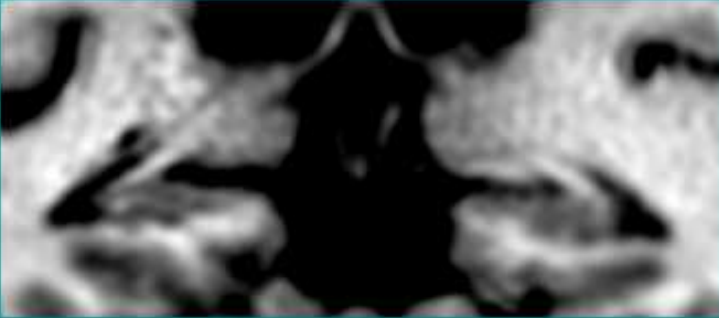
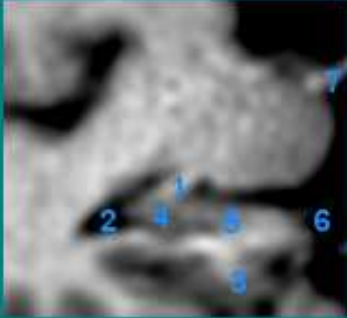
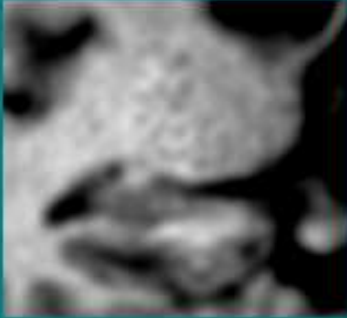
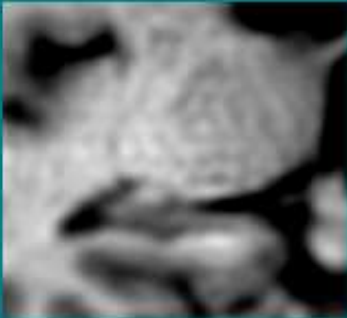
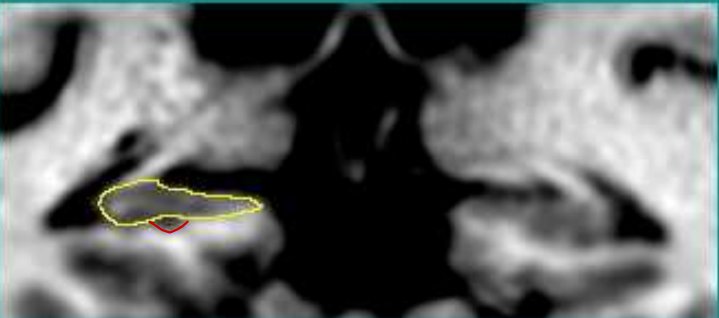
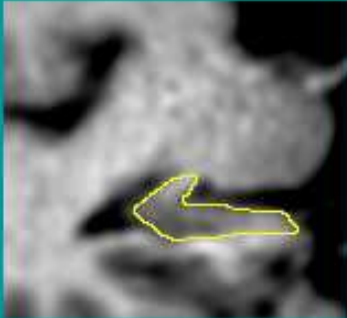
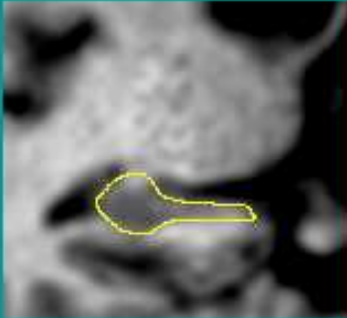
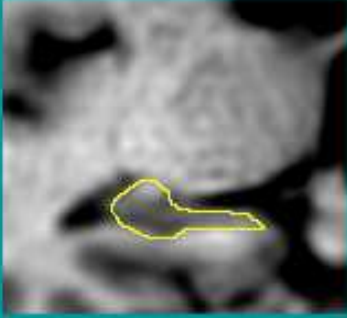
Plane				
Axis of left hippocampus				
Start tracing				
From the tail to the head				
Areas explicitly included	Areas explicitly excluded	Most posterior slice	Most anterior slice	
CA1 through CA4 sectors of the hippocampus proper, dentate gyrus, subiculum, ucal apex (intralimbic gyrus), fimbria, and alveus.	choroid plexus , parahippocampal gyrus	Where the crura of the fornices on both sides are seen in full profile	full anterior extent of hippocampal head	
BORDERS				
	Lateral border	Inferior border	Medial border	Superior border
HEAD	Temporal horn of lateral ventricle (uncal recess)	White matter of the parahippocampal gyrus	CSF in the uncal and ambient cistern	Recognition of the wavelike contour of the pes digitations/alveus/orizontal line connecting the middle of the medial border of the lateral ventricle to the surface of the uncus
BODY	Temporal horn of lateral ventricle (uncal recess)	White matter of the parahippocampal gyrus	CSF in the uncal and ambient cistern)	CSF in the choroidal fissure
TAIL	same as body	same as body	same as body	same as body

2A)CTRL

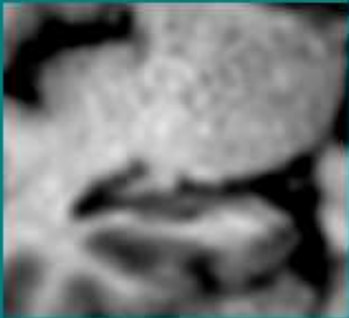


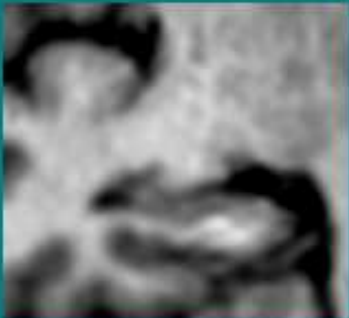
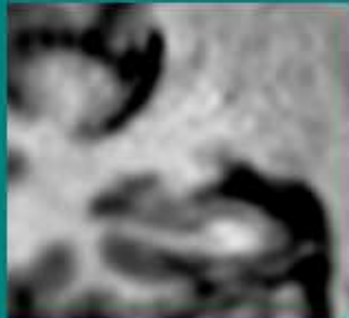
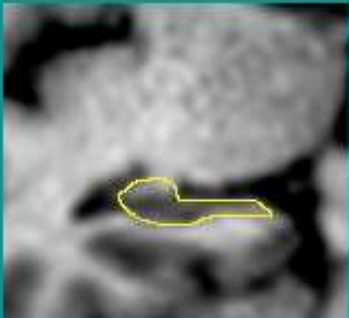
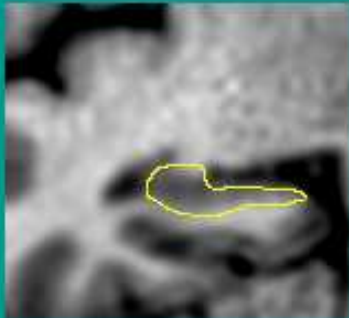
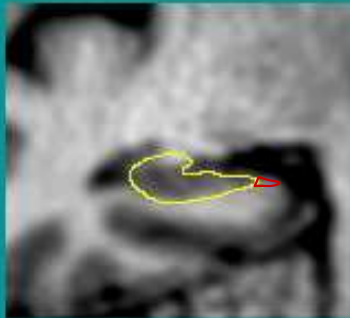
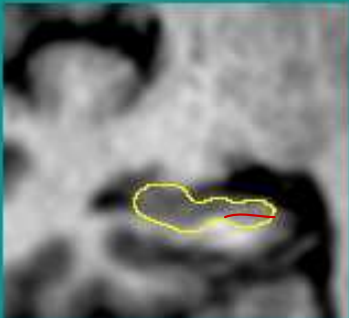
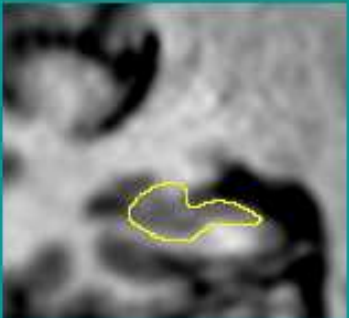
	157	156	155
Anatomical section			
Native MRI			
Tracing			
Notes	1=Hippocampal tail 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Isthmus	2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Isthmus 5=Gyrus dentatus 6=Crus of fornix	

