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Delphi consensus on landmarks for the manual segmentation of the hippocampus on MRI: preliminary results from the EADC-ADNI Harmonized Protocol working group

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Nothing else to disclose*

BACKGROUND

**Standardized hippocampal atrophy quantification
needed as:**

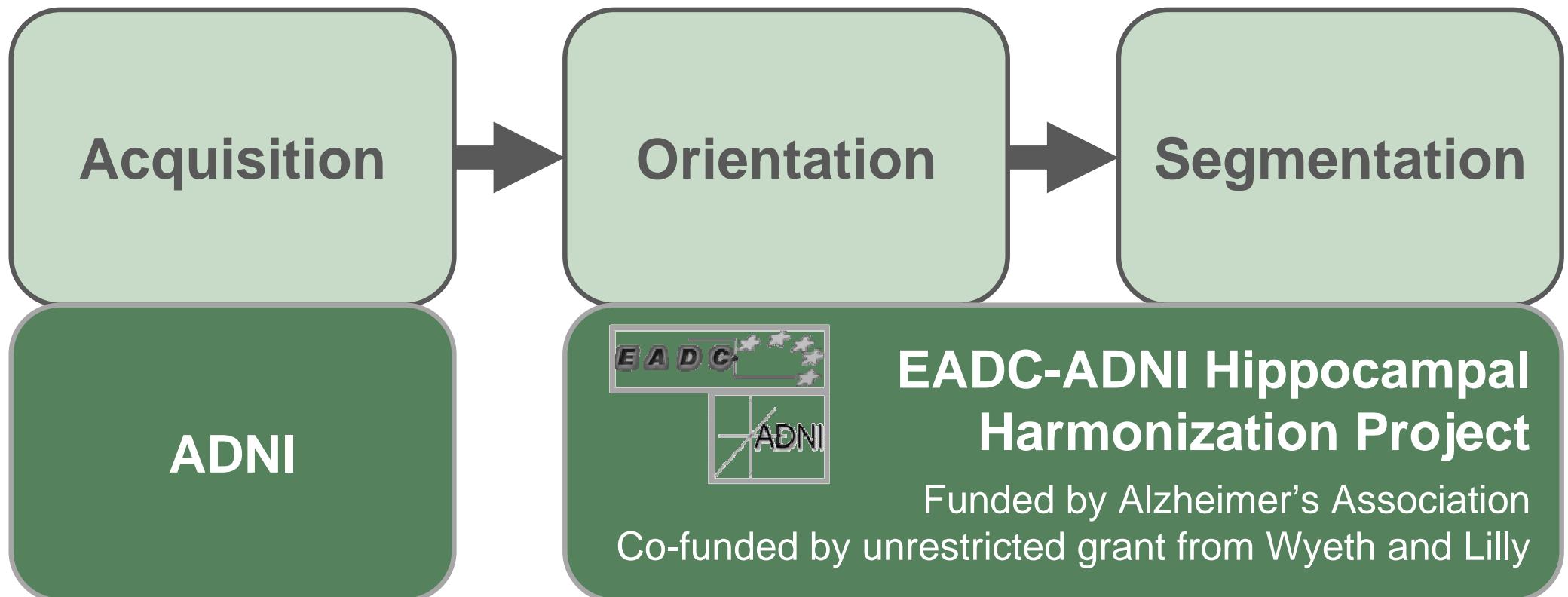
- Biomarker for early diagnosis of AD
- Surrogate marker tracking disease progression in clinical trials
- Validation of automated segmentation algorithms

There's more than 40 (very!) different ways to manually segment the hippocampus, resulting in wildly different volume estimates

Ref.	Med border	Lat border	Inf border	Norm. hippo vol (cm³)	
				Left	Right
Watson et al.	Mesial edge of temporal lobe	Temp horn of lat ventr	Incl subicular complex & uncal cleft w/ border separating subicular complex from	4.903	5.264
Zipursky et al.	Regional outline at choroidal fissure	Not mentioned	... margin of hippocampal tissue and parahippocampal gyrus white matter	1.990	2.070

