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

Pruessner JC, Li LM, Serles W et al. *Volumetry of hippocampus and amygdala with high-resolution MRI and three-dimensional analysis software: minimizing the discrepancies between laboratories.* Cereb Cortex. 2000; 10:433-42.

In the following section you can find:

1)An excerpt of the Survey of anatomical landmarks according to Prussner et al.'s criteria.

2)The hippocampal tracing on consecutive coronal slices of a 1.5T ADNI control subjects (**2A-2B**) and AD patients (**2C-2D**). **2A** and **2C** show the hippocampal tracing on MR images only reoriented along the AC-PC line. **2B** and **2D** show the hippocampal tracing on MR images normalized to the Talairach space (following the preprocessing described in the protocol).

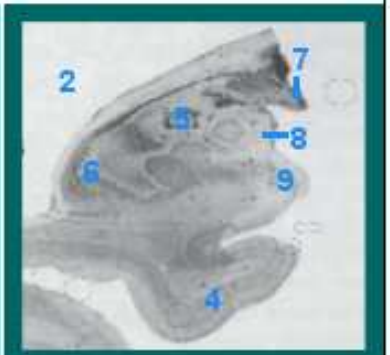
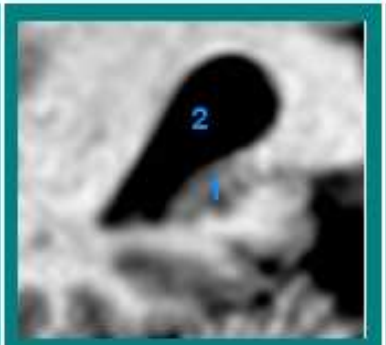
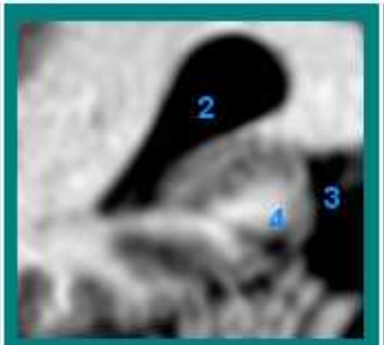
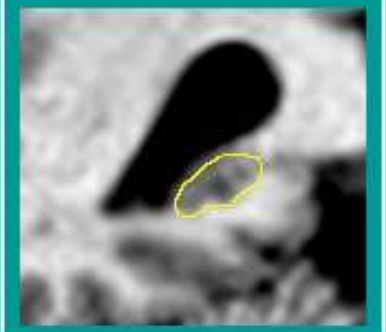
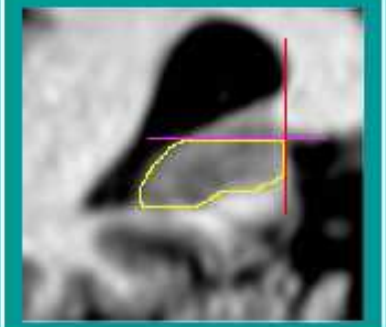
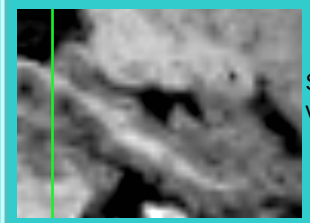
This document has been endorsed by Jens Pruessner (email: jpruessner@me.com) on 7/01/2010.

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

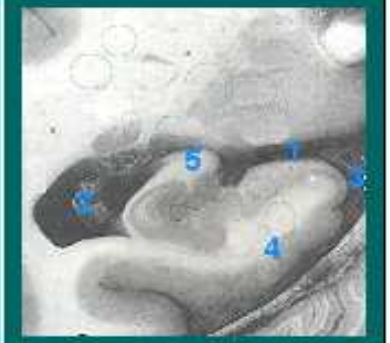
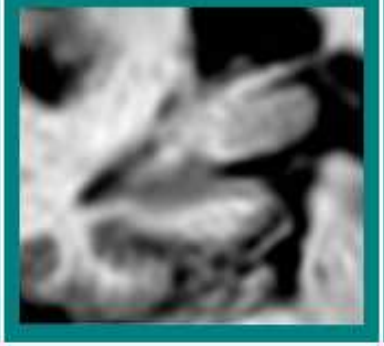
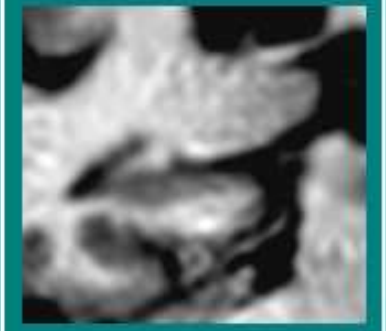
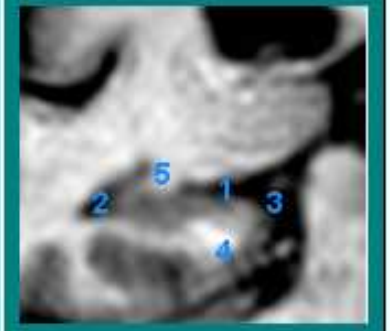
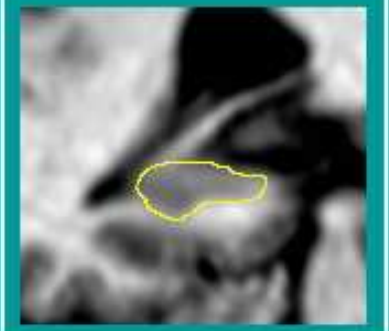
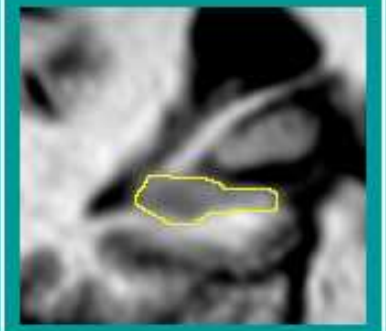
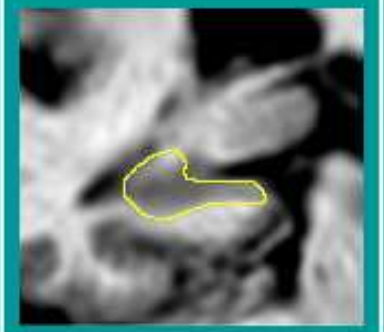
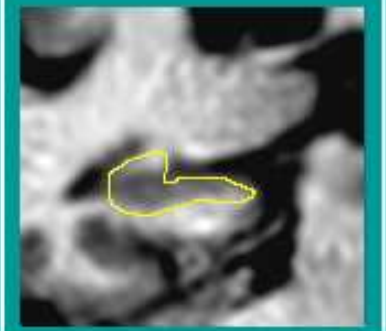
Plane			
AC-PC line			
Start tracing			
from tail to head			
Areas explicitly included	**Areas explicitly excluded**	**Most anterior slice**	**Most posterior slice**
CA regions, dentate gyrus, subiculum, alveus, fimbria, part of the fasciolar gyrus (FG)	Andreas-Retzius gyrus (ARG), the part of the FG that is adjacent to ARG, crus of fornix	slice where one of the following is visible: alveus, temporal horn of lateral ventricle (uncal recess) or amygdala	slice where an avoid mass of gray matter started to appear inferomedially to the trigone of the lateral ventricle
BOUNDARIES			
	Lateral border	**Inferior border**	**Medial border**	**Superior border**
HEAD	temporal horn of lateral ventricle (uncal recess)	[uncal cleft] White matter of the parahippocampal gyrus	CSF of ambient cistern	temporal horn of lateral ventricle (uncal recess) and alveus
BODY	temporal horn of lateral ventricle (uncal recess)	White matter of the parahippocampal gyrus	CSF of ambient cistern	superior excess of the quadrigeminal cistern
TAIL	atrium of lateral ventricle	adjacent white matter	Discrimination of HT from FG and crus of fornix using arbitrary borders	Discrimination of HT from ARG using arbitrary borders

Normalization to the Talairach space

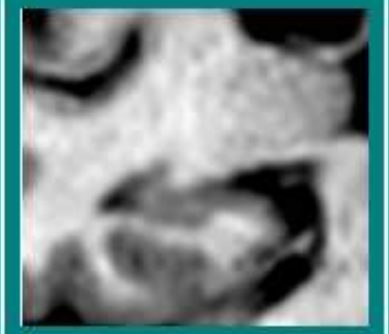
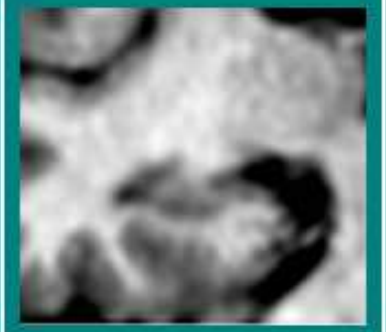
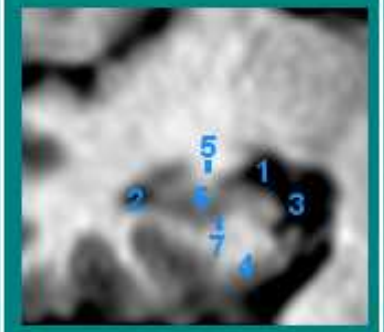
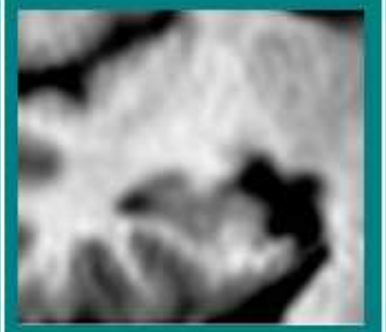
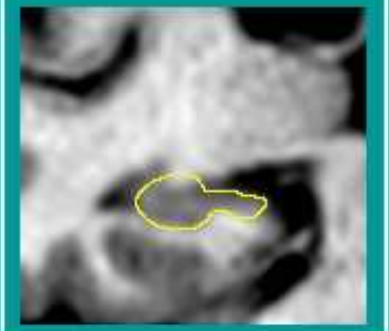
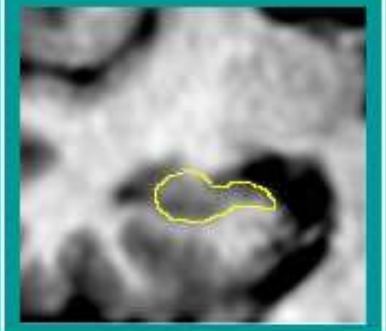
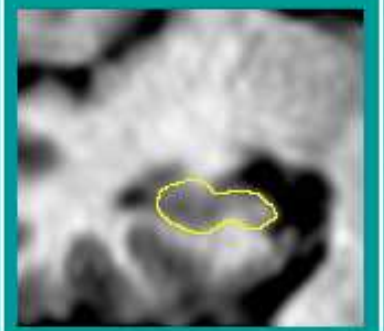
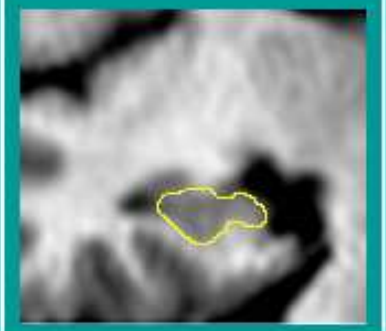
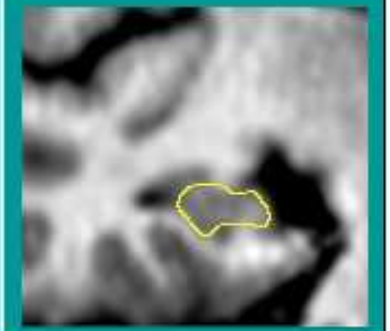
2A)CTRL

