

Hearing Loss and Dementia: Who is at Risk?

Thoughts by:

Richard K. Gurgel, M.D.

May 15th, 2015



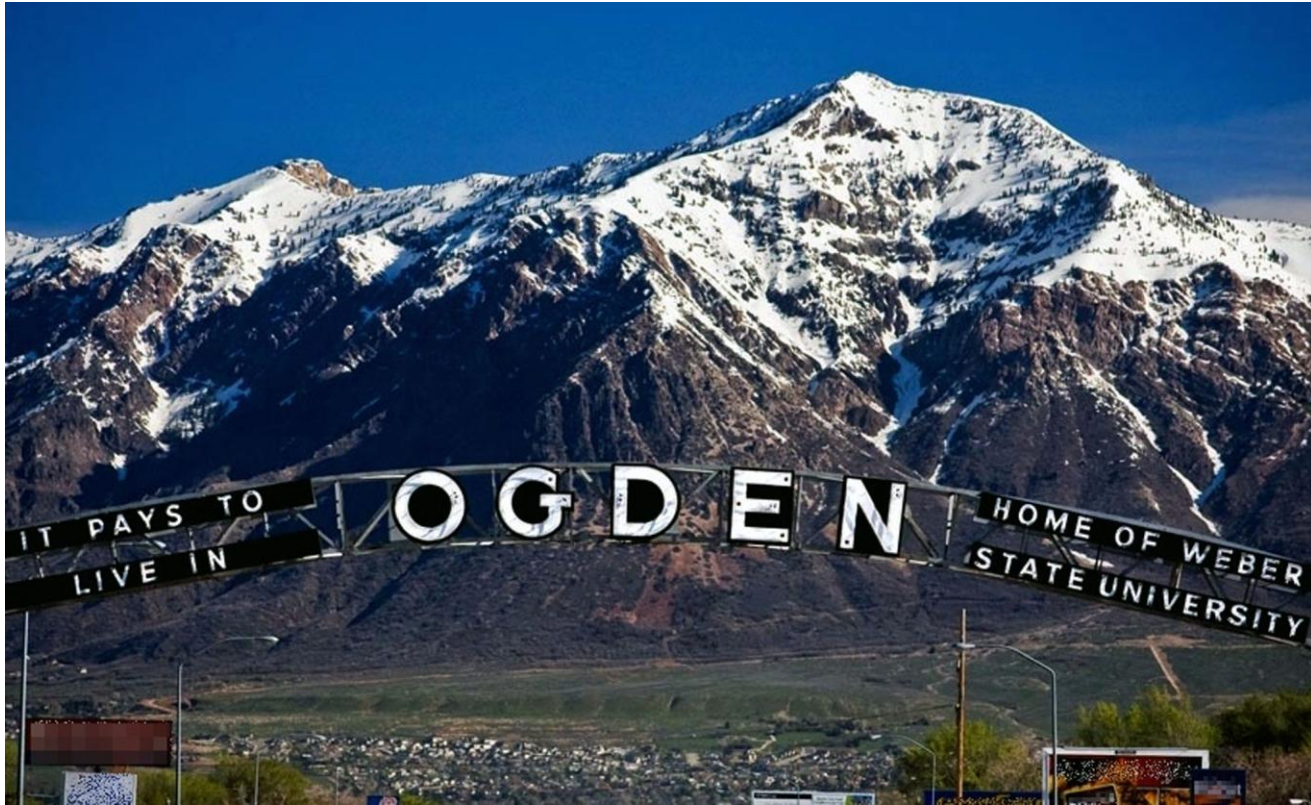
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Disclosures