	154	153
Anatomical section		
Native MRI		
Tracing		
Notes	<p>Most posterior slice: Where the crura of the fornices on both sides are seen in full profile</p> <p>More posteriorly, the hippocampus continues below the cingulum, but this portion of the hippocampus is considered a vestigial structure</p> <div><p>Sagittal view</p></div>	


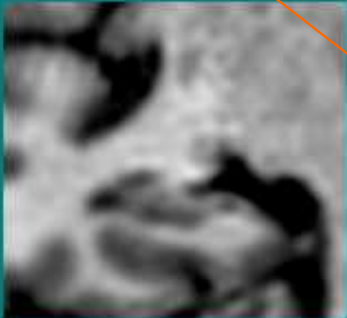
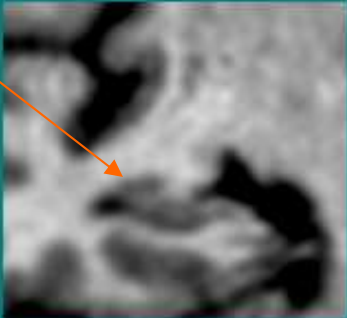
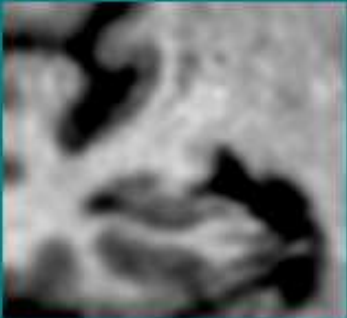
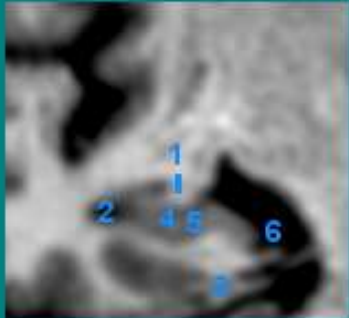
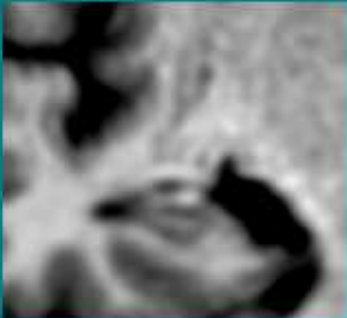
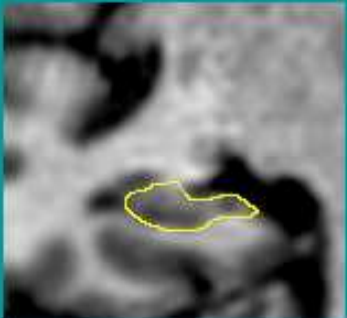
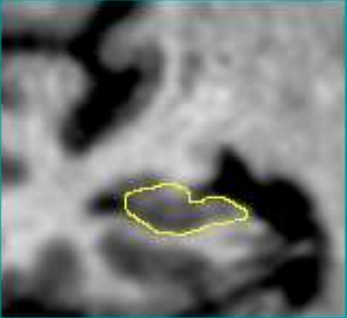
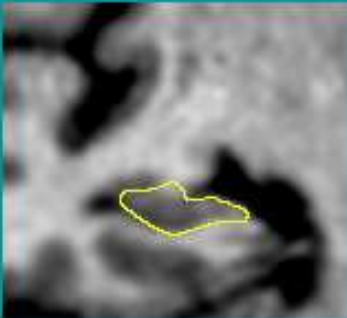
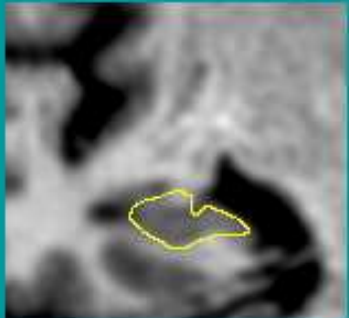
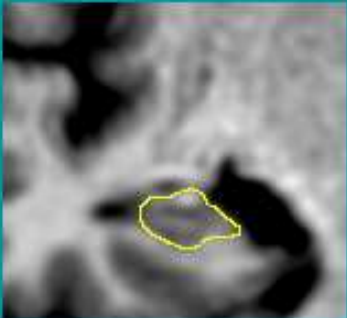
2A)CTRL

	152	151	150	149
Anatomical section				
Native MRI				
Tracing				
Notes		<p>1=Fimbria 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Gyrus dentatus 5=Subiculum 6=Ambient cistern 7=Crus of fornix</p>		

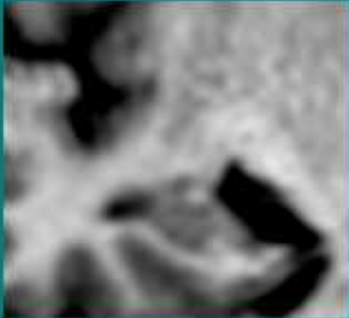
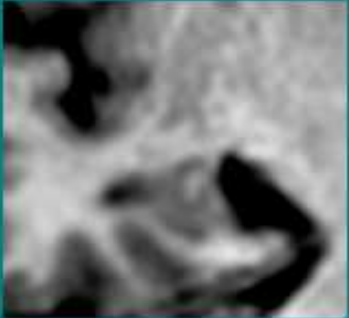
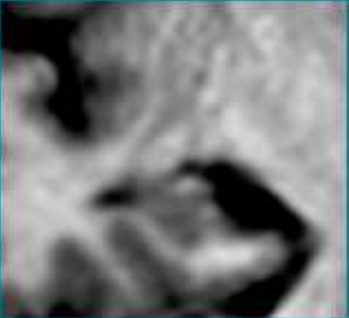
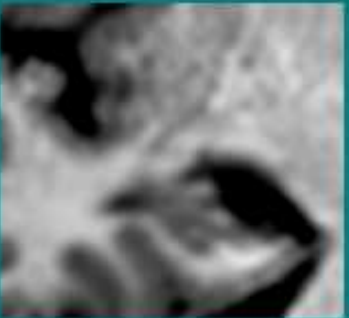
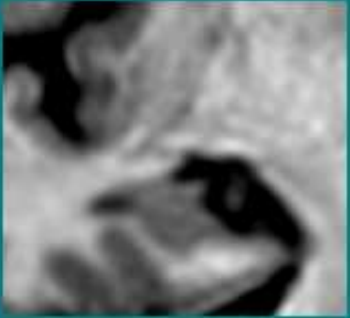
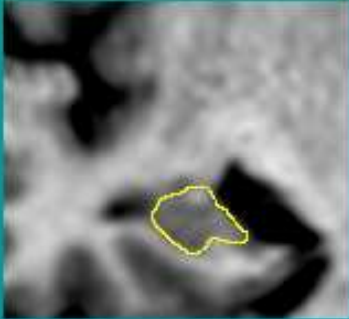
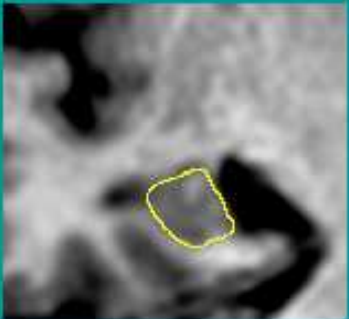
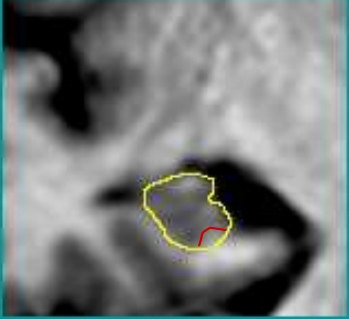
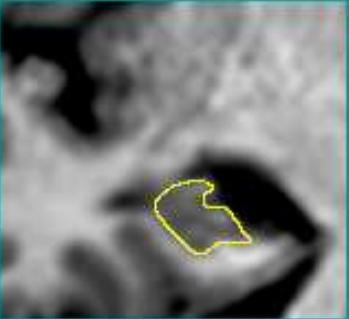
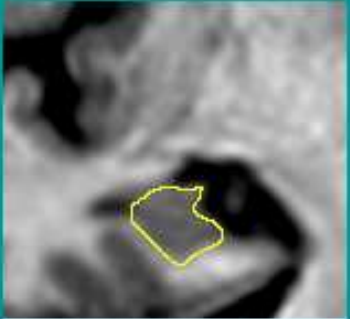
2A)CTRL