	113	112	111	110	109
Anatomical section					
Native MRI					
Tracing					
Notes		**Most posterior slice :** slice where an ovoid mass of gray matter (1) started to appear inferomedially of the atrium of lateral ventricle (2)  Sagittal view	After the most posterior slice, the fornix can be excluded by a horizontal line (in fuchsia) from the superior border of the quadrigeminal cistern (3) to the lateral ventricle (2). Part of gyrus fasciolaris (7) and of Andreas-Retzius gyrus (8) can be excluded by a vertical line (red) from the medial end of the lateral ventricle (2) down to the parahippocampal gyrus (4).	2= Atrium of lateral ventricle 4= Parahippocampal gyrus 5= Gyrus dentatus 6= Cornu Ammonis 7= Gyrus fasciolaris 8= Gyrus of Andreas-Retzius 9= Isthmus	

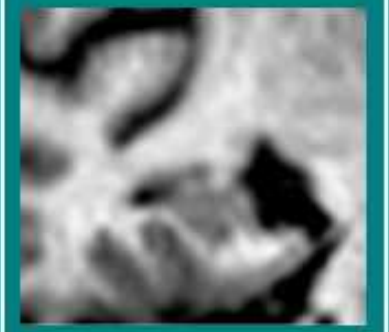
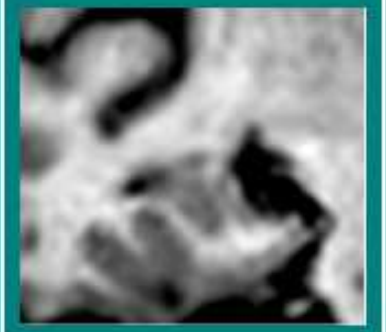
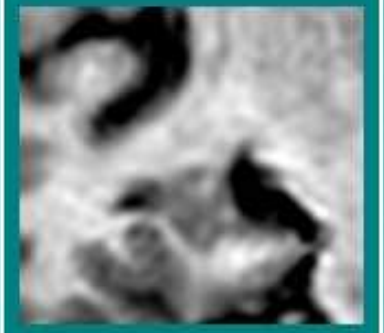
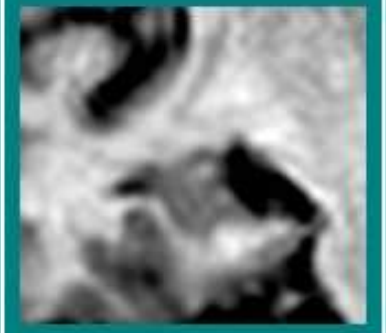
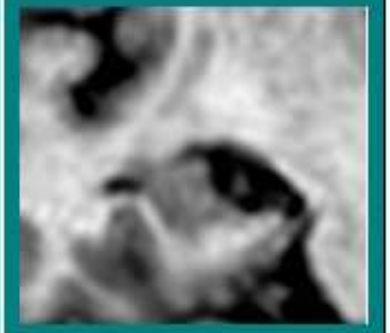
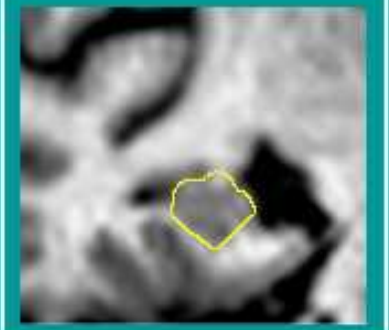
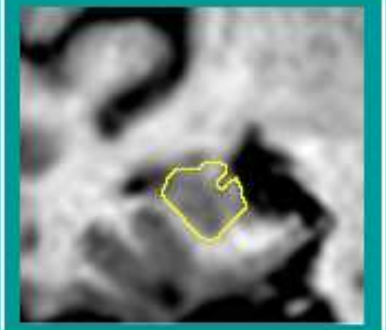
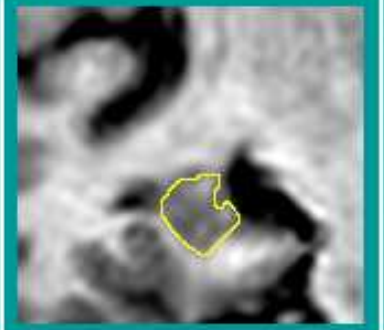
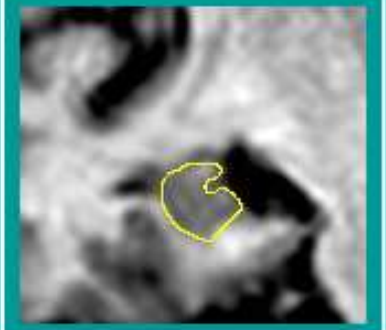
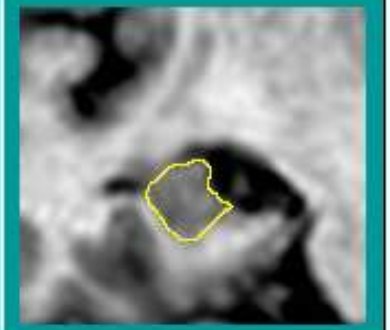
2A)CTRL

	108	107	106	105	104
Anatomical section					
Native MRI					
Tracing					
Notes					1=Superior excess of the quadrigeminal cistern 2=Temporal horn of lateral ventricle 3=CSF of ambient cistern 4= Parahippocampal gyrus 5= Fimbria (included in the tracing)

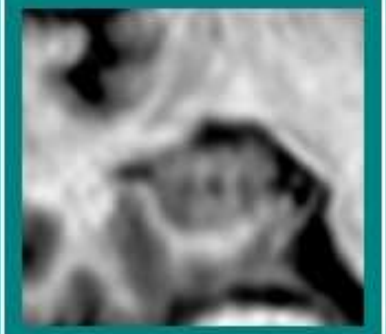
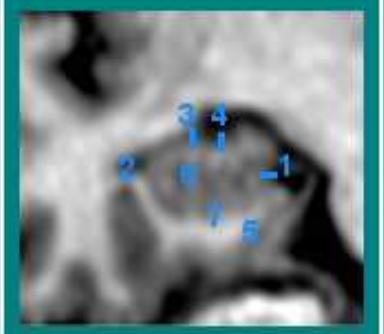
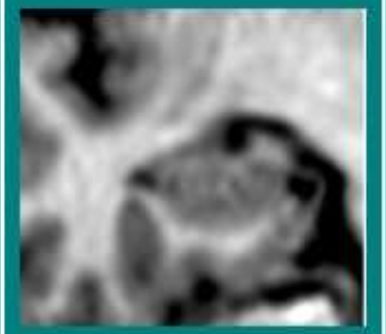
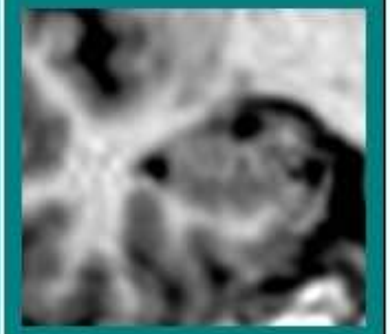
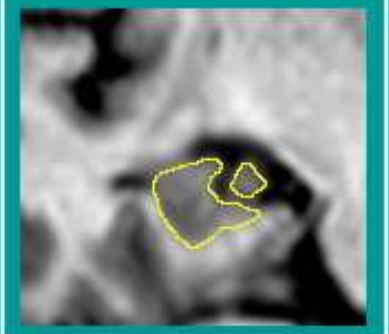
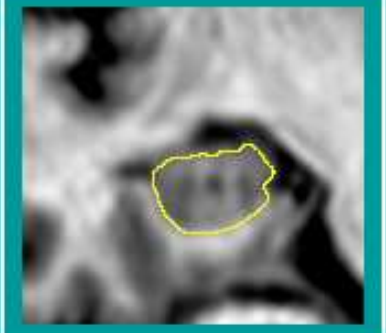
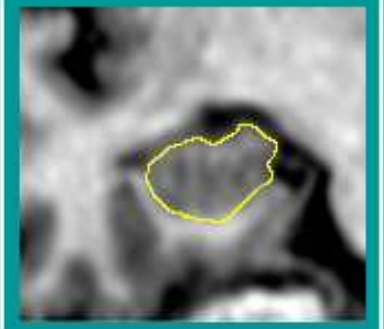
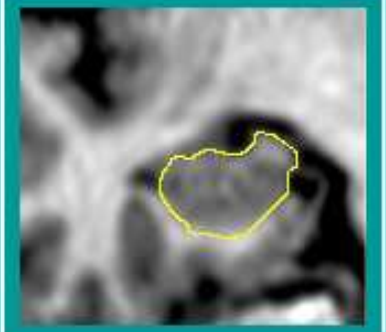
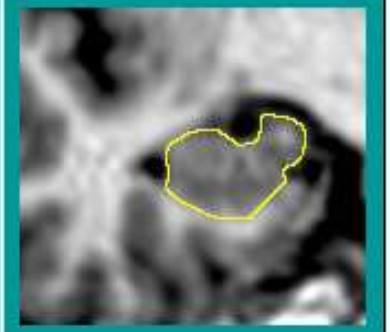
2A)CTRL

	103	102	101	100	99
Anatomical section					
Native MRI					
Tracing					
Notes			1=Superior excess of the quadrigeminal cistern 2=Temporal horn of lateral ventricle 3=CSF of ambient cistern 4= Parahippocampal gyrus 5= Fimbria (included in the tracing) 6= Gyrus dentatus 7= Subiculum		