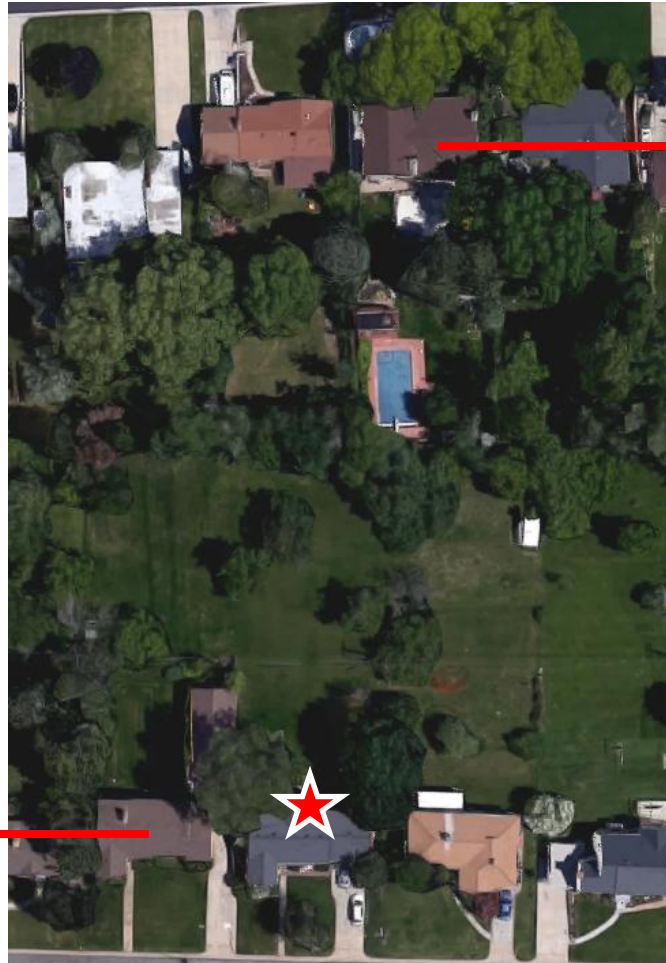
- Surgical advisory board for Med-EI
- Research funding from the American Otological Society



Background



D. Wilson
Hales (2009)



Objectives

- **There is more to hearing than just hearing**
 - Communication, relationships
 - Psychosocial effects
 - Cognitive ability – brain activity



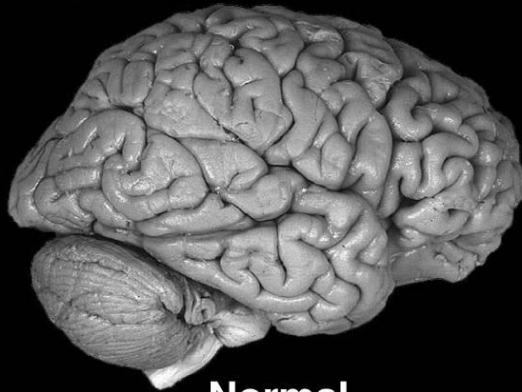
Alzheimer's Disease Risk

- Genetics: APOE- ϵ 4, Trisomy 21
- Cardiovascular
- Head Injury
- Depression

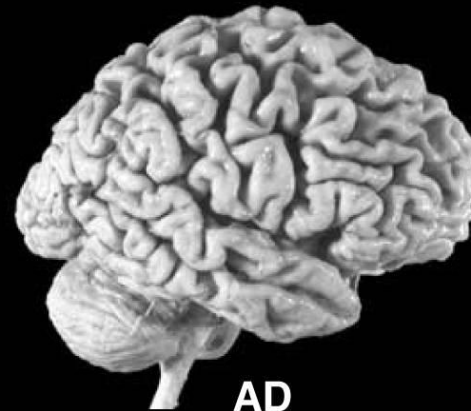


The Problem

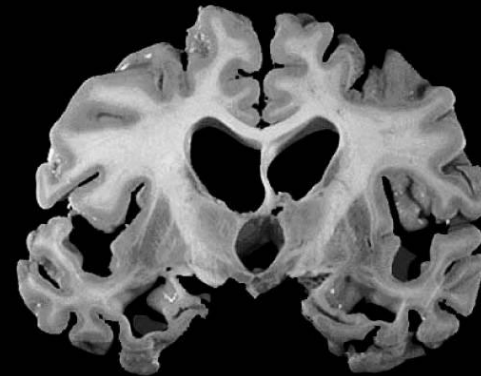
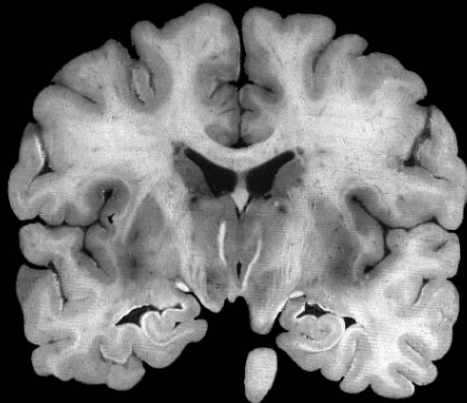
Brain Atrophy in Advanced Alzheimer's Disease