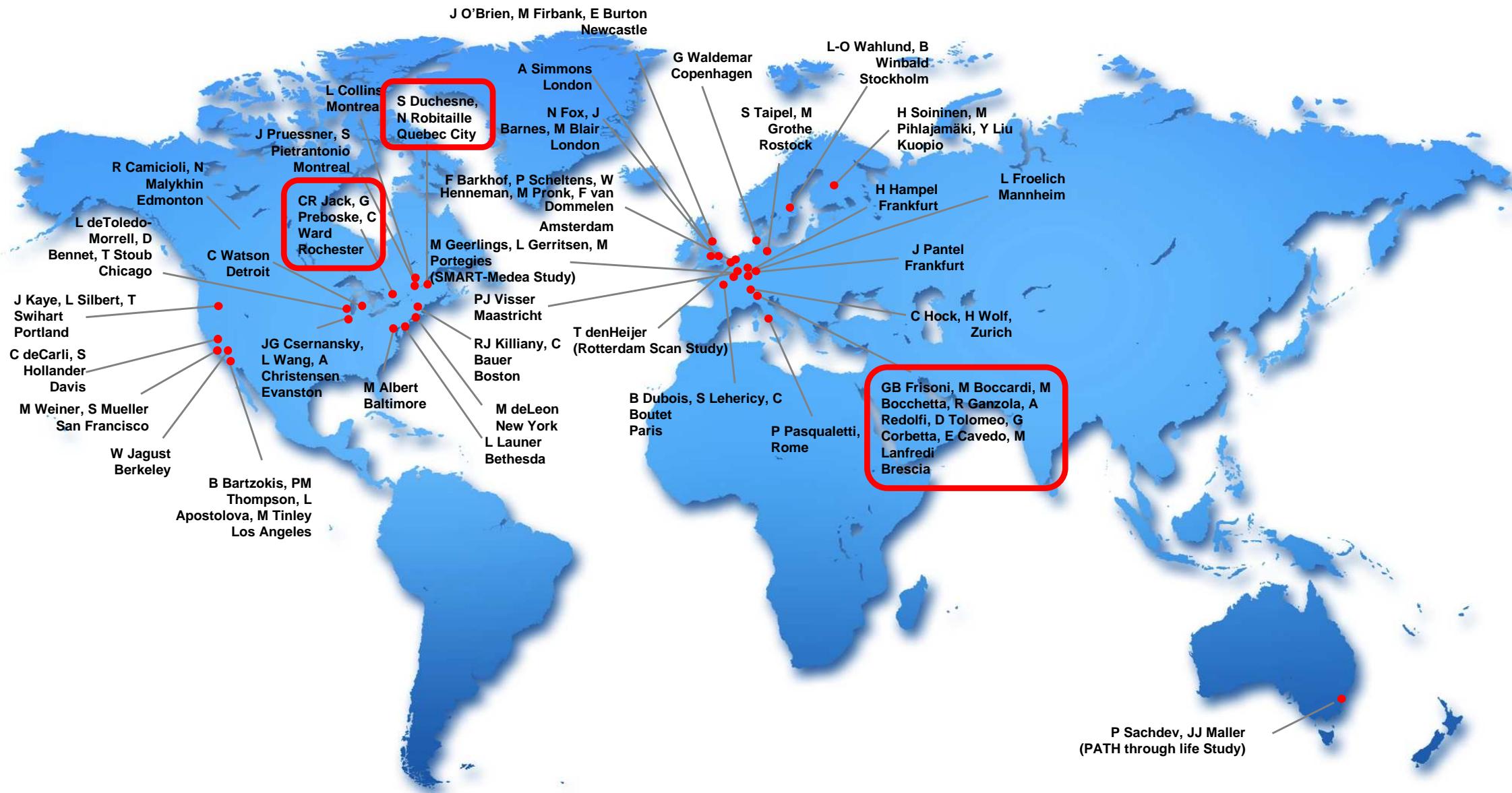
2.5-fold difference

Standardization of manual hippocampal volumetry



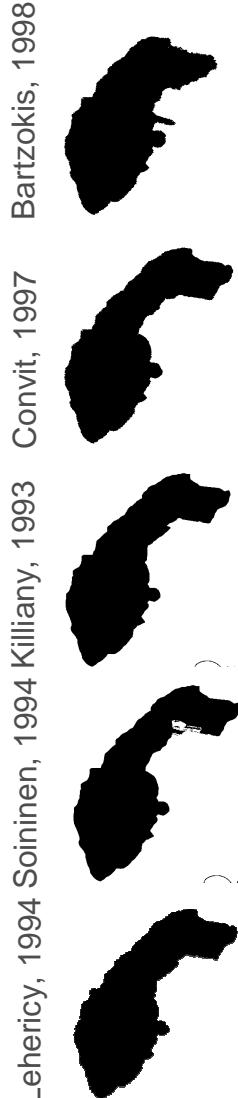


The EADC-ADNI Working Group on the Harmonized Protocol for Hippocampal Volumetry



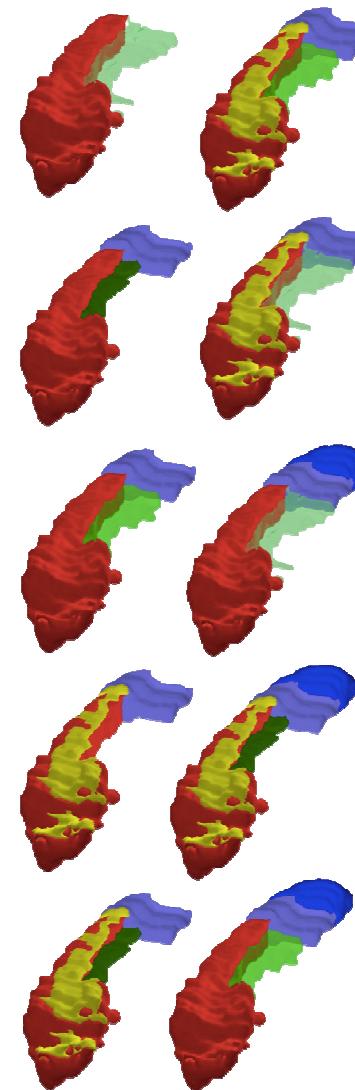