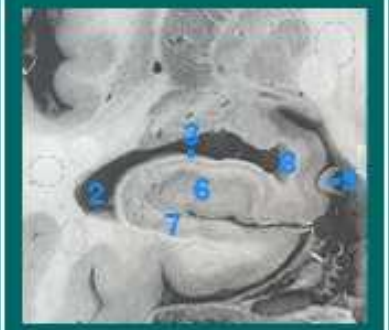
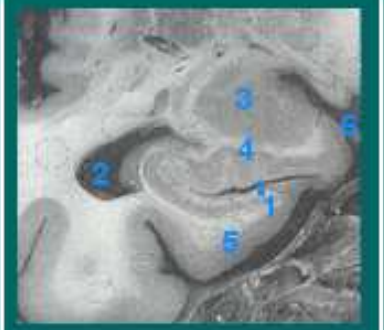
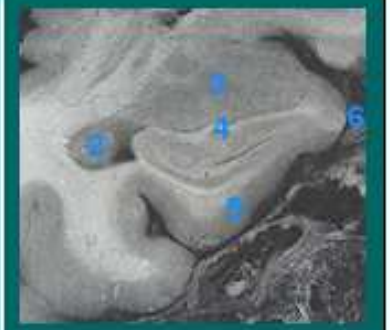
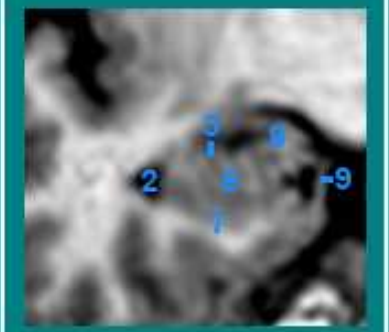
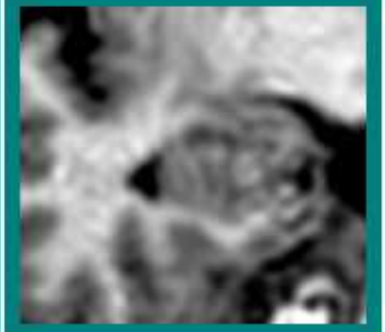
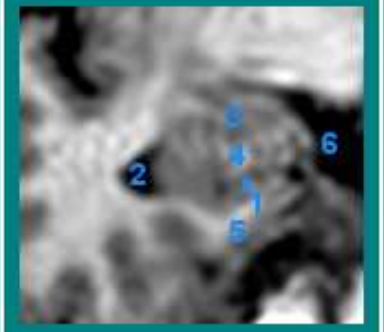
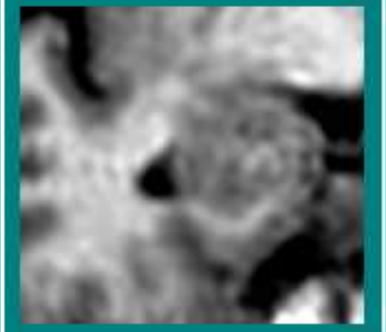
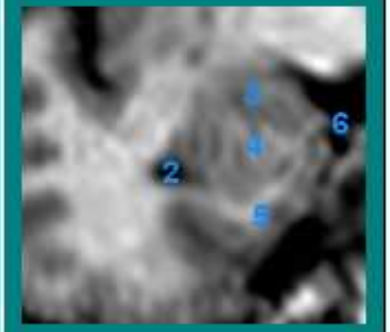
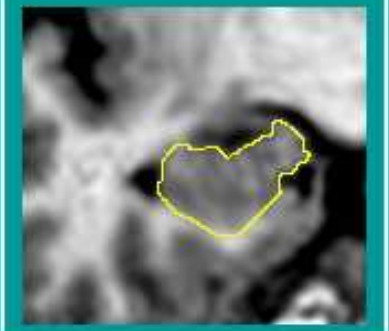
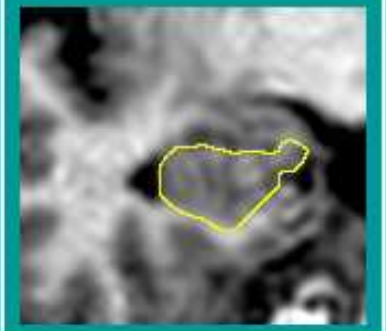
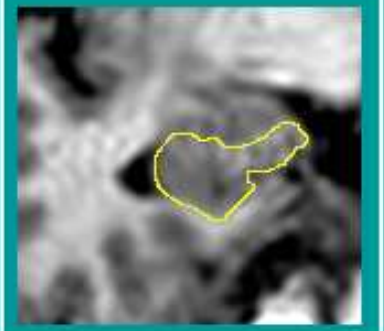
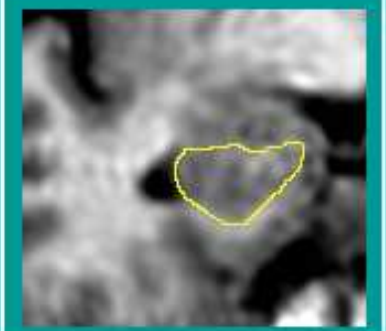
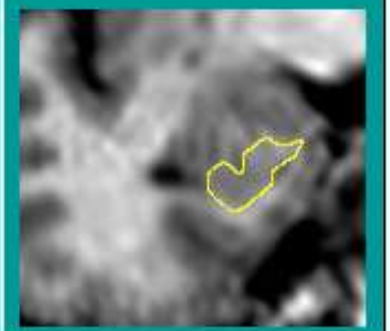
2A)CTRL

	98	97	96	95	94
Anatomical section					
Native MRI					
Tracing					
Notes			When the separation between the parahippocampal gyrus and hippocampal body is not clear, your protocol divides the subiculum from the entorhinal cortex by drawing a 45° line starting from the most inferior part of hippocampal body medially to the cistern.		

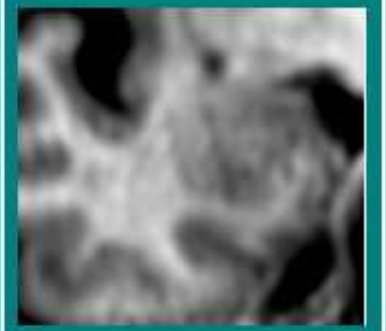
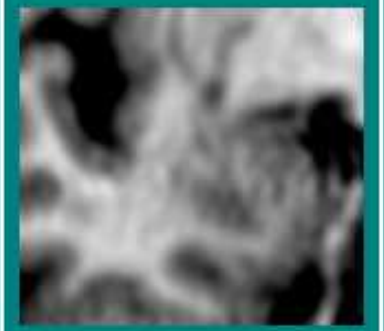
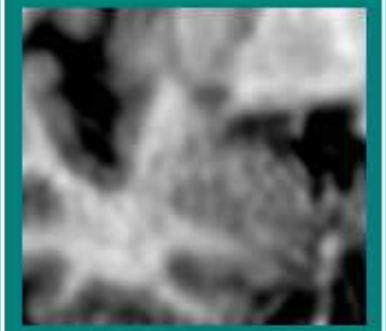
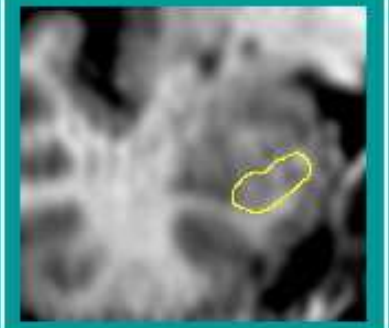
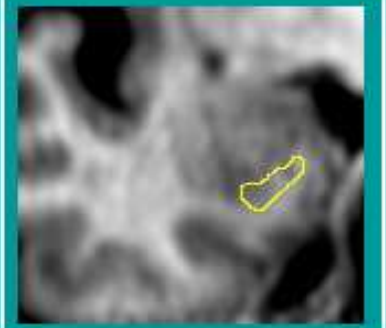
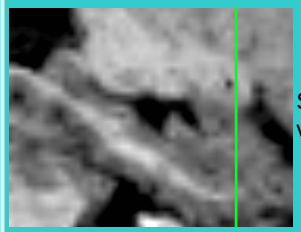
2A)CTRL

	93	92	91	90	89
Anatomical section					
Native MRI					
Tracing					
Notes			1= Uncal sulcus 2= Temporal horn of lateral ventricle 3= Alveus (included) 4= Fimbria (included) 5= Parahippocampal gyrus 6= Gyrus dentatus 7= Subiculum		

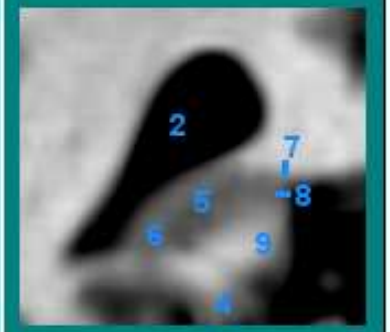
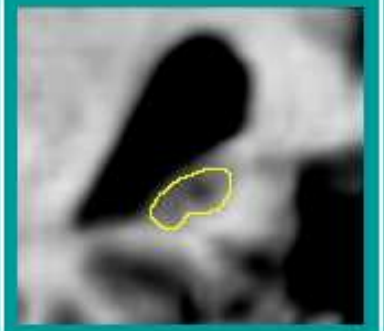
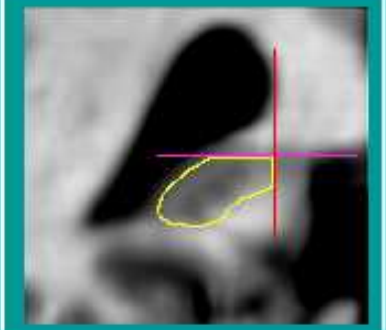
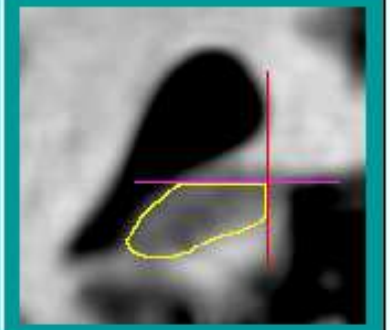
2A)CTRL

	88	87	86	85	84
Anatomical section					
Native MRI					
Tracing					
Notes	2= Temporal horn of lateral ventricle 3= Alveus (included) 6= Gyrus dentatus 7= Subiculum 8= Vertical digitation 9= Posterior cerebral artery		1= Uncal sulcus 2= Temporal horn of lateral ventricle 3= Amygdala 4= Alveus 5= Parahippocampal gyrus 6= CSF of ambient cistern		2= Temporal horn of lateral ventricle 3= Amygdala 4= Alveus 5= Parahippocampal gyrus 6= CSF of ambient cistern

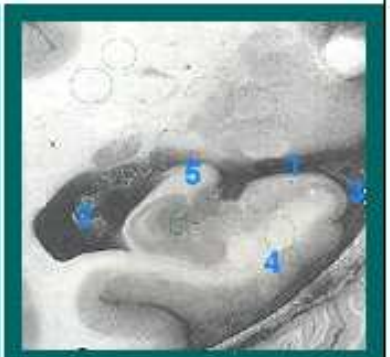
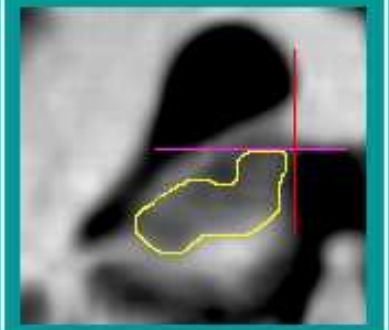
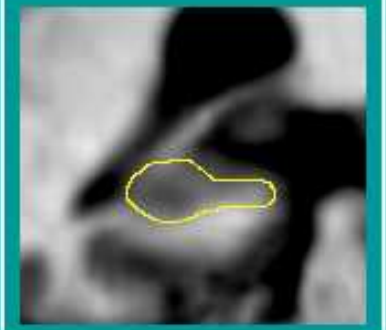
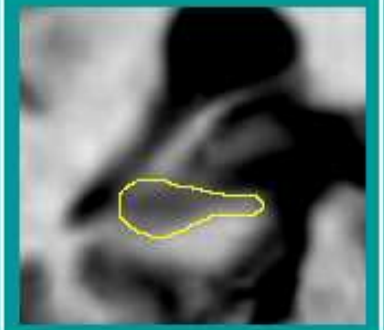
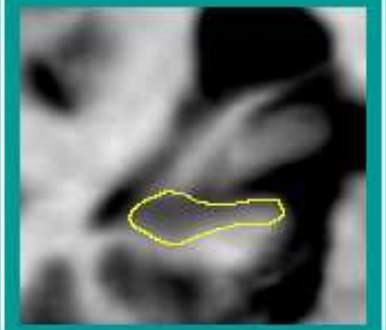
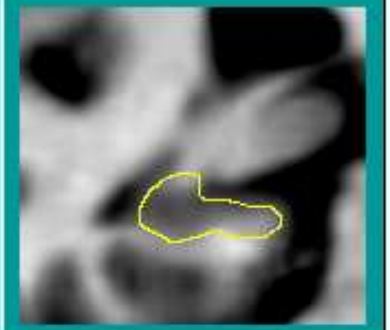
2A)CTRL