Normal



AD



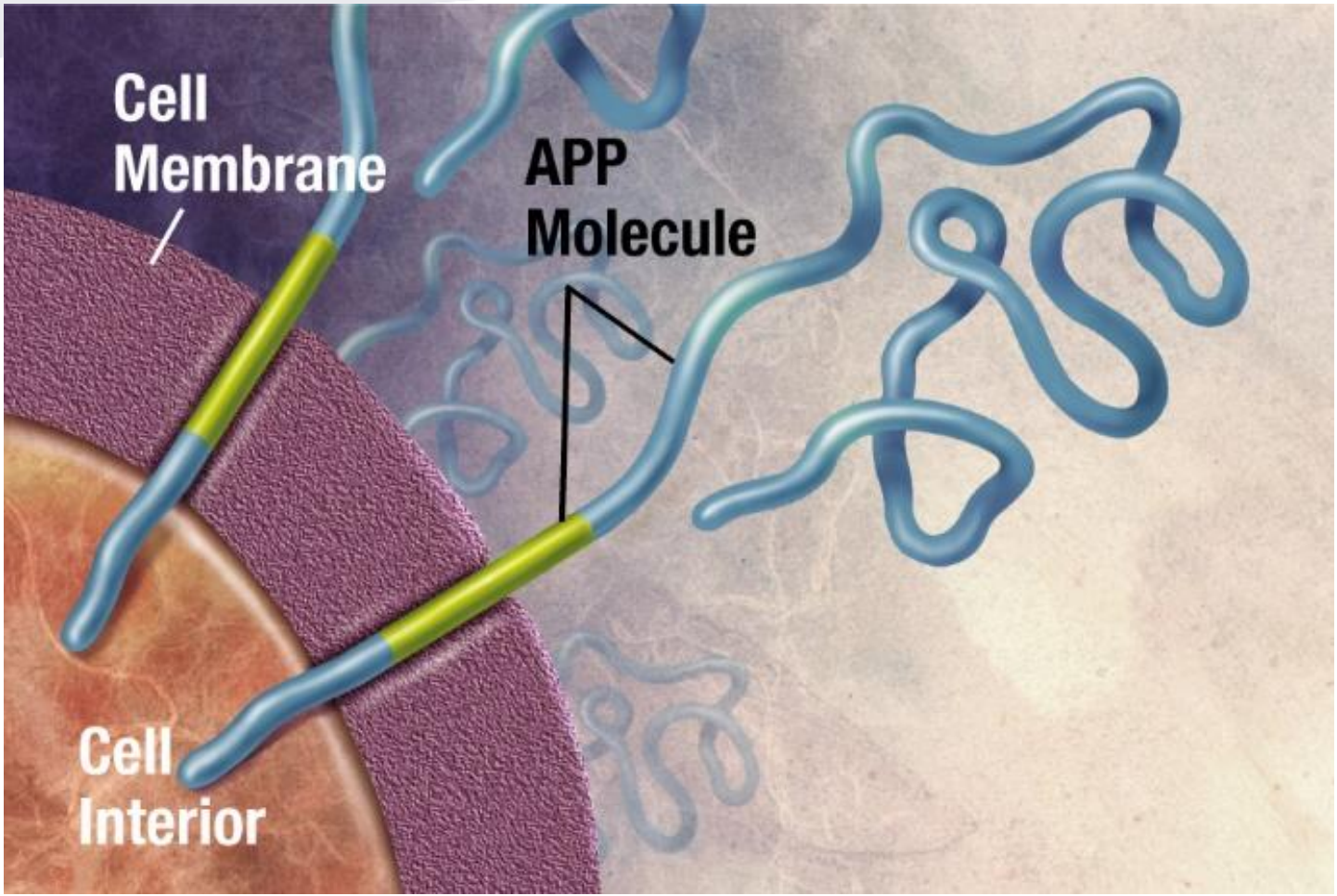
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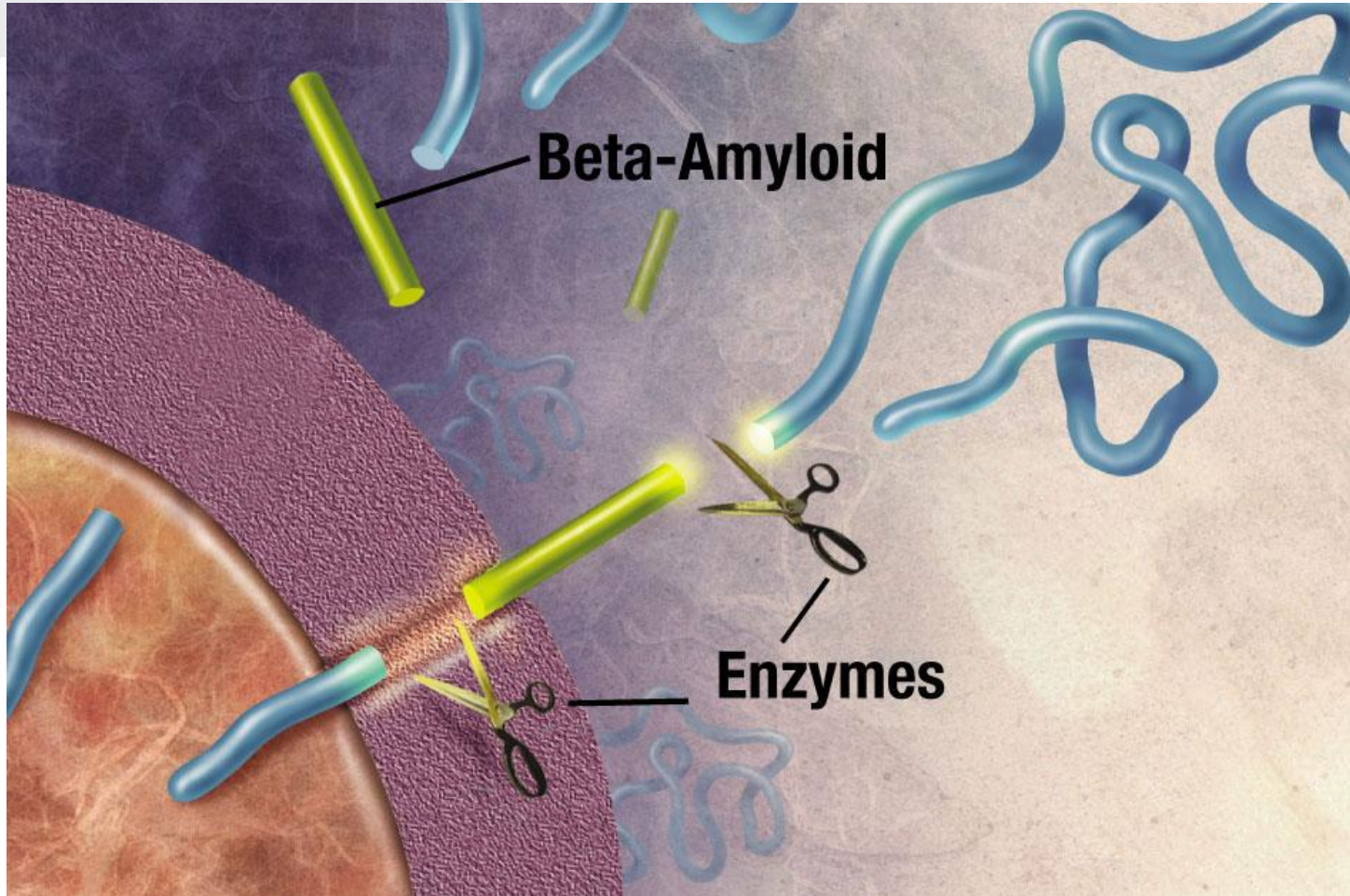