METHODS

Survey and operationalization



Watson, 1992 Pantel, 2000 Pruessner, 2000 Malykhin, 2007 Haller, 1997 Jack, 1994; de Toledo-Morrell, 2004

Break down into segmentation units



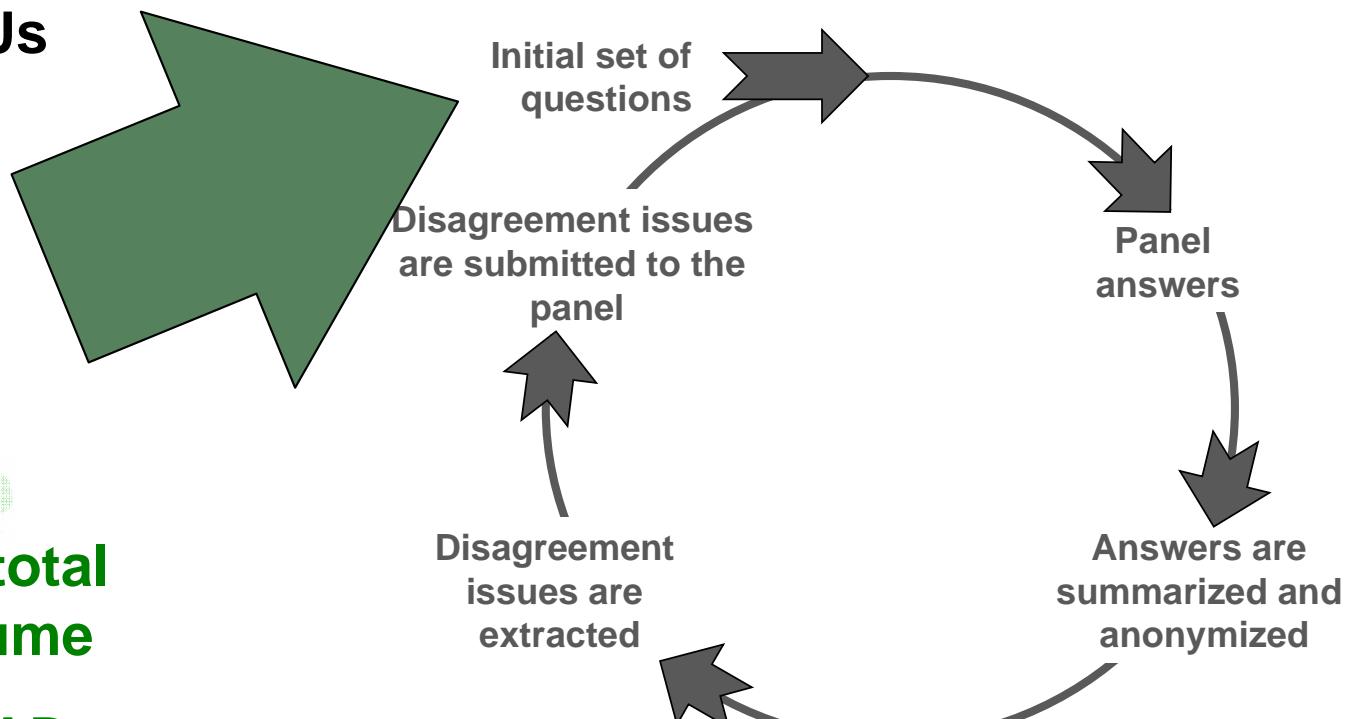
Assessment of measurement properties of SUs