	83	82	81	80	
Anatomical section					
Native MRI					
Tracing					
Notes		**Most anterior slice:** slice were one of the following is visible: alveus temporal horn of lateral ventricle or amygdala  Sagittal view			

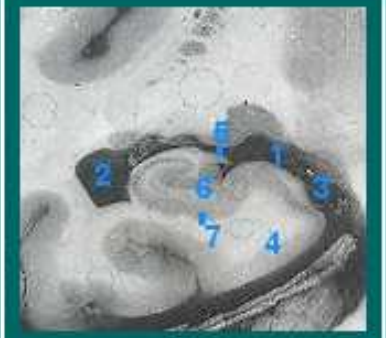
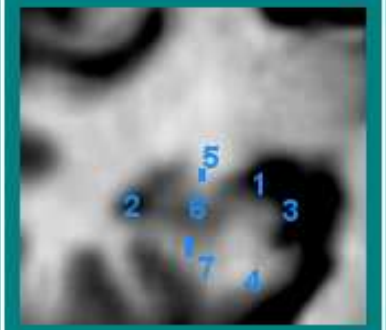
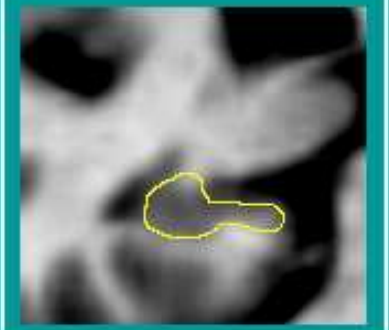
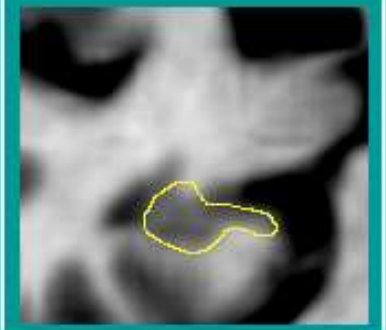
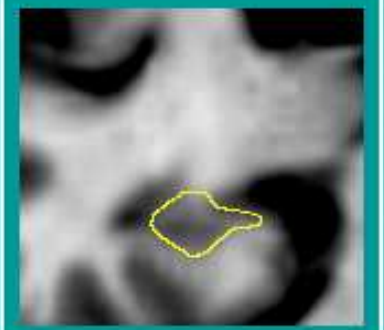
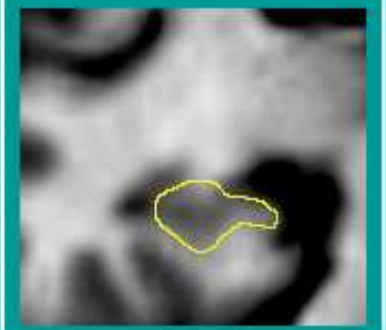
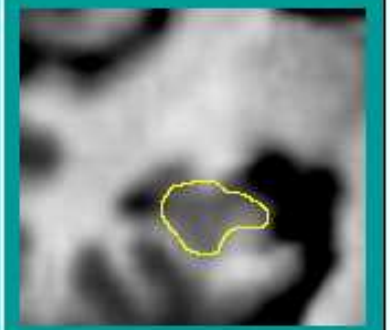
2B)CTRL

	86	87	88	89	90
Anatomical section					
Native MRI					
Tracing					
Notes			1= Hippocampal tail 2= Atrium of lateral ventricle		2= Atrium of lateral ventricle 4= Parahippocampal gyrus 5= Gyrus dentatus 6= Cornu Ammonis 7= Gyrus fasciolaris 8= Gyrus of Andreas-Retzius 9= Isthmus

2B)CTRL

	91	92	93	94	95
Anatomical section					
Native MRI					
Tracing					
Notes					1=Superior excess of the quadrigeminal cistern 2=Temporal horn of lateral ventricle 3=CSF of ambient cistern 4= Parahippocampal gyrus 5= Fimbria (included in the tracing)

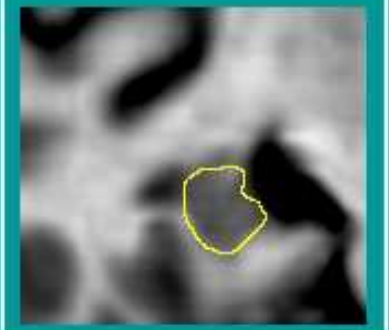
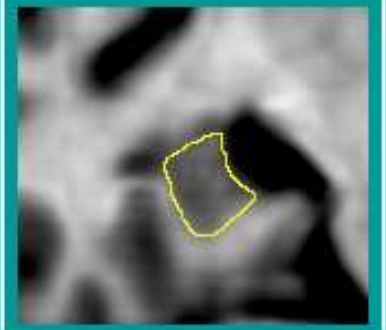
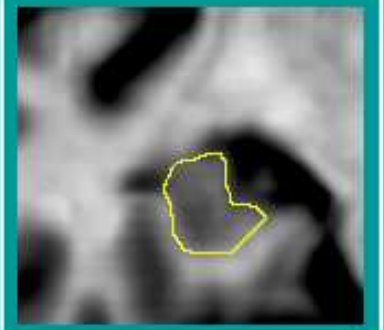
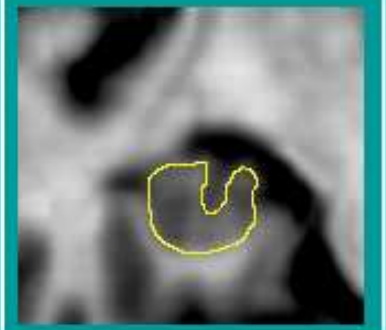
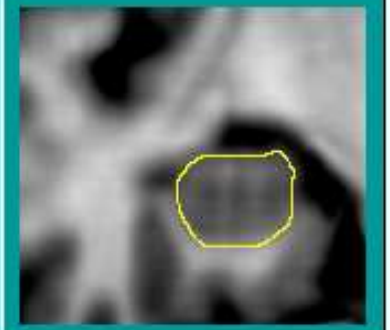
2B)CTRL

	96	97	98	99	100
Anatomical section					
Native MRI					
Tracing					
Notes				1=Superior excess of the quadrigeminal cistern 2=Temporal horn of lateral ventricle 3=CSF of ambient cistern 4= Parahippocampal gyrus 5= Fimbria (included in the tracing) 6= Gyrus dentatus 7= Subiculum	

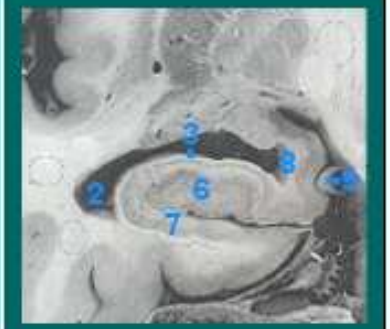
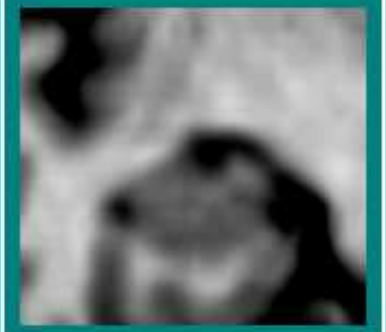
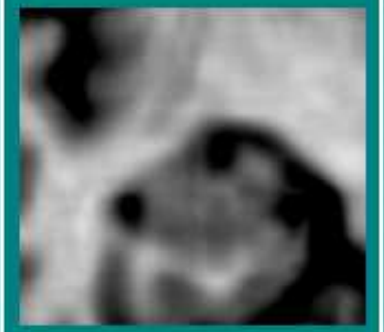
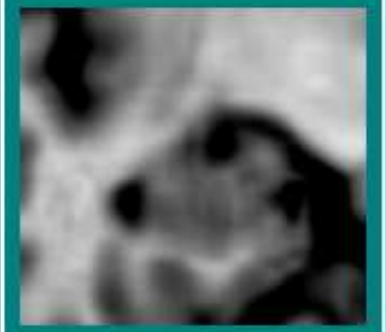
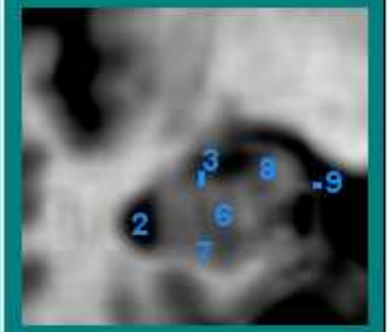
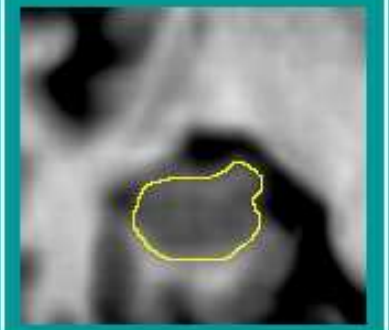
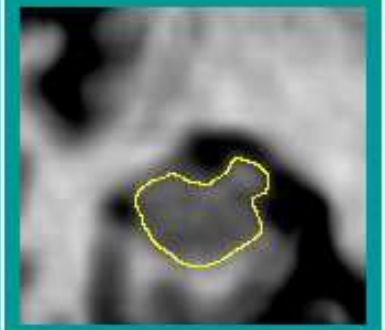
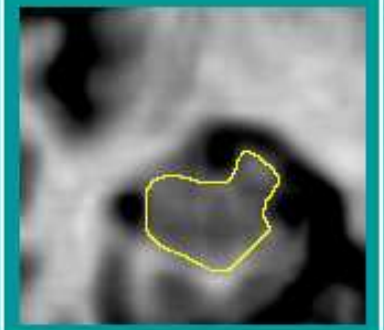
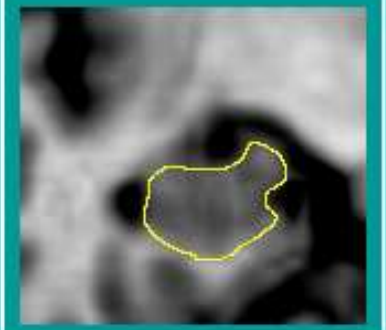
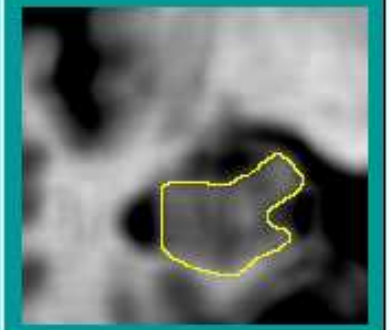
2B)CTRL