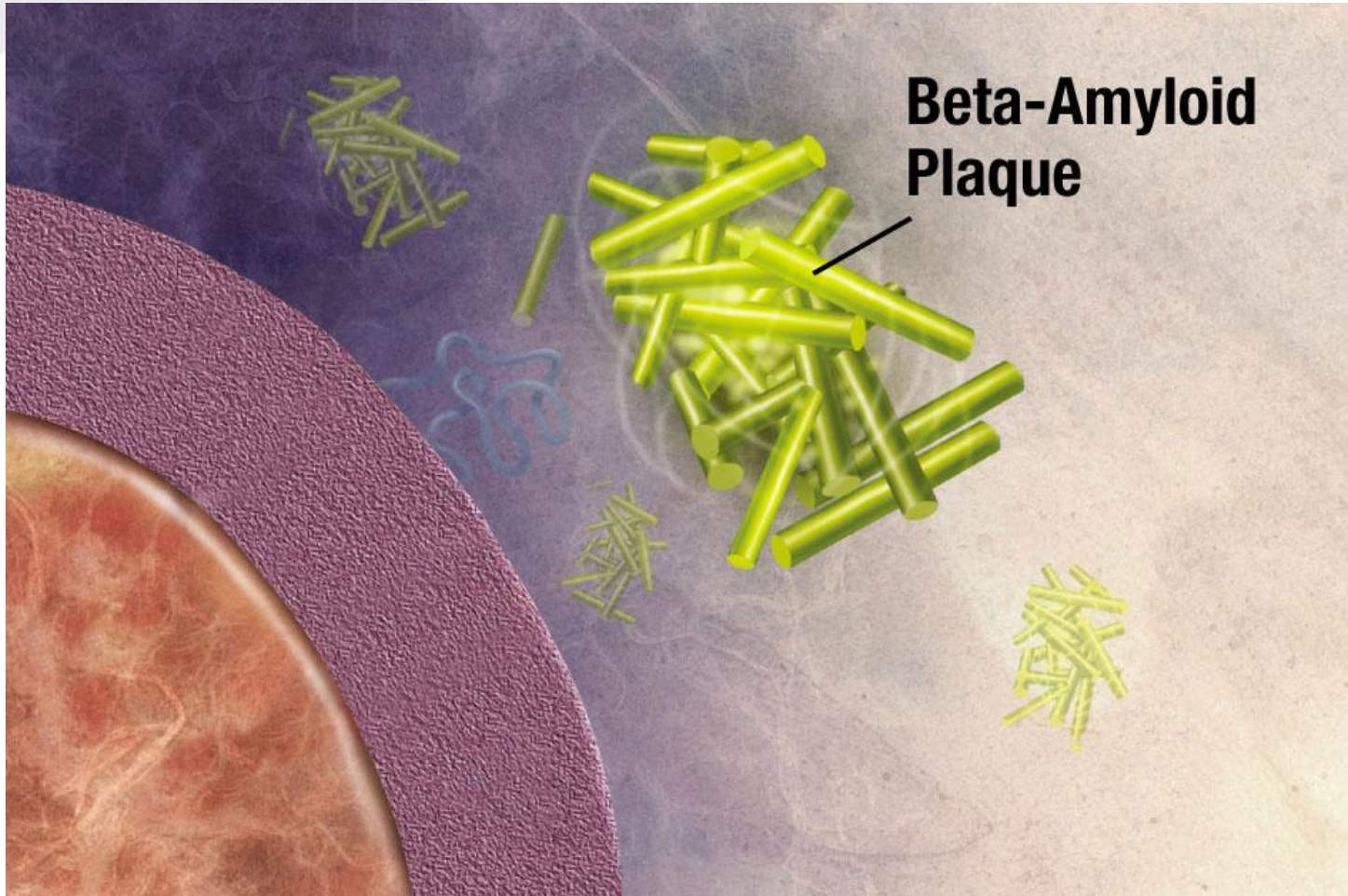
The Problem

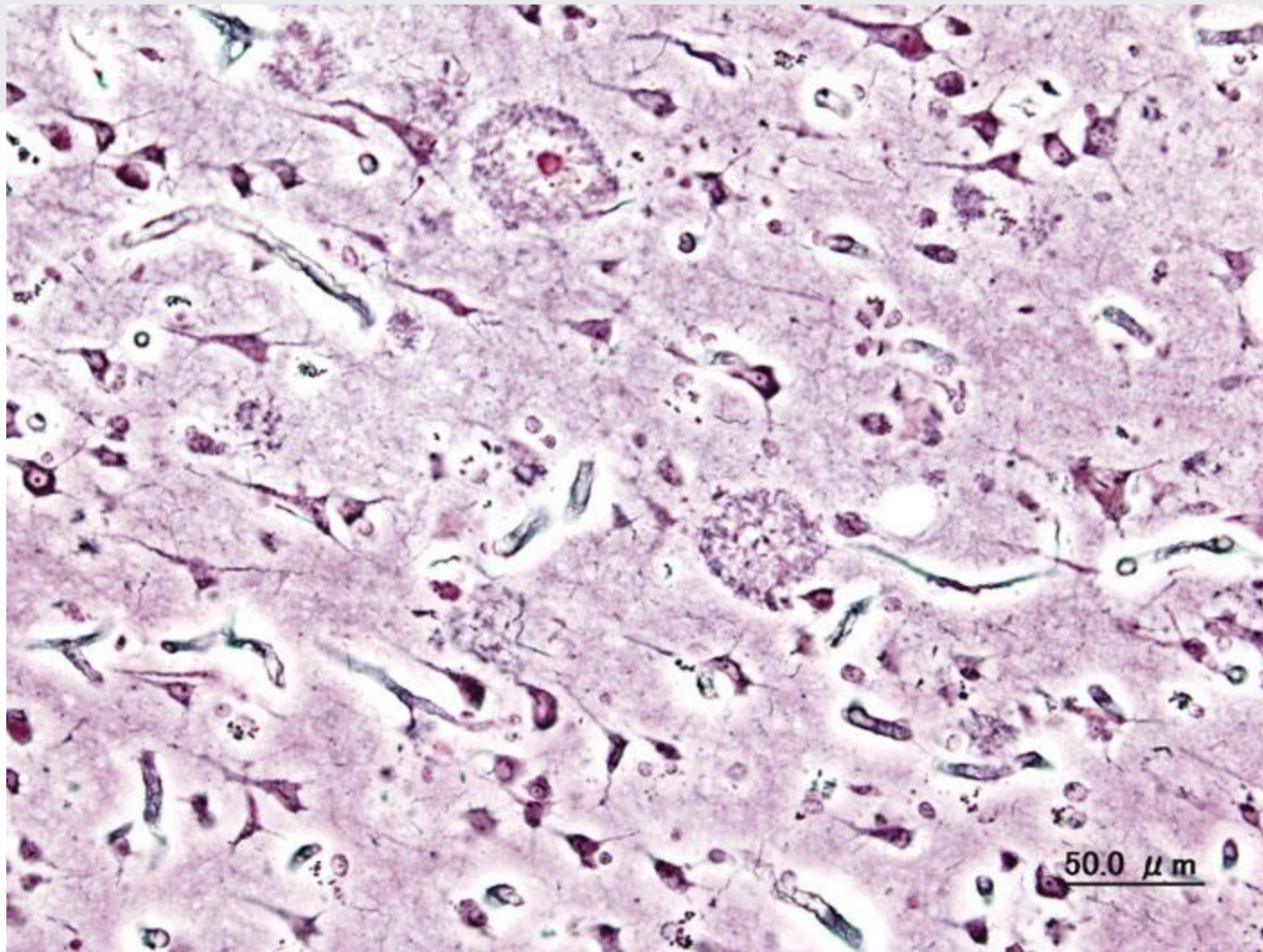
- Incidence of Alzheimer's disease is rapidly increasing:
 - 2010: 4.7 million
 - 2050: 13.8 million