METHODS

Assessment of measurement properties of SUs

- Stability of segmentation
- Contribution to total hippocampal volume
- Contribution to AD-related atrophy





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H Soininen
Kuopio



L Wang
Chicago



C Watson
Detroit



H Wolf
Zurich



Delphi panel questions

Likert

9 8 7 6

5

4 3 2 1

Agree

Neutral

Disagree

N (%)

N (%)

N (%)

Segmentation Units to be included

Inclusion of alveus/fimbria

Segmentation of subiculum (morphology - I choice)

Segmentation of subiculum (horizontal - II choice)

Inclusion of tail end

Harmonized Hippocampus

Segmentation Modality

Disambiguating amygdala with 3D navigation

Inclusion of vestigial tissue

CSF pools

Not visible structures (final definition)

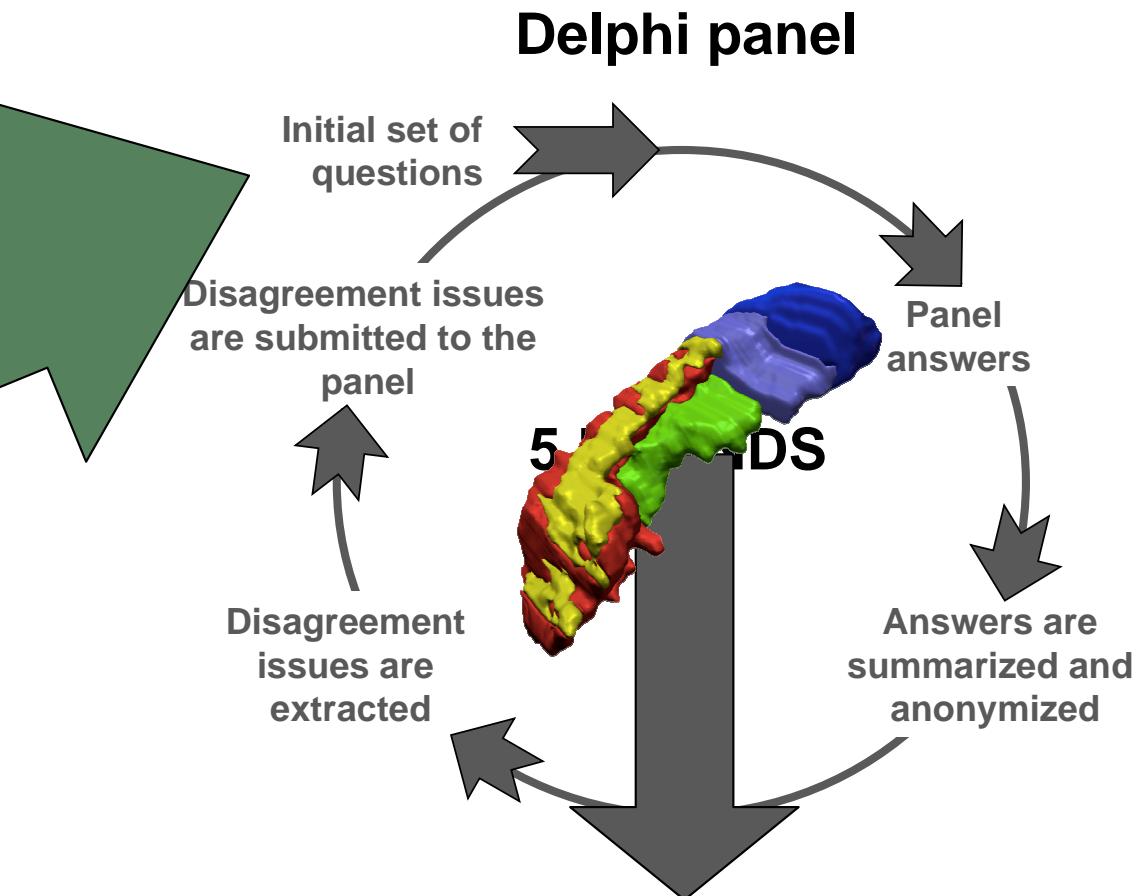
Separating Alveus/Fimbria from fornix

AC-PC Image orientation

METHODS

Assessment of measurement properties of SUs

- Stability of segmentation
 - Contribution to total hippocampal volume
 - Contribution to AD-related atrophy



Covers 100% of hippo proper
Captures 100% of AD atrophy
Very high IRR & TRTR: <.96