	101	102	103	104	105
Anatomical section					
Native MRI					
Tracing					
Notes					

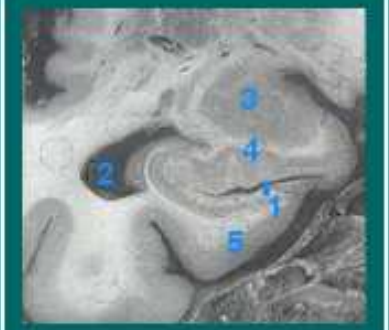
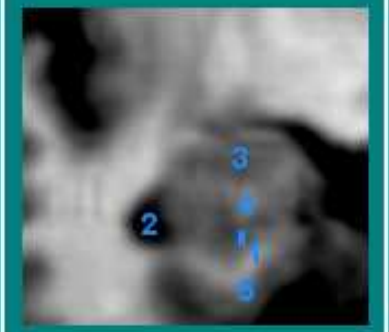
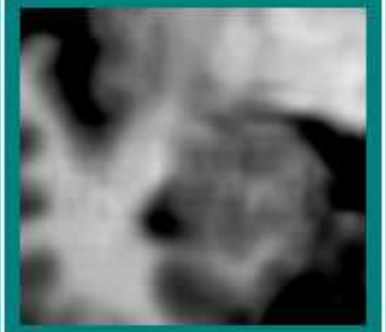
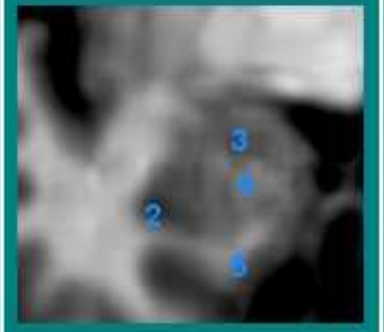
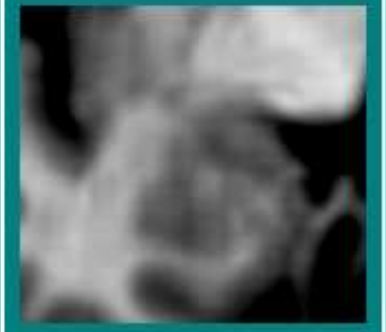
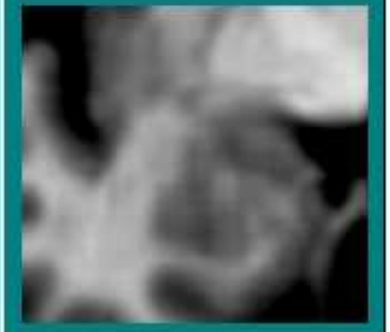
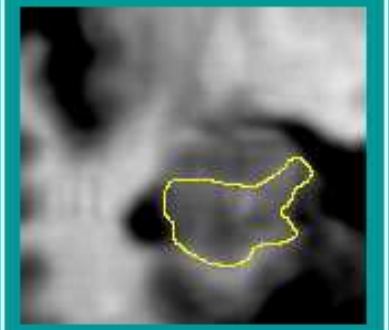
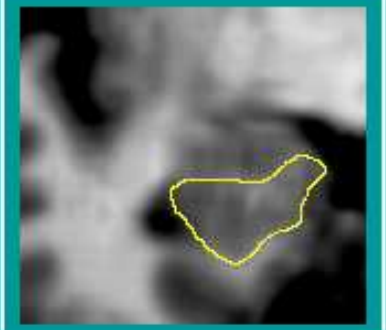
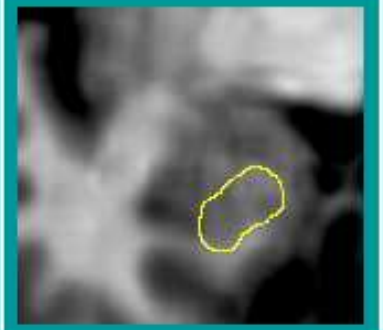
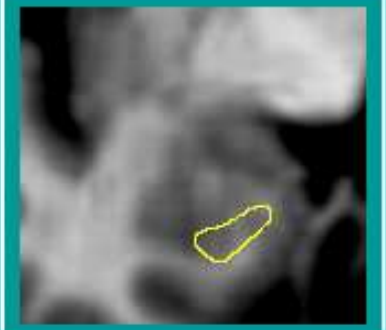
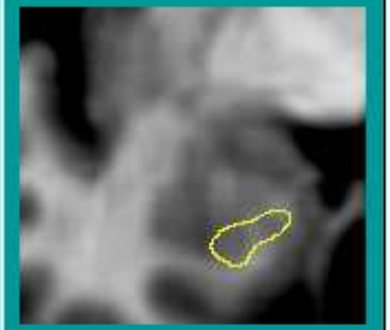
2B)CTRL

	106	107	108	109	110
Anatomical section					
Native MRI					
Tracing					
Notes					1= Uncal sulcus 2= Temporal horn of lateral ventricle 3= Alveus (included) 4= Fimbria (included) 5= Parahippocampal gyrus 6= Gyrus dentatus 7= Subiculum

2B)CTRL

	111	112	113	114	115
Anatomical section					
Native MRI					
Tracing					
Notes					2= Temporal horn of lateral ventricle 3= Alveus (included) 6= Gyrus dentatus 7= Subiculum 8= Vertical digitation 9= Posterior cerebral artery

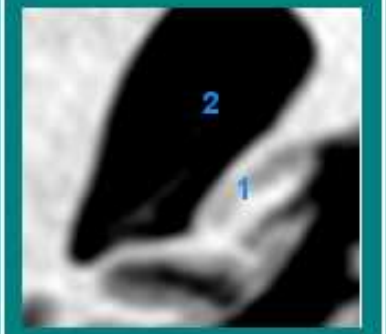
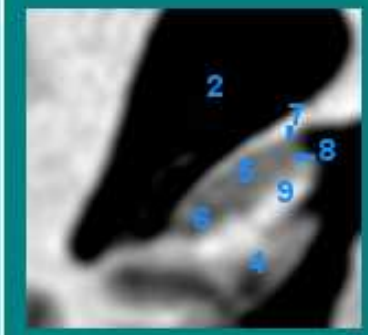
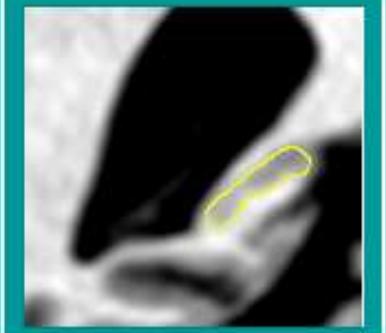
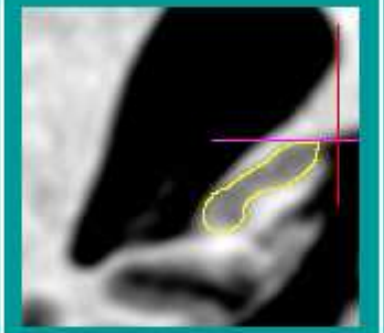
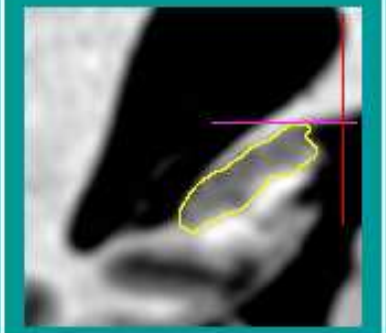
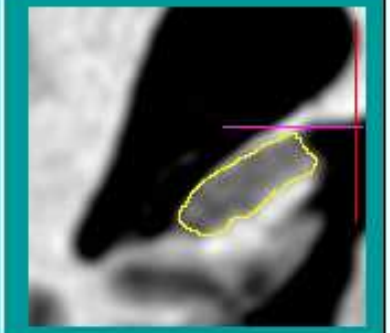
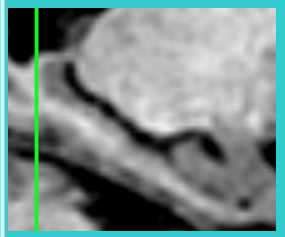
2B)CTRL

	116	117	118	119	120
Anatomical section					
Native MRI					
Tracing					
Notes	1= Uncal sulcus 2= Temporal horn of lateral ventricle 3= Amygdala 4= Alveus 5= Parahippocampal gyrus		2= Temporal horn of lateral ventricle 3= Amygdala 4= Alveus 5= Parahippocampal gyrus		

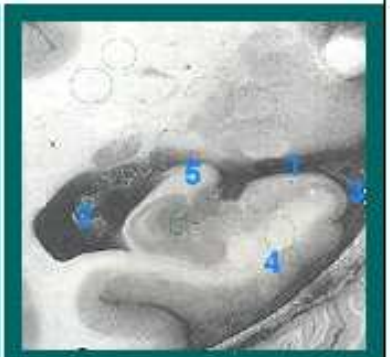
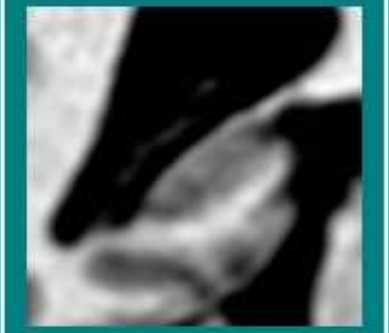
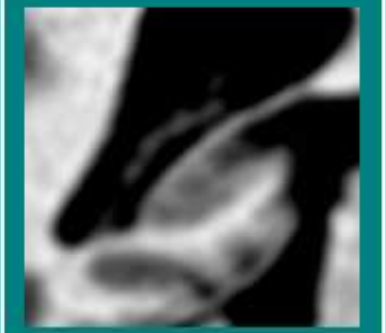
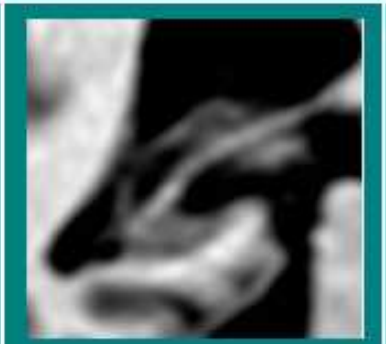
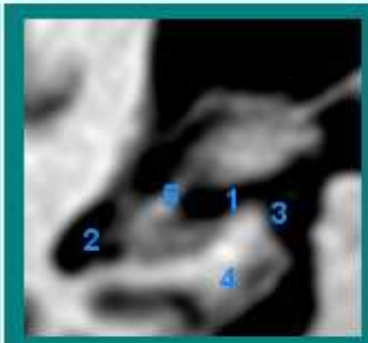
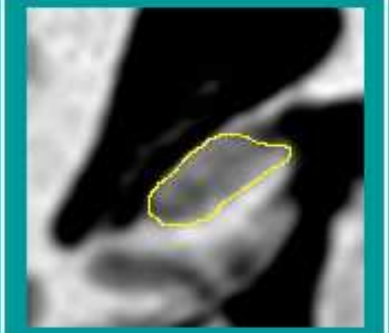
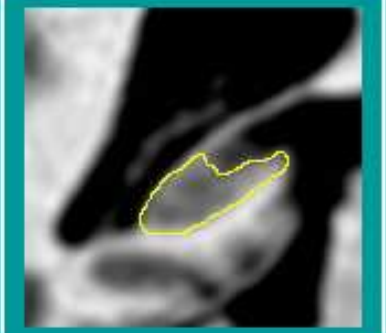
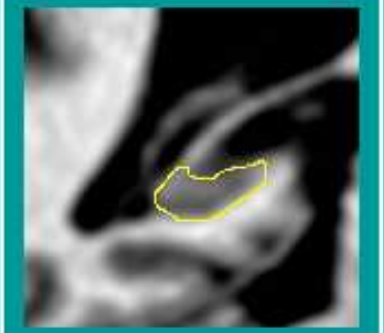
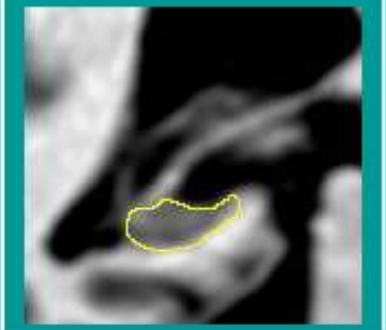
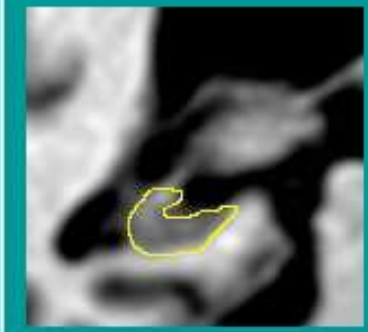
2B)CTRL