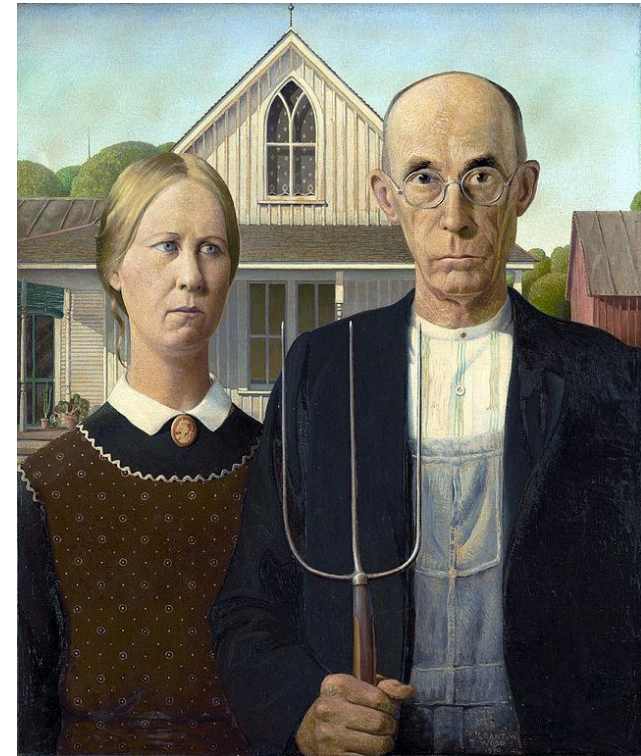
Hearing Loss

- Hearing loss is one the most prevalent sensory neurologic deficits in the elderly
 - 25-40% in adults above 65 years old
 - >80% in people older than 85 years