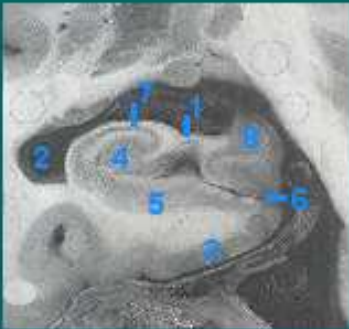
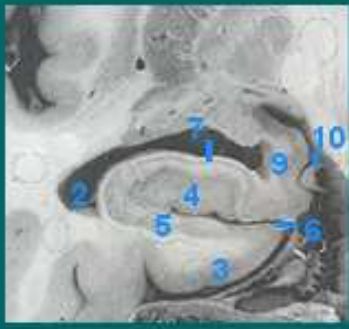
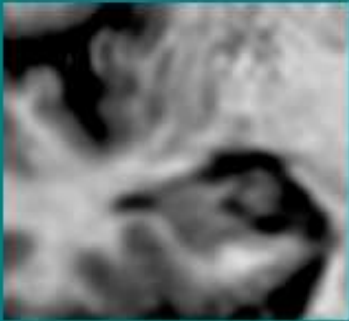
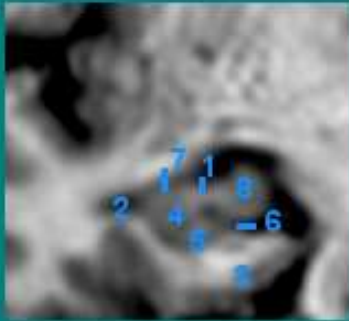
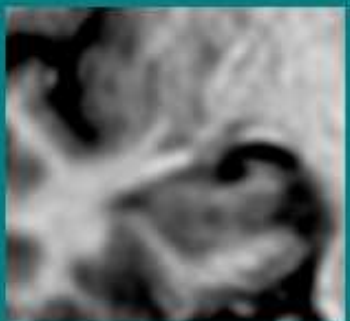
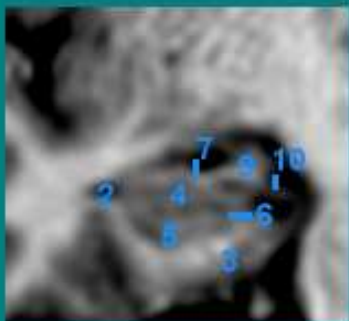
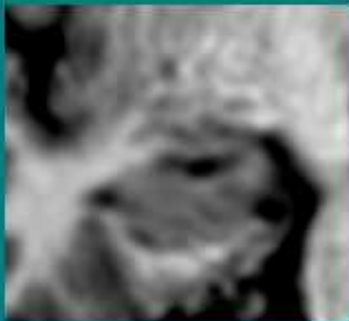
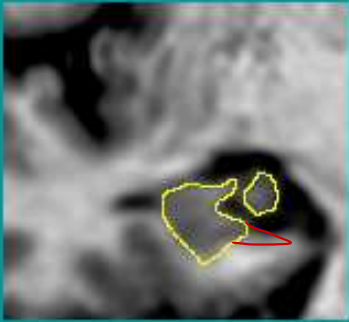
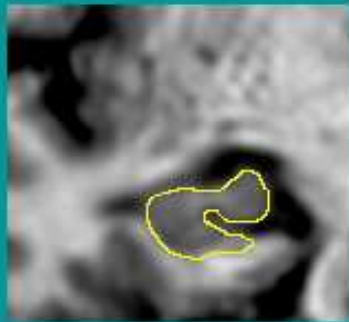
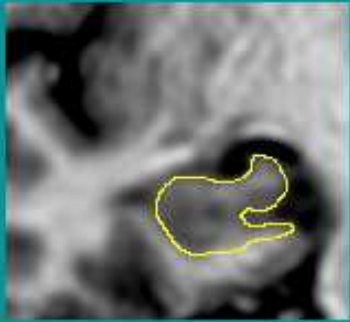
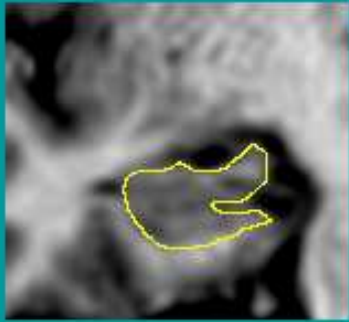
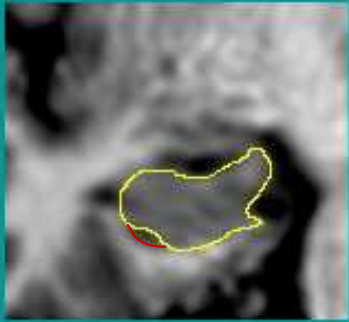
	148	147	146	145	144
Anatomical section					
Native MRI					
Tracing					
Notes					

2A)CTRL


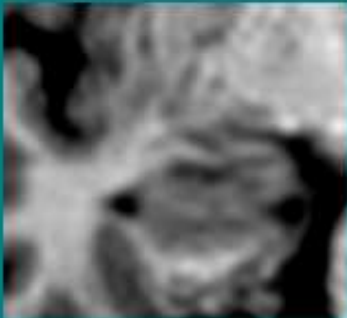
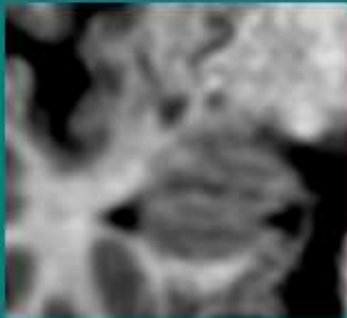
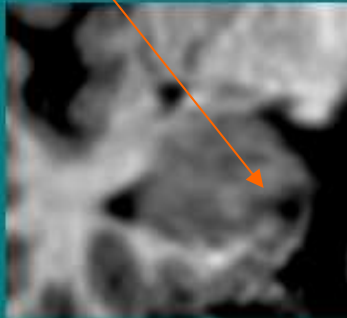
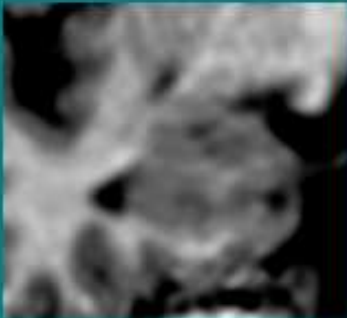
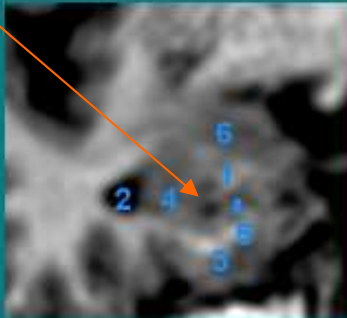
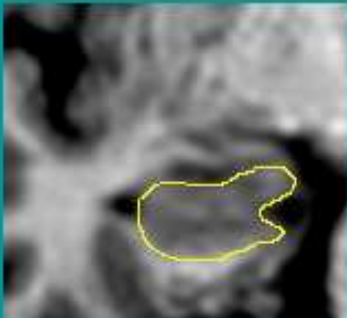
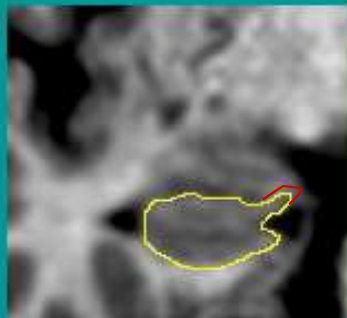
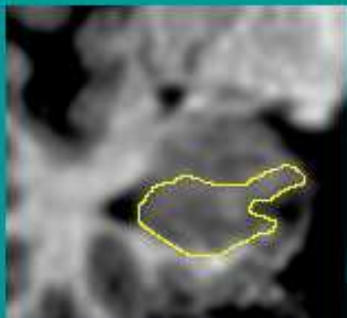
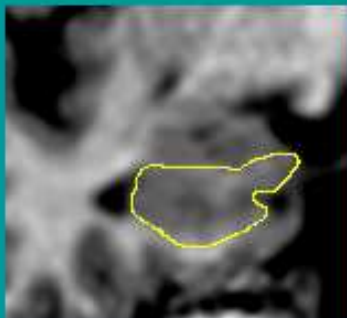
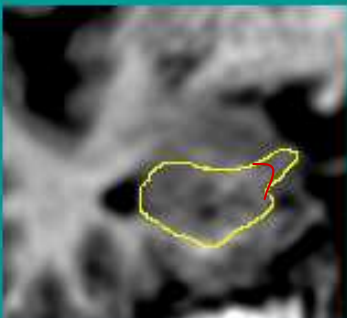
	143	142	141	140	139
Anatomical section					
Native MRI					
Tracing					
Notes	The choroid plexus (not included in the tracing) appears less dense than the hippocampus and similar to an inflorescence. It is located above the hippocampus and laterally. If we find the CP above the hippocampus we can use the alveus or fimbria as a superior border			1=Fimbria 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Gyrus dentatus 5=Subiculum 6=Ambient cistern	