	121	122	123		
Anatomical section					
Native MRI					
Tracing					
Notes					

2C) AD

	123	122	121	120	119
Anatomical section					
Native MRI					
Tracing					
Notes		**Most posterior slice :** slice where an ovoid mass of gray matter (1) started to appear inferomedially of the atrium of lateral ventricle (2)  Sagittal view			2= Atrium of lateral ventricle 4= Parahippocampal gyrus 5= Gyrus dentatus 6= Cornu Ammonis 7= Gyrus fasciolaris 8= Gyrus of Andreas-Retzius 9= Isthmus

2C) AD

	118	117	116	115	114
Anatomical section					
Native MRI					
Tracing					
Notes					1= Superior excess of the quadrigeminal cistern 2= Temporal horn of lateral ventricle 3= CSF of ambient cistern 4= Parahippocampal gyrus 5= Fimbria (included in the tracing)

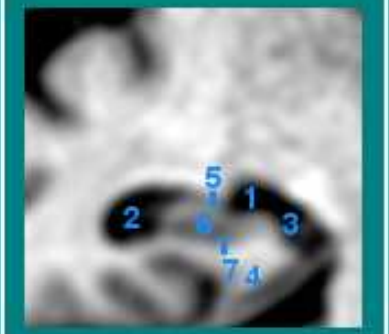
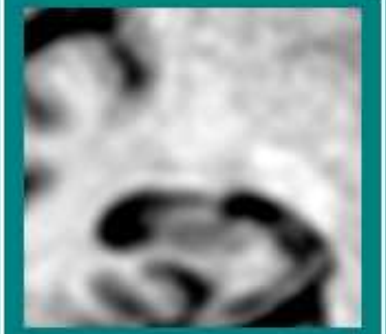
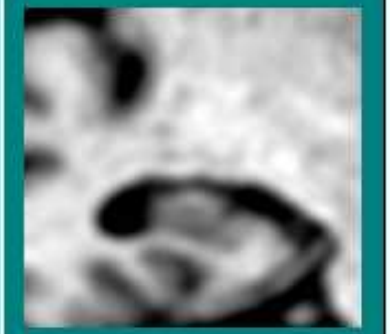
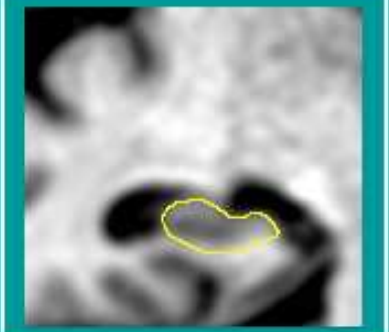
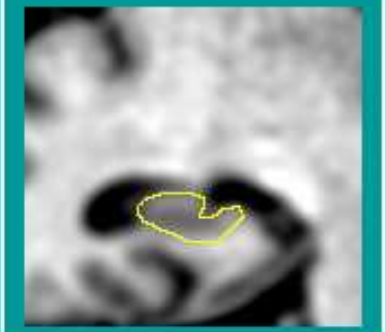
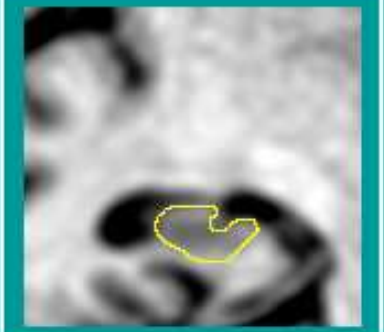
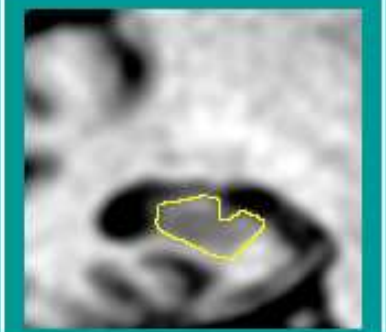
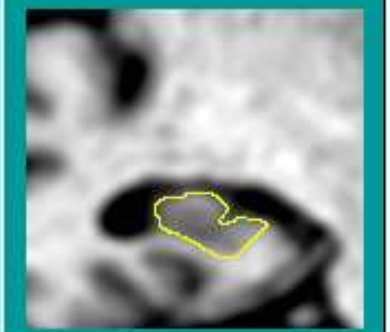
2C) AD

	113	112	111	110	109
Anatomical section					
Native MRI					
Tracing					
Notes					

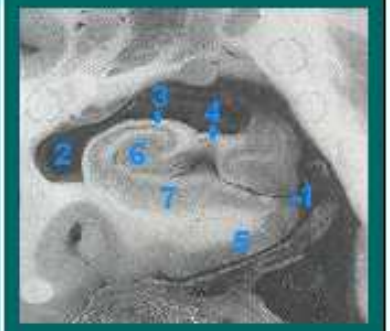
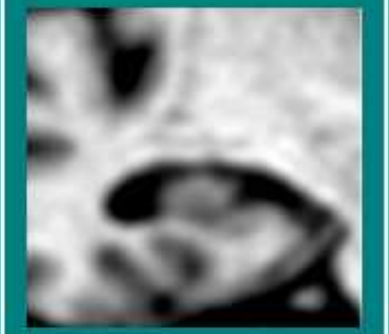
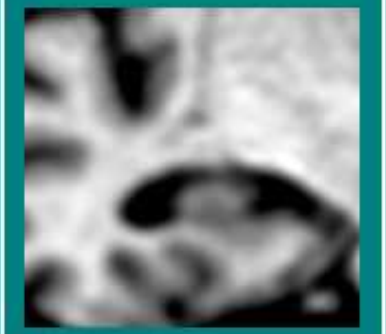
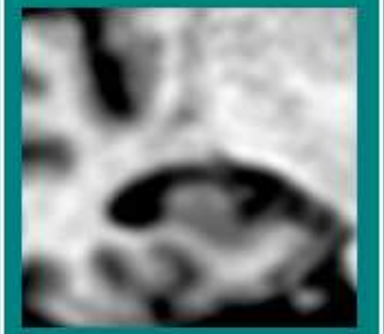
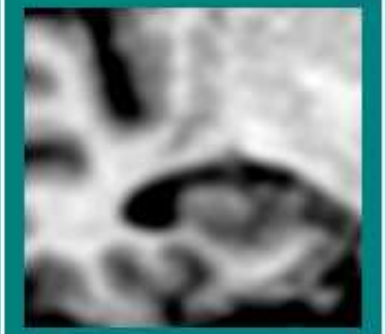
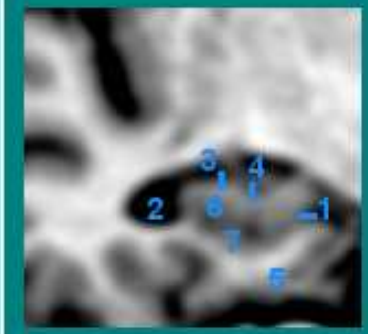
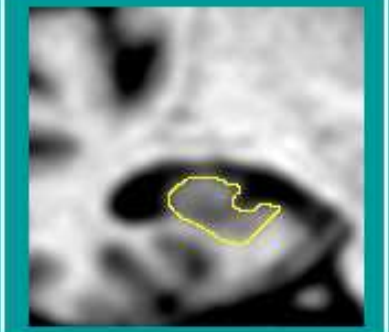
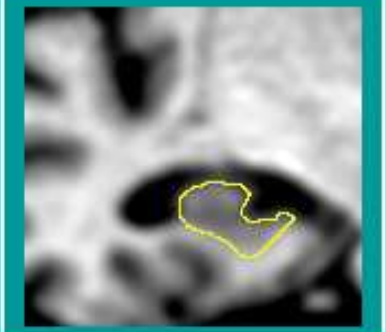
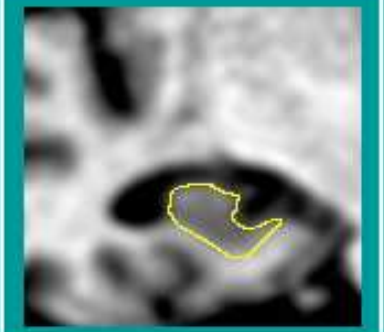
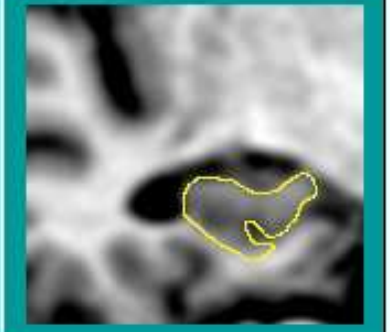
2C) AD

	108	107	106	105	104
Anatomical section					
Native MRI					
Tracing					
Notes					

2C) AD

	103	102	101	100	99
Anatomical section					
Native MRI					
Tracing					
Notes	1=Superior excess of the quadrigeminal cistern 2=Temporal horn of lateral ventricle 3=CSF of ambient cistern 4= Parahippocampal gyrus 5= Fimbria (included in the tracing) 6= Gyrus dentatus 7= Subiculum				