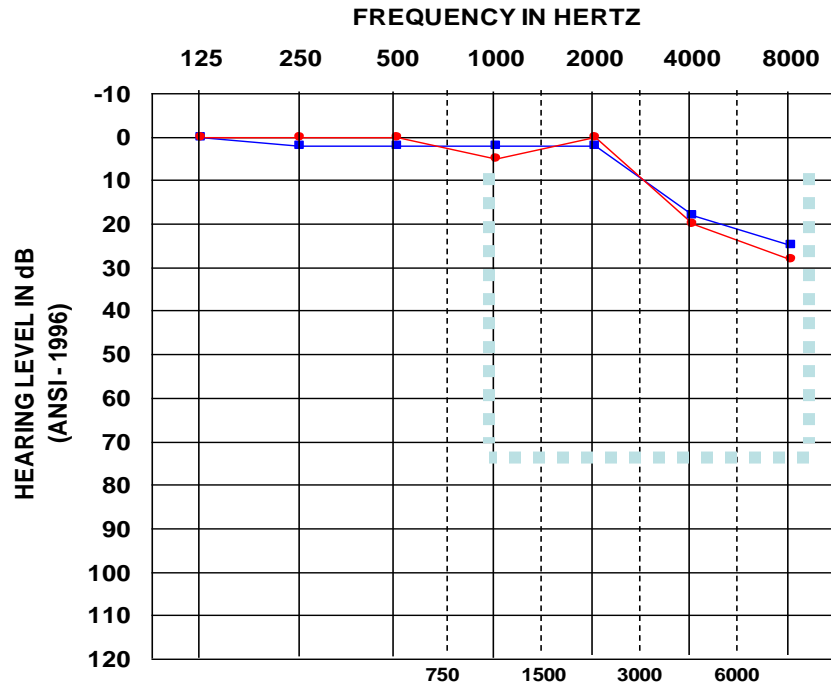


Presbycusis

- Effects 75% over age 60
- Males > females (differential noise exposure?)
- No association with hypertension, cardiovascular disease, hypercholesterolemia (Framingham cohort)
- Correlation with diabetes - inconclusive
- Genetically determined, at least in part