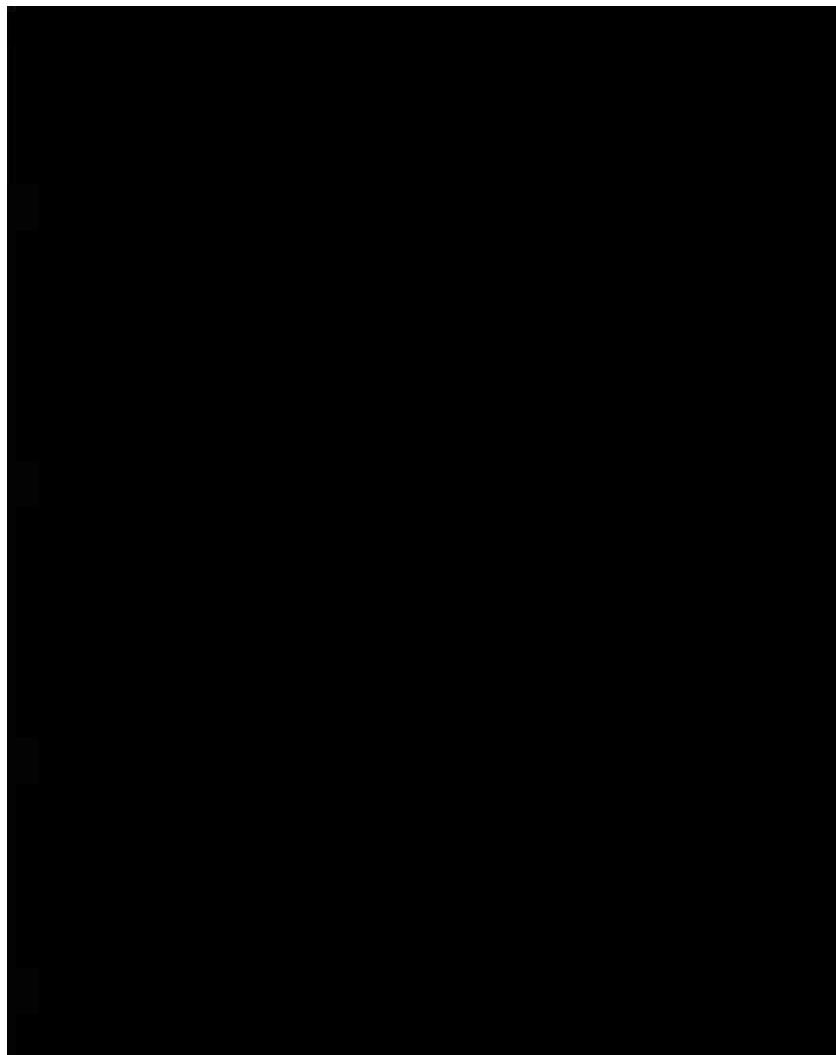
Delphi panel results

	Round	Median	Agree N (%)	Neutral N (%)	Disagree N (%)	P (Binomial)
<i>Segmentation Units to be included</i>						
Inclusion of alveus/fimbria	II	9	13 (81%)	0 (0%)	3 (19%)	0.021
Segmentation of subiculum (morphology - I choice)	III	7.5	11 (69%)	4 (25%)	1 (6%)	0.006
Segmentation of subiculum (horizontal - II choice)	III	-	13 (81%)	0 (0%)	3 (19%)	0.021
Inclusion of tail end	III	9	12 (75%)	2 (12.5%)	2 (12.5%)	0.013
Harmonized Hippocampus	II	8	14 (88%)	1 (6%)	1 (6%)	0.001
<i>Segmentation Modality</i>						
Disambiguating amygdala with 3D navigation	II	8	16 (100%)	0 (0%)	0 (0%)	<0.0005
Inclusion of vestigial tissue	III	-	10 (63%)	0 (0%)	6 (37%)	n.s.
CSF pools	III	8	14 (88%)	0 (0%)	2 (12%)	0.004
Not visible structures (final definition)	III	8	16 (100%)	0 (0%)	0 (0%)	<0.0005
Separating Alveus/Fimbria from fornix	IV	8	12 (82%)	0 (0%)	1 (8%)	0.003
AC-PC Image orientation	V	8.5	11 (79%)	2 (14%)	1 (7%)	0.006

How is the Harmonized Protocol Working?

Agreement among L Apostolova, M Bocchetta, G Preboske

Subject 3, AC/PC, Right HC, Slice 001



FUTURE STEPS

- 1. Develop a qualification environment and thresholds for**
 - naïve tracers
 - automated algorithms
- 2. Validate on:**
 - 1800 ADNI hippocampi segmented by 20 human tracers
 - 20x2 (R&L) hippocampi with volume on pathology, neuronal density, and *ex vivo* MR
- 3. Availability of protocol and benchmark masks:**
 - Until the end of validation process (summer 2013), restricted to beta-testers based on ad hoc agreements
 - Free afterwards

More info

www.hippocampal-protocol.net

SOPs

Rohlwing Rd, Addison, D... × UNIL Lemanic Neuroscience - ... × UNIGE - ENSEIGNEMENT ... × UNIL Lemanic Neuroscience - ... × UNIGE - ENSEIGNEMENT ... × +