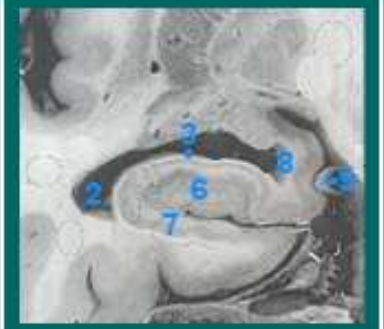
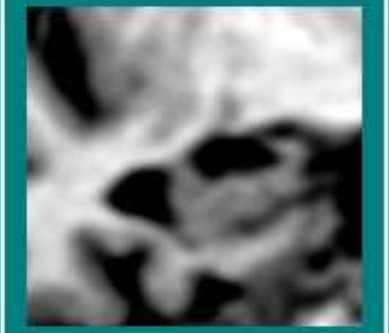
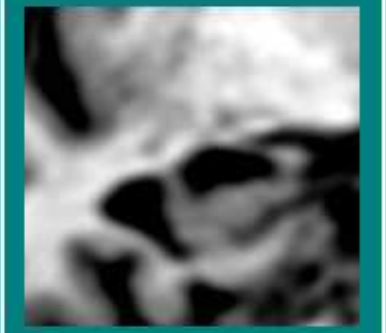
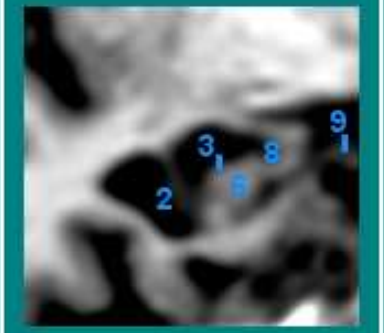
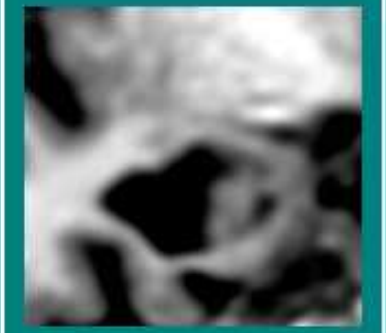
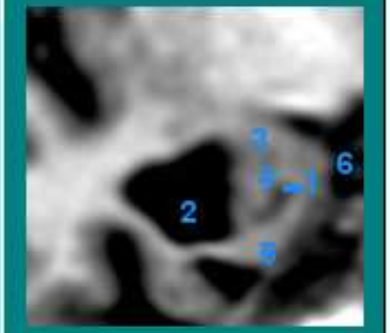
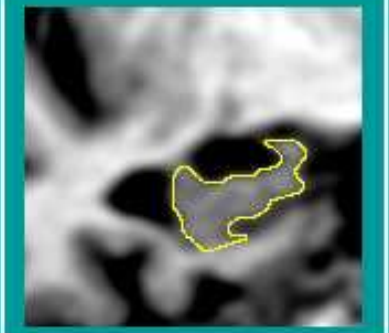
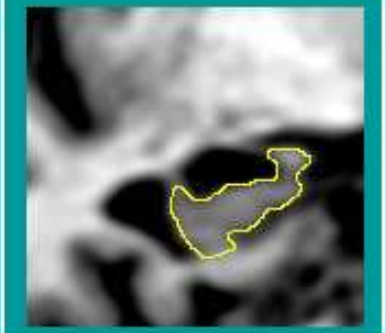
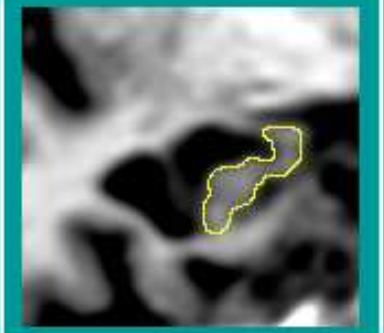
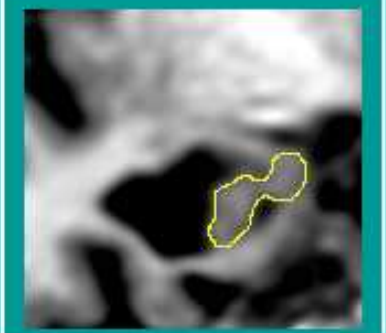
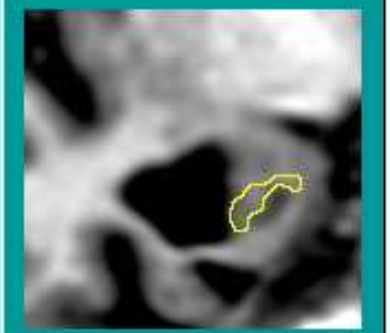
2C) AD

	98	97	96	95	94
Anatomical section					
Native MRI					
Tracing					
Notes					1= Uncal sulcus 2= Temporal horn of lateral ventricle 3= Alveus (included) 4= Fimbria (included) 5= Parahippocampal gyrus 6= Gyrus dentatus 7= Subiculum

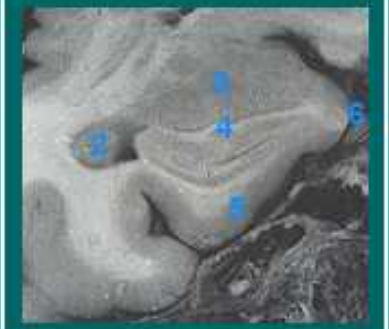
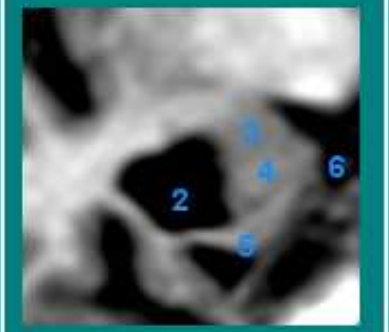
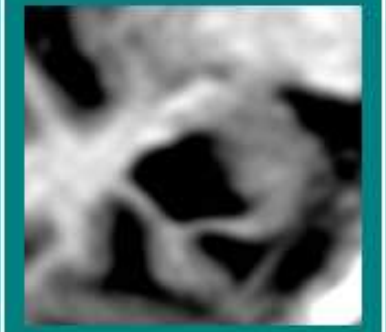
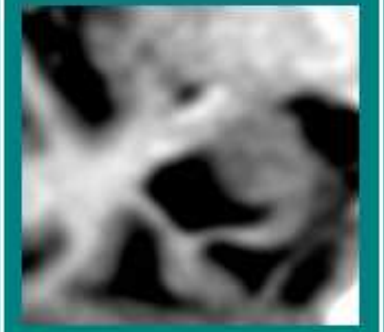
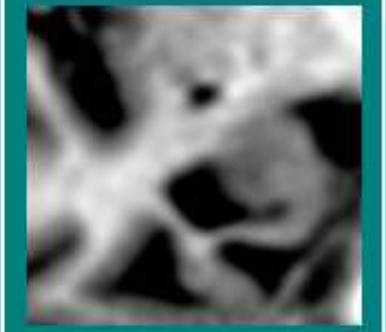
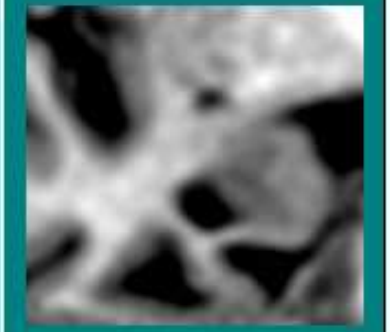
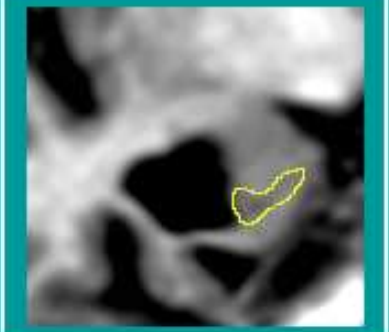
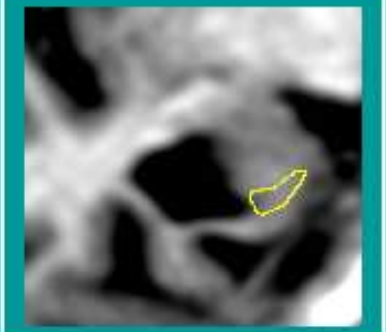
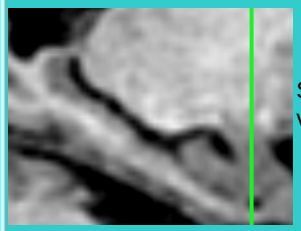
2C) AD

Anatomical section	93	92	91	90	89
Native MRI					
Tracing					
Notes					

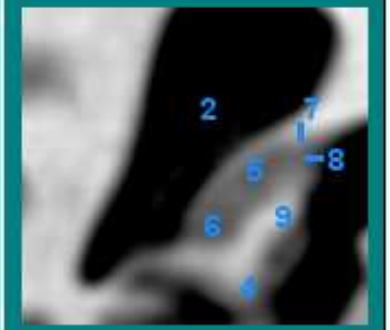
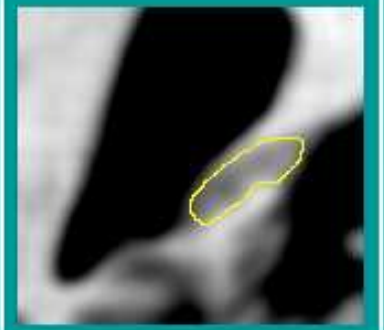
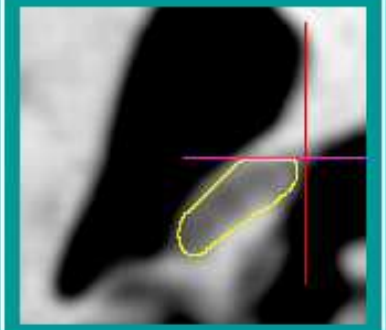
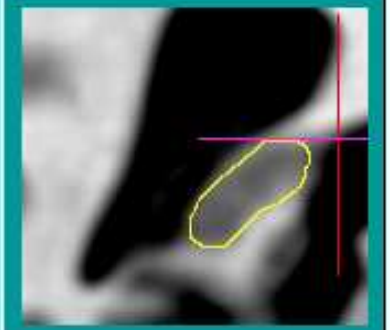
2C) AD

	88	87	86	85	84
Anatomical section					
Native MRI					
Tracing					
Notes			2= Temporal horn of lateral ventricle 3= Alveus (included) 6= Gyrus dentatus 7= Subiculum 8= Vertical digitation 9= Posterior cerebral artery		1= Uncal sulcus 2= Temporal horn of lateral ventricle 3= Amygdala 4= Alveus 5= Parahippocampal gyrus 6= CSF of ambient cistern

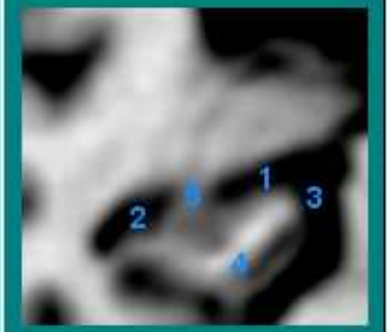
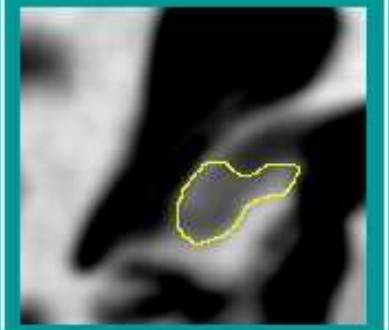
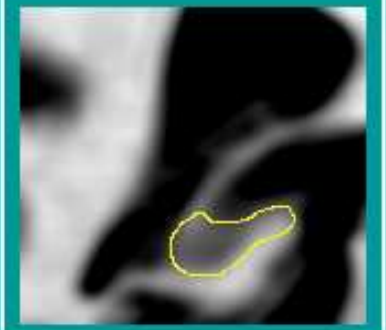
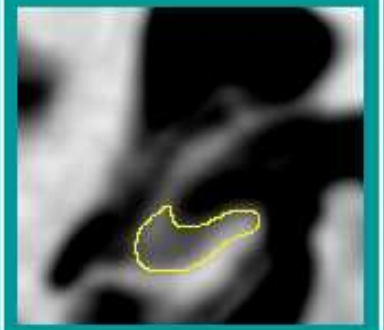
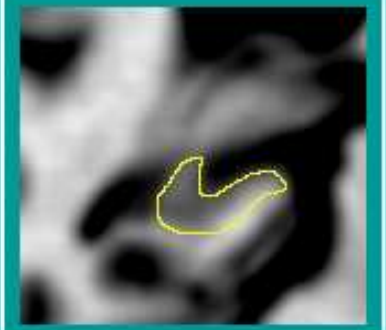
2C) AD