2A)CTRL

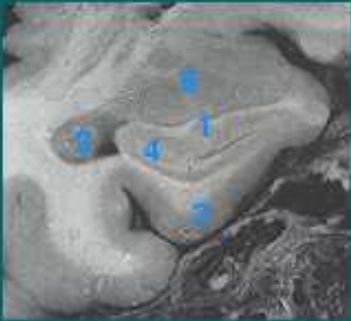
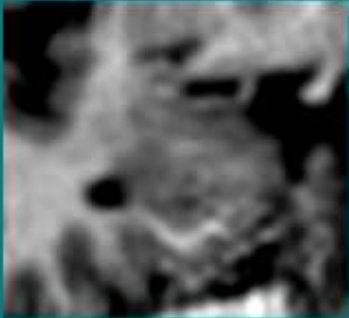
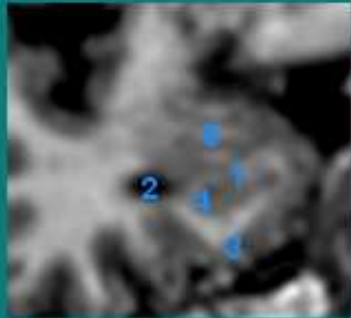
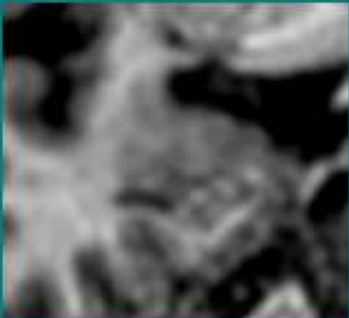
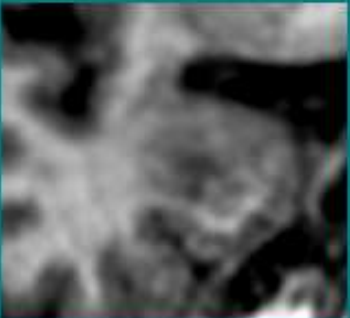
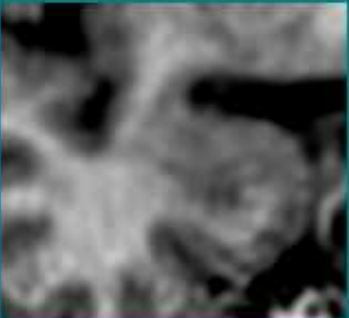
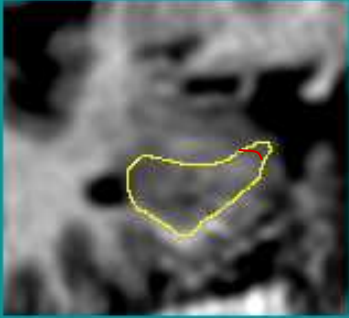
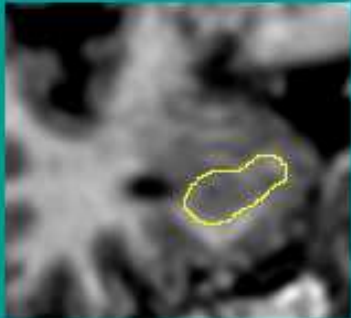
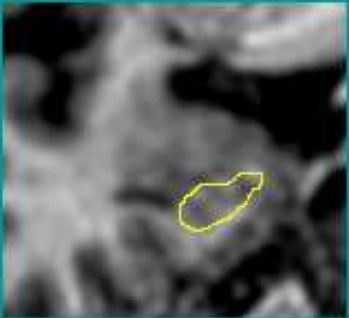
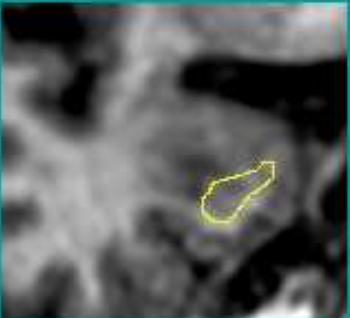
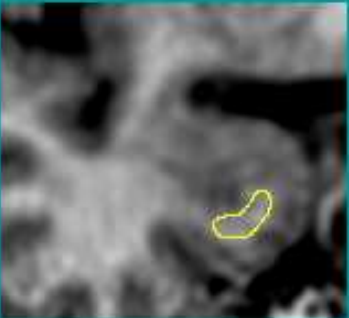
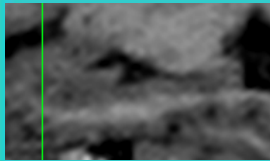
	138	137	136	135	134
Anatomical section					
Native MRI					
Tracing					
Notes					

	133	132	131	130	129
Anatomical section					
Native MRI					
Tracing					
Notes		1=Fimbria 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Gyrus dentatus 5=Subiculum 6=Uncal sulcus 7=Alveus 8=Uncal apex	If the boundary between the hippocampus and the parahippocampal cortex is not clear, a straight horizontal line is drawn. At this level, the posterior cerebral artery can be confused with the hippocampal tissue.	1=Fimbria 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Gyrus dentatus 5=Subiculum 6=Uncal sulcus 7=Alveus 9=Vertical digitation 10=Posterior cerebral artery	

2A)CTRL

	128	127	126	125	124
Anatomical section					
Native MRI					
Tracing					
Notes	<p>If alveus is not visible, a horizontal line is drawn. The line starts from the middle inferior horn and reaches the medial CSF.</p> <p>The anatomical shape of the intralimbic gyrus is often consistent with this arbitrary border and help to find the boundary. The same consideration can be applied to the following slices.</p>		<p>The hippocampal head folds up. Occasionally, the liquor is found in the folds.</p> <p>These areas are visualized on the MRI images as a black dot. These black dots should be excluded but this increases the variability of the tracing. A possible criterion is the following: close holes are to be included in the tracing, whereas areas of liquor communicating with the CSF of the uncus sulcus (the open holes) are to be excluded from the tracing.</p>		<p>1=Alveus 2=Temporal horn of the lateral ventricle (uncus recess) 3=Parahippocampal gyrus 4=Hippocampal head 5=Uncus sulcus 6=Amygdala</p>

2A)CTRL

	123	122	121	120	119
Anatomical section					
Native MRI					
Tracing					
Notes		1=Alveus 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Hippocampal head 5=Amygdala			<p><u>Most anterior slice</u>: full anterior extent of hippocampal head</p>  <p>Sagittal view</p>

	118				
Anatomical section					
Native MRI					
Tracing					
Notes					

2B) AD

	164	163	162	161	160
Anatomical section					
Native MRI					
Tracing					
Notes		1=Hippocampal tail 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Isthmus			2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Isthmus 5=Gyrus dentatus 6=Crus of fornix

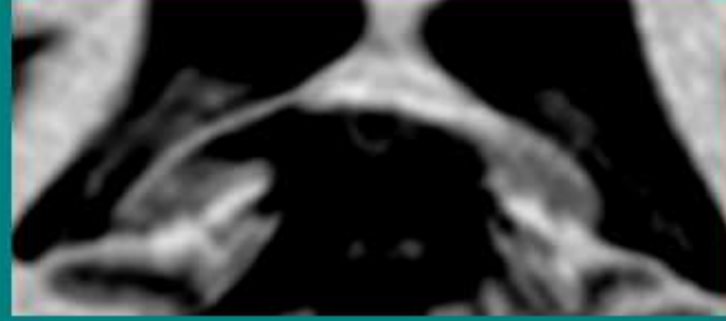
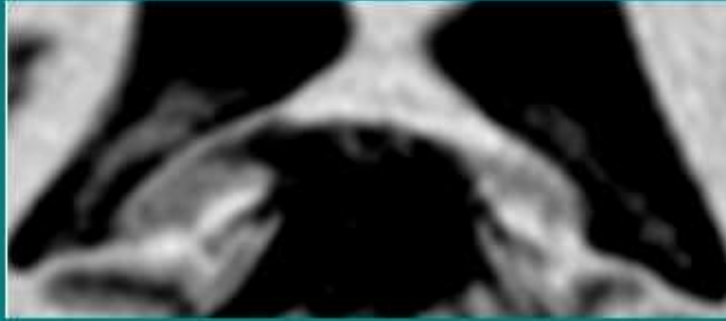
2B) AD