http://www.hippocampal-protocol.net/SOPs/publications.html

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A HARMONIZED PROTOCOL FOR HIPPOCAMPAL VOLUMETRY: AN EADC-ADNI EFFORT



About the Project Outcomes News & Events References

PUBLICATIONS

Full Papers

Frisoni GB, Jack CR.
Harmonization of magnetic resonance-based manual hippocampal segmentation: A mandatory step for wide clinical use.
Alzheimer's & Dementia, Volume 7, Issue 2, Pages 171-174, March 2011.

Jack CR, Barkhof F, Bernstein MA, Cantillon M, Cole PE, DeCarli C, Dubois B, Duchesne S, Fox NC, Frisoni GB, Hampel H, Hill DLG, Johnson K, Mangin J, Scheltens P, Schwarz AJ, Sperling R, Suhy J, Thompson PM, Weiner M, Foster NL.
Steps to standardization and validation of hippocampal volumetry as a biomarker in clinical trials and diagnostic criterion for Alzheimer's disease.
Alzheimer's & Dementia, Volume 7, Issue 4, Pages 474-485, July 2011.

Boccardi M, Ganzola R, Bocchetta M, Pievani M, Redolfi A, Bartzokis G, Carmicioli R, Csernansky J, de Leone MJ, de Toledo-Morrell L, Killiany RJ, Lehericy S, Pantel J, Pruessner JC, Soininen H, Watson C, Duchesne S, Jack CR Jr, Frisoni GB.
Survey of Protocols for the Manual Segmentation of the Hippocampus: Preparatory Steps Towards a Joint EADC-ADNI Harmonized Protocol.
Journal of Alzheimer's Disease, Volume 26, Issue 1, Pages 61-75, January 2011.

Congress Presentations

AAN 2010 (Toronto, April 10-17):
Frisoni GB, Boccardi M, Ganzola R, Duchesne S, Robitaille N, Redolfi A, Bartzokis GB, Csernansky J, de Leon MJ, Killiany RJ, Lehericy S, Malykhin NV,

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WORKING ON STANDARDIZATION OF THE HIPPOCAMPUS