	83	82	81	80	79
Anatomical section					
Native MRI					
Tracing					
Notes	2= Temporal horn of lateral ventricle 3= Amygdala 4= Alveus 5= Parahippocampal gyrus 6= CSF of ambient cistern	**Most anterior slice:** slice where one of the following is visible: alveus temporal horn of lateral ventricle or amygdala  Sagittal view			

2D) AD

	84	85	86	87	88
Anatomical section					
Native MRI					
Tracing					
Notes			1= Hippocampal tail 2= Atrium of lateral ventricle		2= Atrium of lateral ventricle 4= Parahippocampal gyrus 5= Gyrus dentatus 6= Cornu Ammonis 7= Gyrus fasciolaris 8= Gyrus of Andreas-Retzius 9= Isthmus

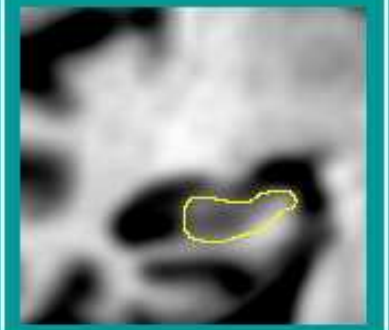
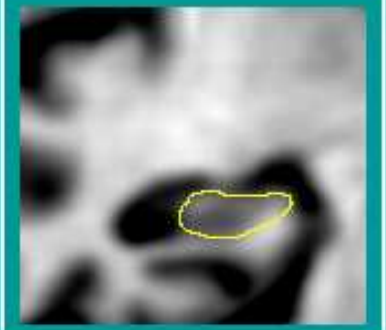
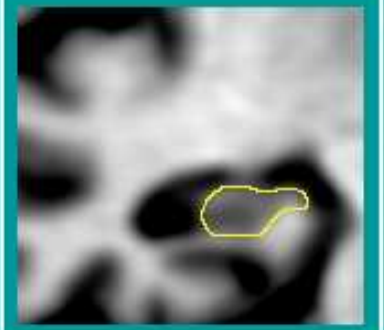
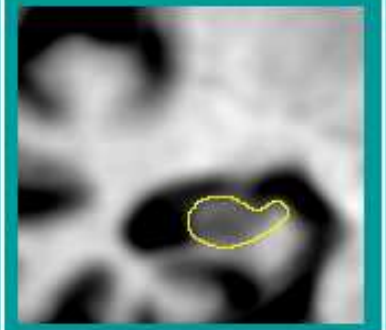
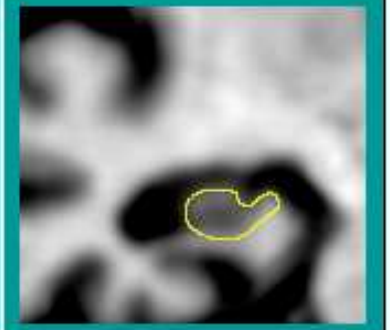
2D) AD

	89	90	91	92	93
Anatomical section					
Native MRI					
Tracing					
Notes					1=Superior excess of the quadrigeminal cistern 2=Temporal horn of lateral ventricle 3=CSF of ambient cistern 4= Parahippocampal gyrus 5= Fimbria (included in the tracing)

2D) AD

	94	95	96	97	98
Anatomical section					
Native MRI					
Tracing					
Notes					

2D) AD

	99	100	101	102	103
Anatomical section					
Native MRI					
Tracing					
Notes		1=Superior excess of the quadrigeminal cistern 2=Temporal horn of lateral ventricle 3=CSF of ambient cistern 4= Parahippocampal gyrus 5= Fimbria (included in the tracing) 6= Gyrus dentatus 7= Subiculum			

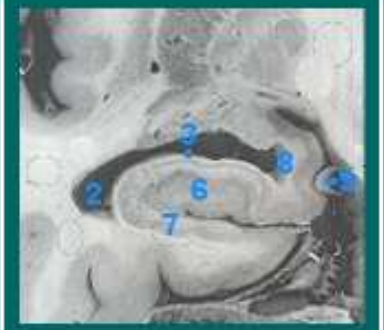
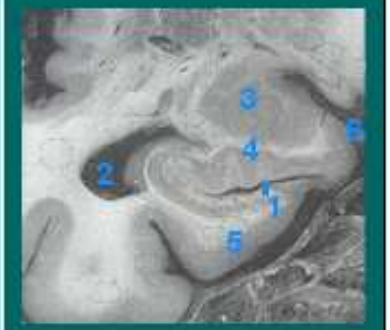
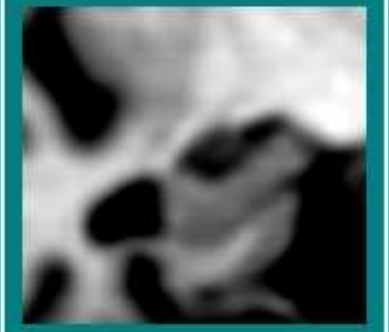
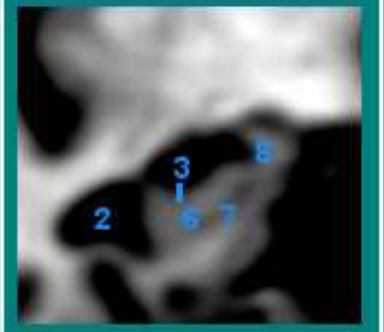
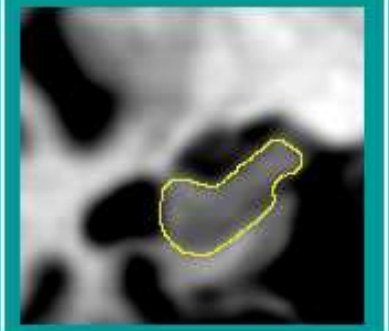
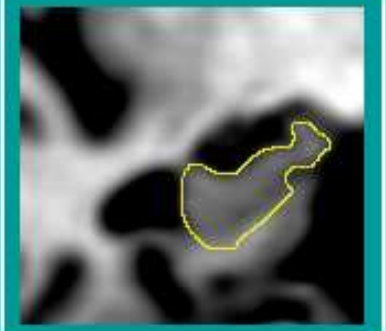
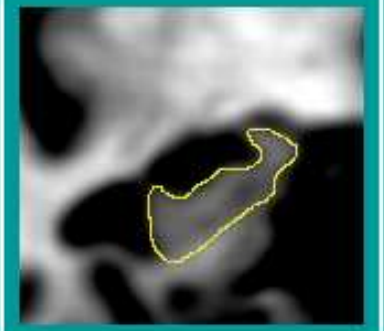
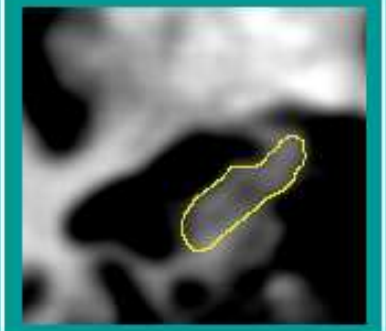
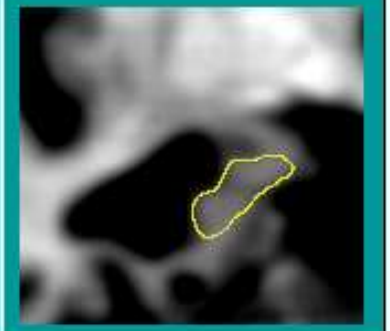
2D) AD

	104	105	106	107	108
Anatomical section					
Native MRI					
Tracing					
Notes					

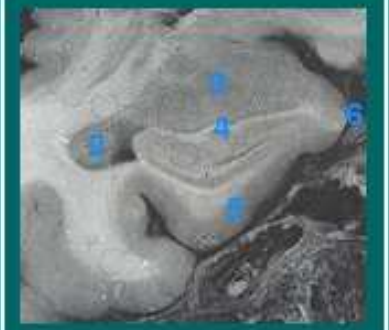
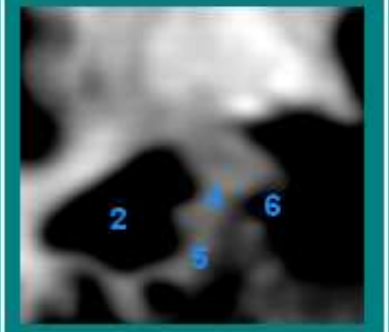
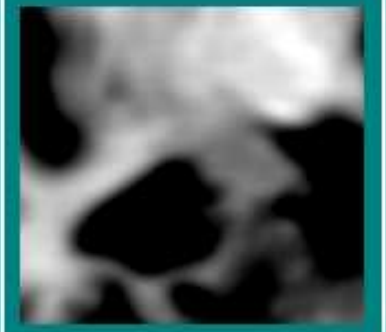
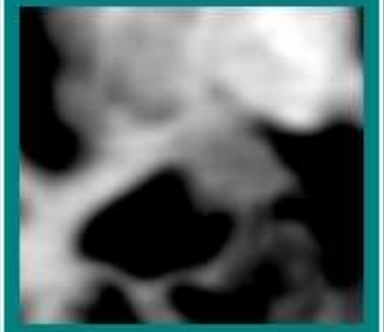
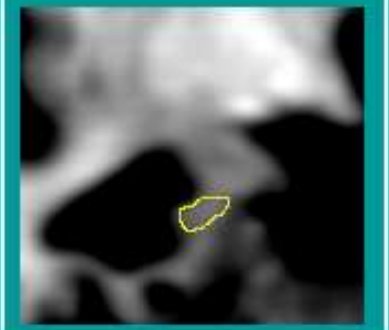
2D) AD

	109	110	111	112	113
Anatomical section					
Native MRI					
Tracing					
Notes					

2D) AD

	114	115	116	117	118
Anatomical section					
Native MRI					
Tracing					
Notes			2= Temporal horn of lateral ventricle 3= Alveus (included) 6= Gyrus dentatus 7= Subiculum 8= Vertical digitation 9= Posterior cerebral artery		1= Uncal sulcus 2= Temporal horn of lateral ventricle 3= Amygdala 4= Alveus 5= Parahippocampal gyrus 6= CSF of ambient cistern

2D) AD

	119	120	121		
Anatomical section					
Native MRI					
Tracing					
Notes	2= Temporal horn of lateral ventricle 3= Amygdala 4= Alveus 5= Parahippocampal gyrus 6= CSF of ambient cistern				