159

158

Anatomical
section

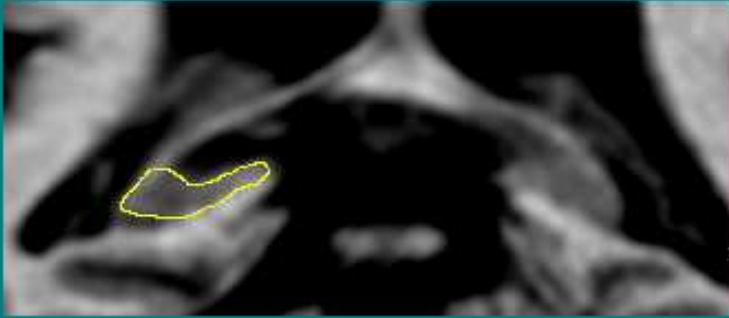
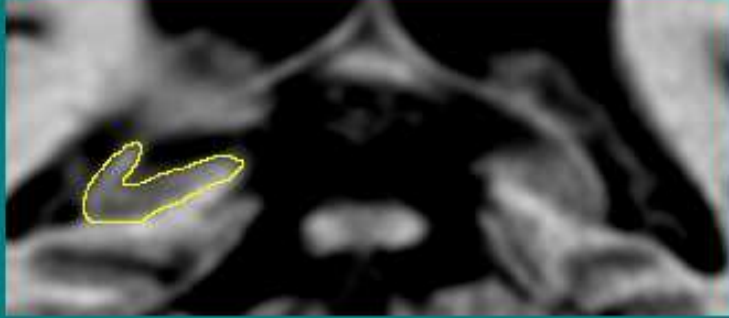
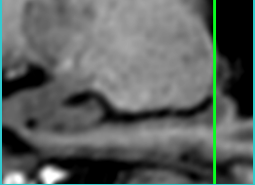
Native MRI



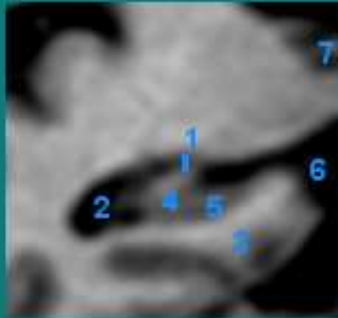
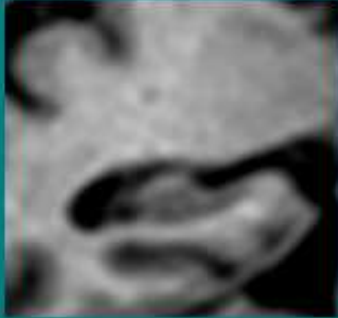
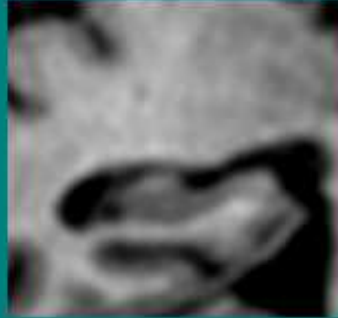
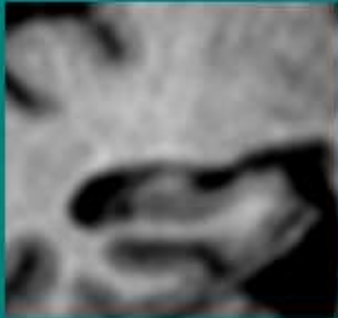
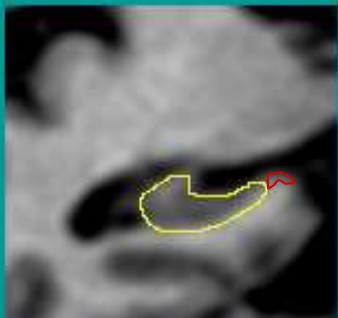
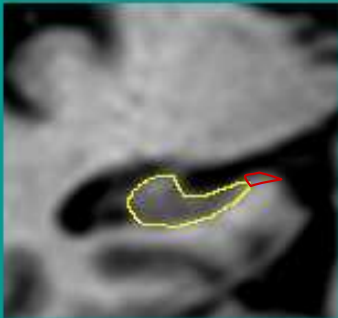
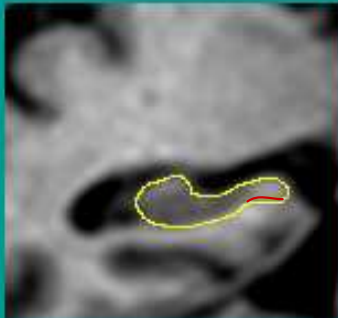
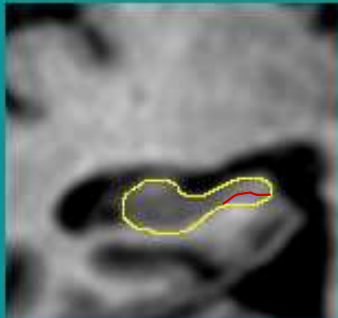
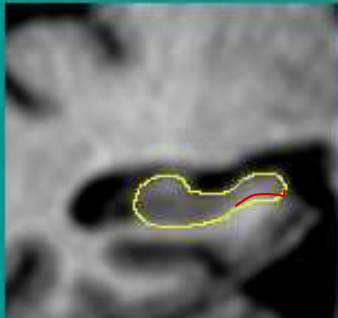


Tracing


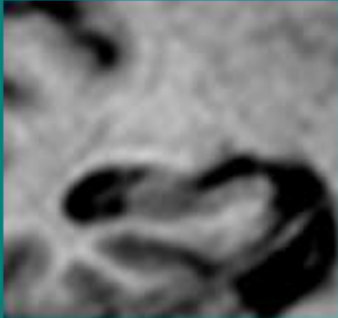
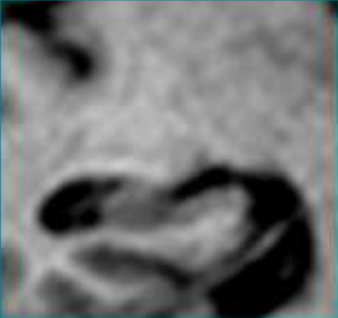

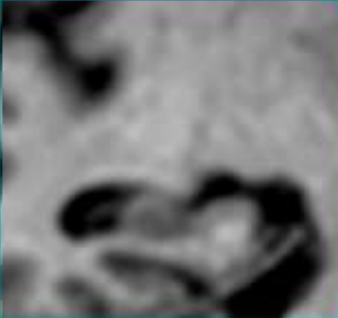
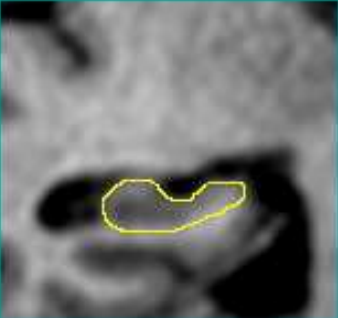
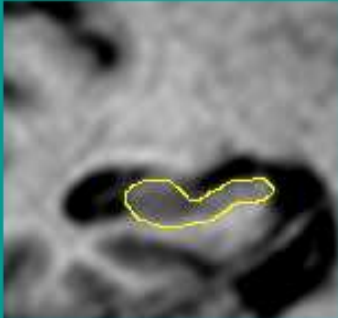


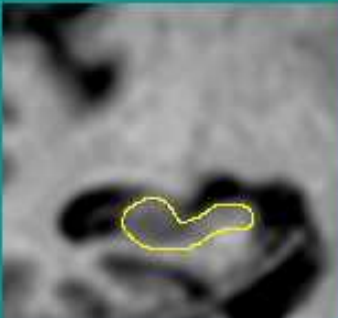
Notes


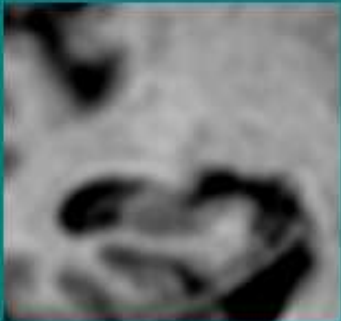
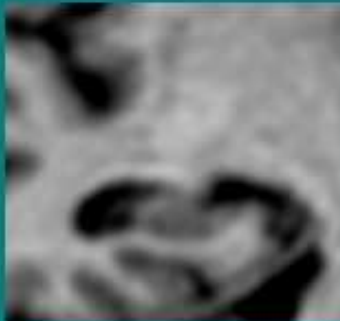
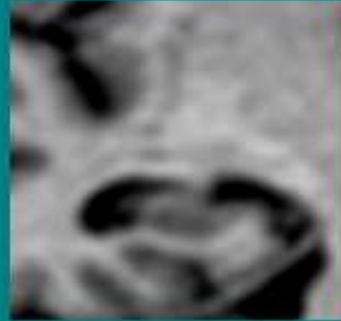
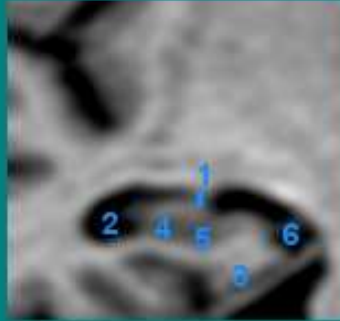
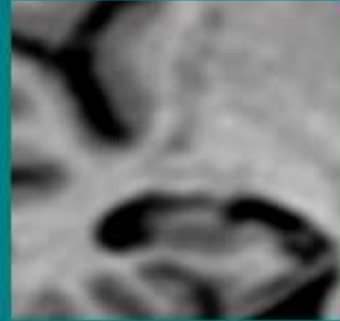
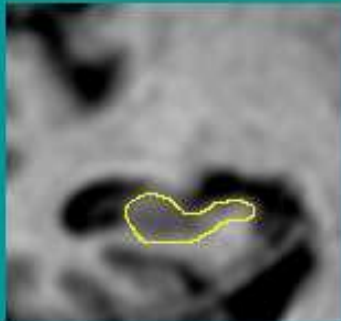
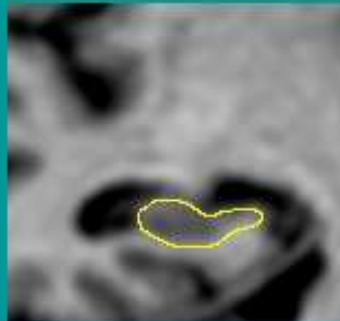
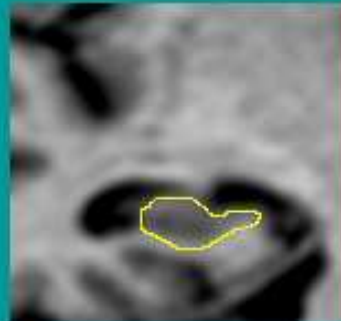
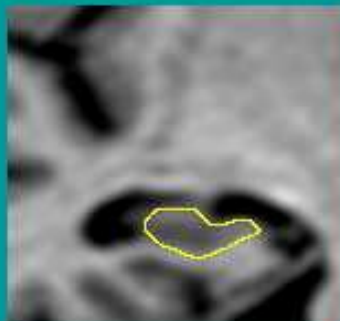
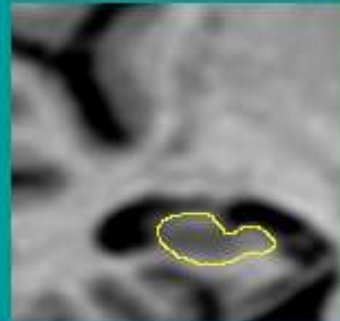
2B) AD

	157	156
Anatomical section		
Native MRI		
Tracing		
Notes	<p>Most posterior slice: Where the crura of the fornices on both sides are seen in full profile</p>  <p>Sagittal view</p>	

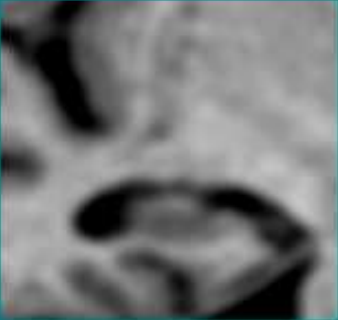
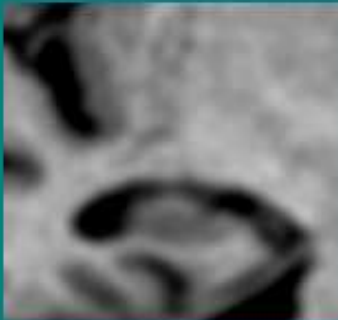
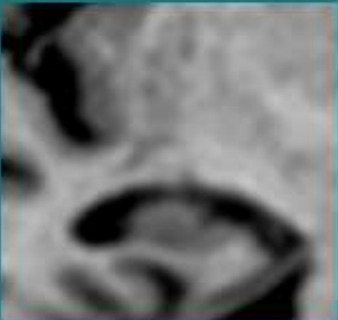
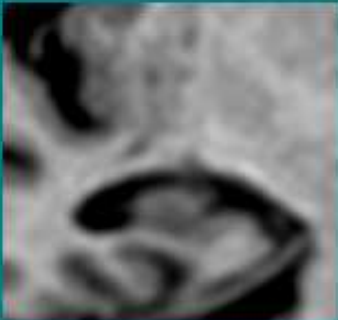
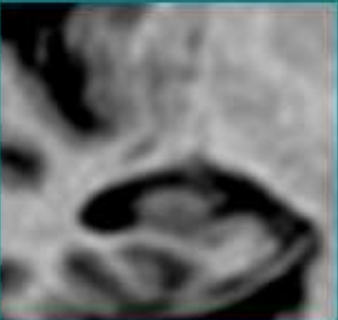
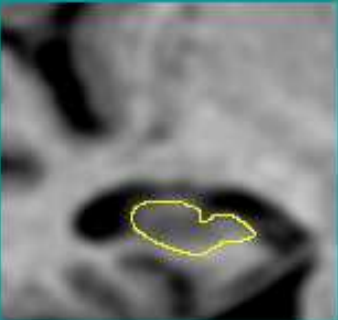
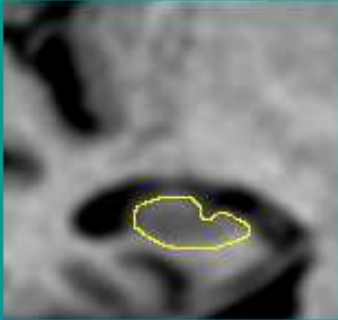
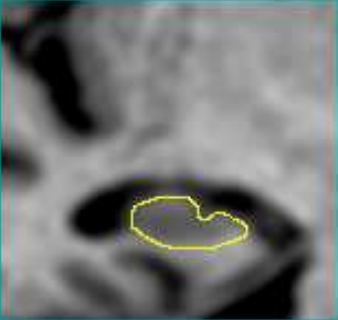
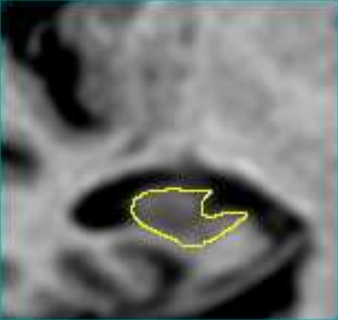
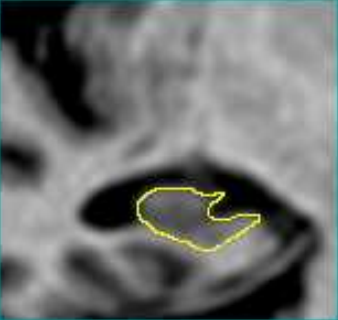
2B) AD	155	154	153	152	151
Anatomical section					
Native MRI					
Tracing					
Notes		1=Fimbria 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Gyrus dentatus 5=Subiculum 6=Ambient cistern 7=Crus of fornix			

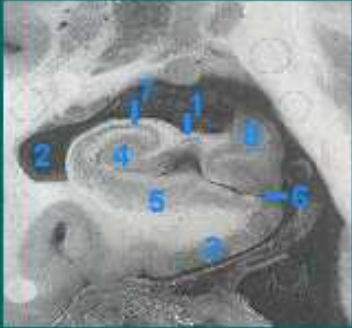
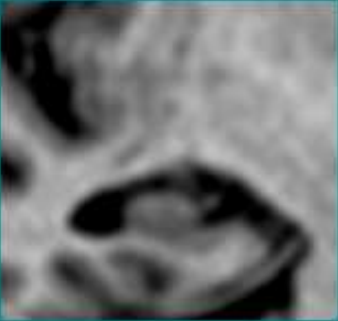

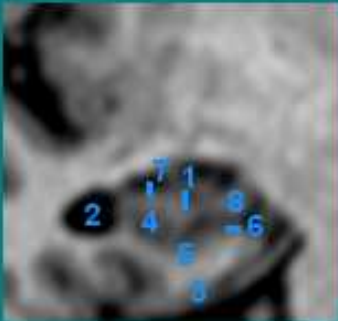
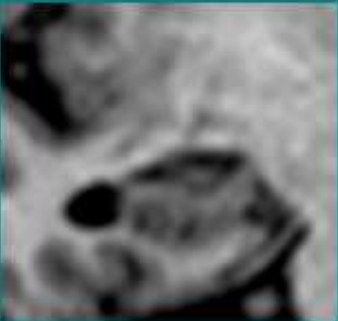
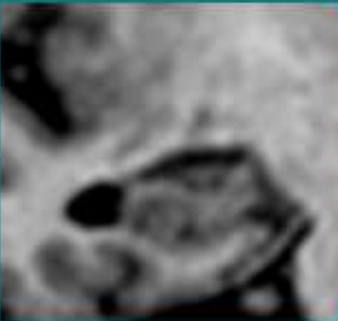
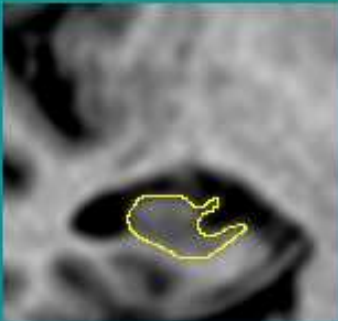
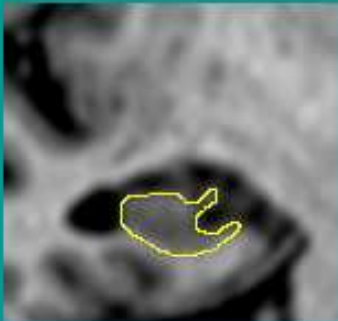
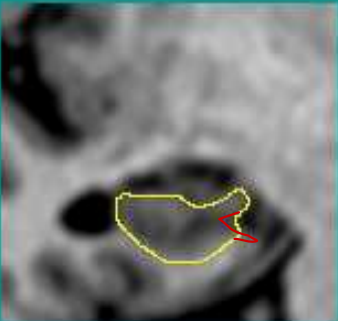
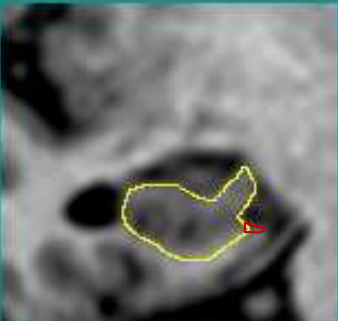
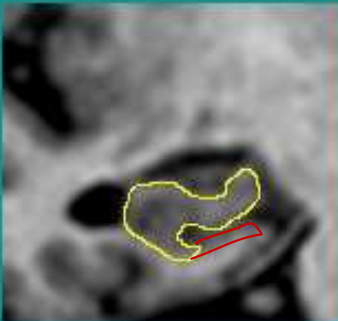
2B) AD


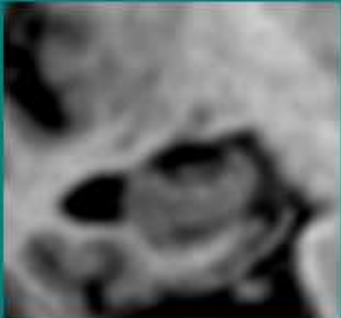
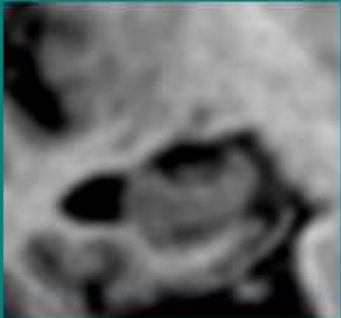
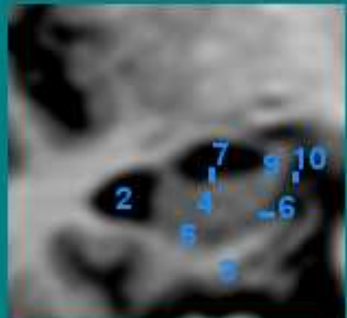
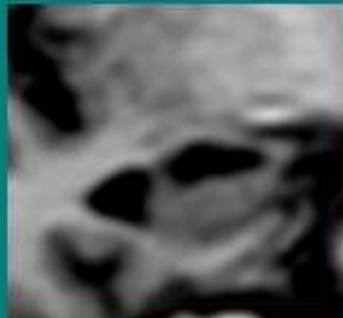
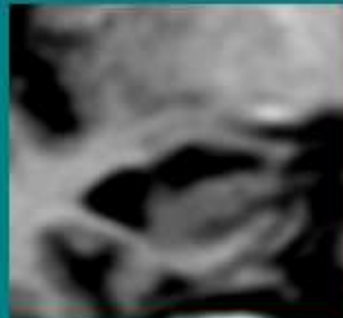
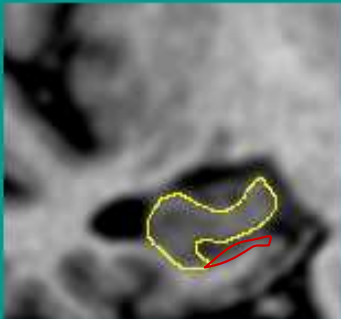
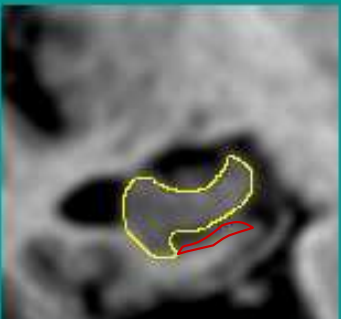
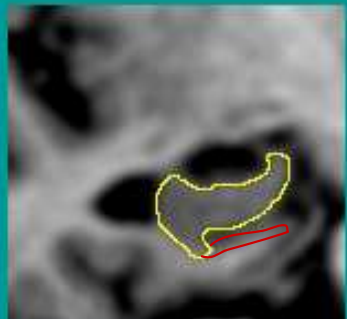
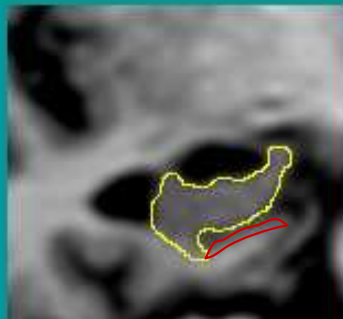
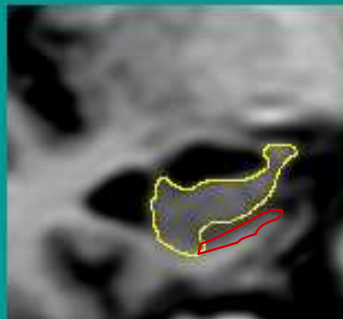
	150	149	148	147	146
Anatomical section					
Native MRI					
Tracing					
Notes					


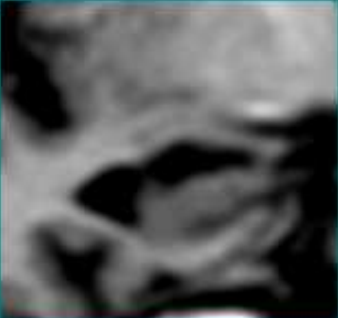
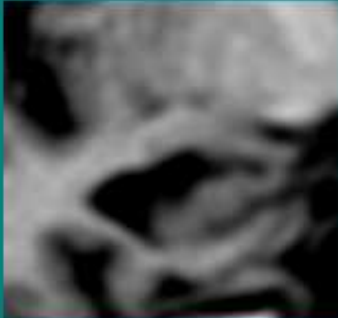
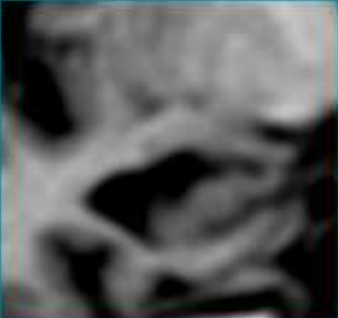
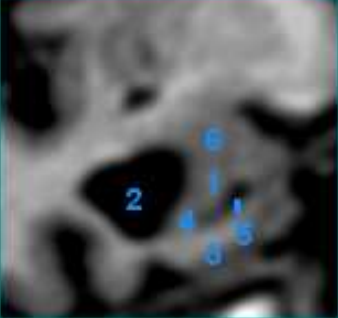
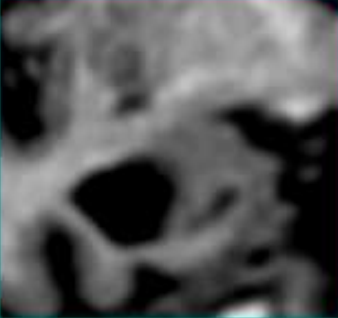
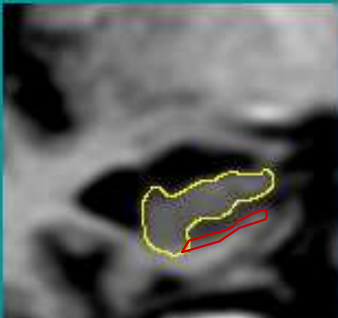
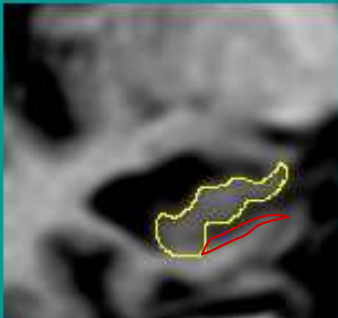
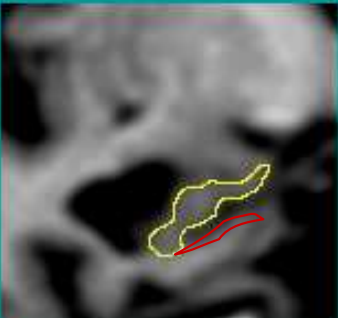
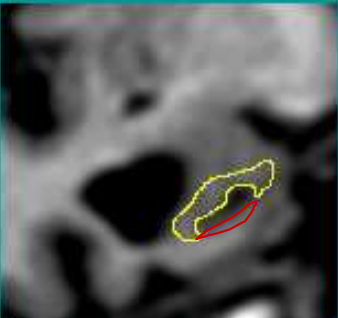
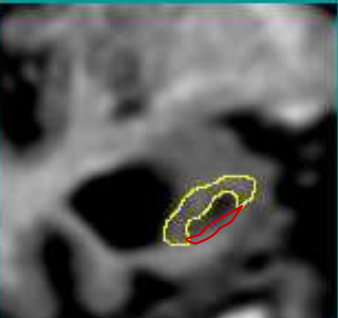
2B) AD	145	144	143	142	141
Anatomical section					
Native MRI					
Tracing					
Notes				<p>1=Fimbria 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Gyrus dentatus 5=Subiculum 6=Ambient cistern</p>	

2B) AD

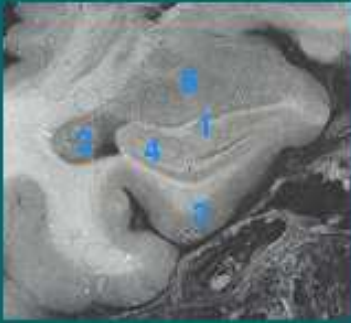
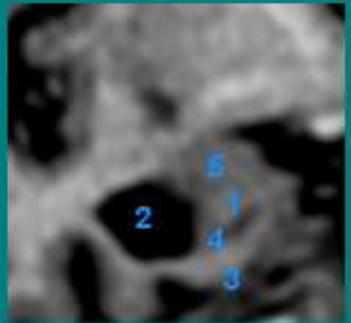
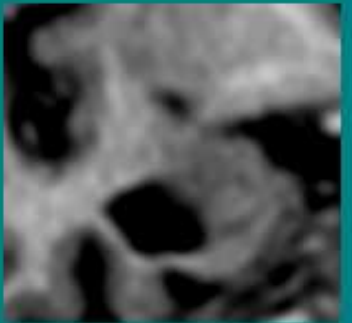
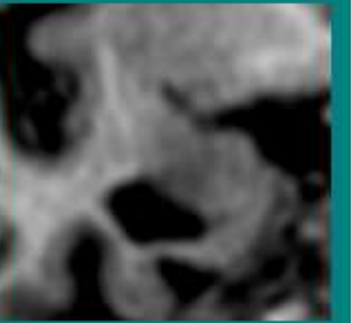
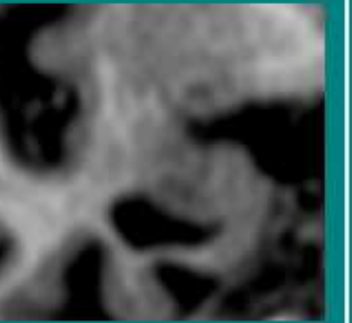
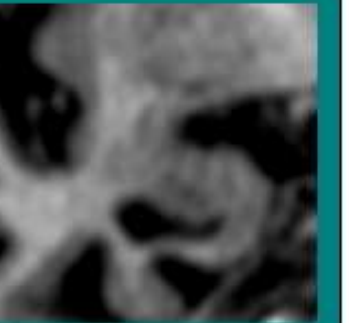
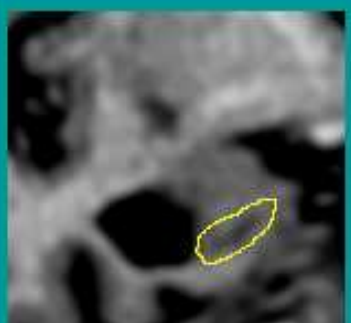
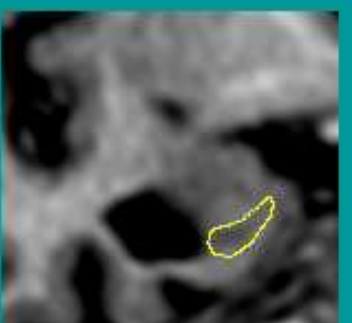
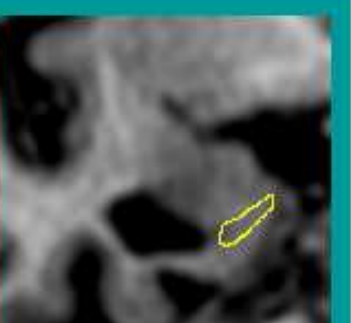
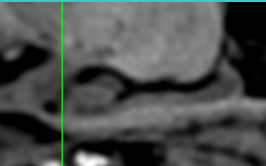
	140	139	138	137	136
Anatomical section					
Native MRI					
Tracing					
Notes					

2B) AD	135	134	133	132	131
Anatomical section					
Native MRI					
Tracing					
Notes			1=Fimbria 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Gyrus dentatus 5=Subiculum 6=Uncal sulcus 7=Alveus 8=Uncal apex		

2B) AD	129	128	127	126	125
Anatomical section					
Native MRI					
Tracing					
Notes			1=Fimbria 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Gyrus dentatus 5=Subiculum 6=Uncal sulcus 7=Alveus 9=Vertical digitation 10=Posterior cerebral artery		

2B) AD	124	123	122	121	120
Anatomical section					
Native MRI					
Tracing					
Notes				<p>1=Alveus 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Hippocampal head 5=Uncal sulcus 6=Amygdala</p>	

2B) AD

	119	118	117	116	115
Anatomical section					
Native MRI					
Tracing					
Notes	1=Alveus 2=Temporal horn of the lateral ventricle (uncal recess) 3=Parahippocampal gyrus 4=Hippocampal head 5=Amygdala		<p>Most anterior slice: full anterior extent of hippocampal head</p>  <p>Sagittal view</p>		