Presbycusis

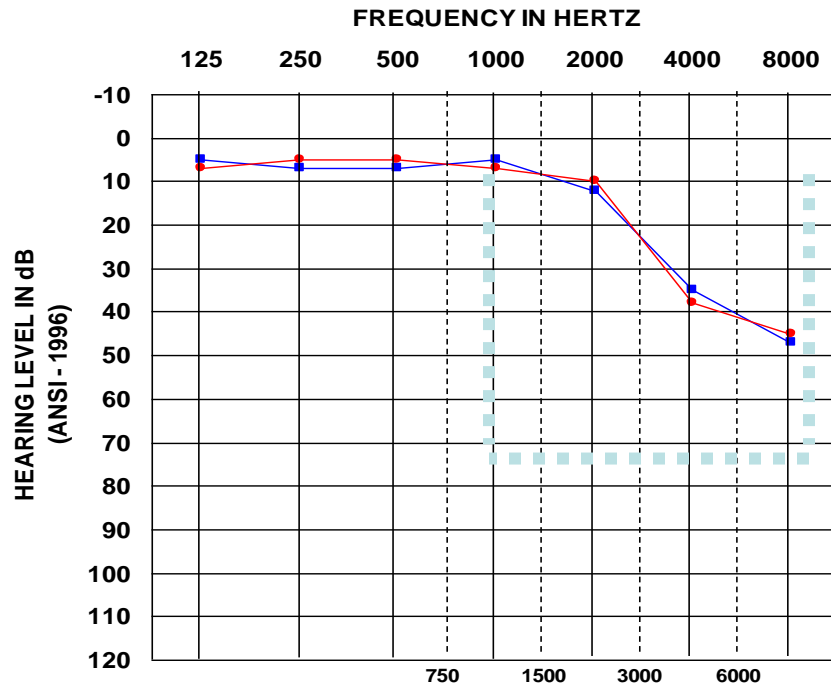


**Word
Recognition
Score**

**R = 100%
L = 100%**



Presbycusis



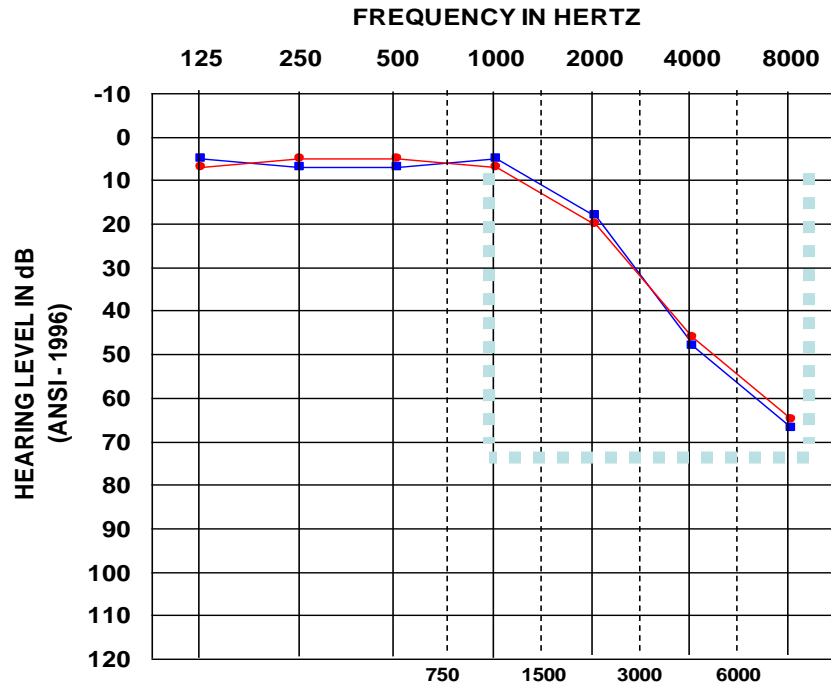
**Word
Recognition
Score**

R = 96%

L = 96%



Presbycusis



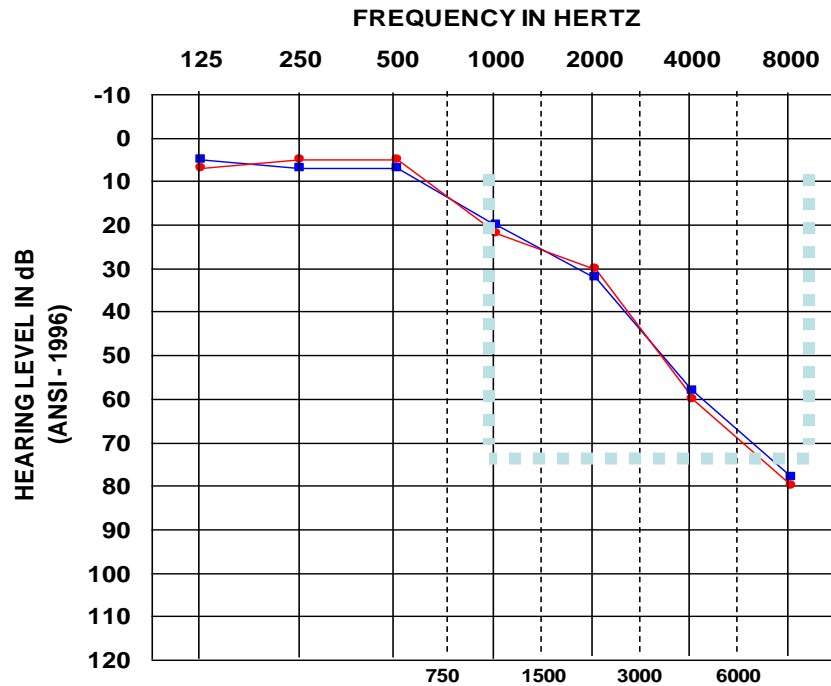
**Word
Recognition
Score**

R = 92%

L = 92%



Presbycusis



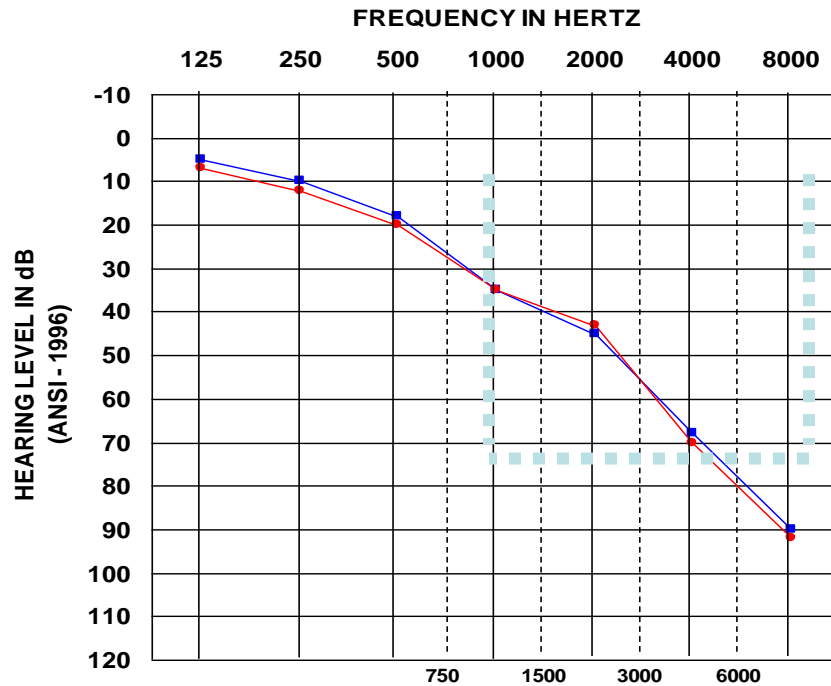
**Word
Recognition
Score**

R = 84%

L = 88%



Presbycusis



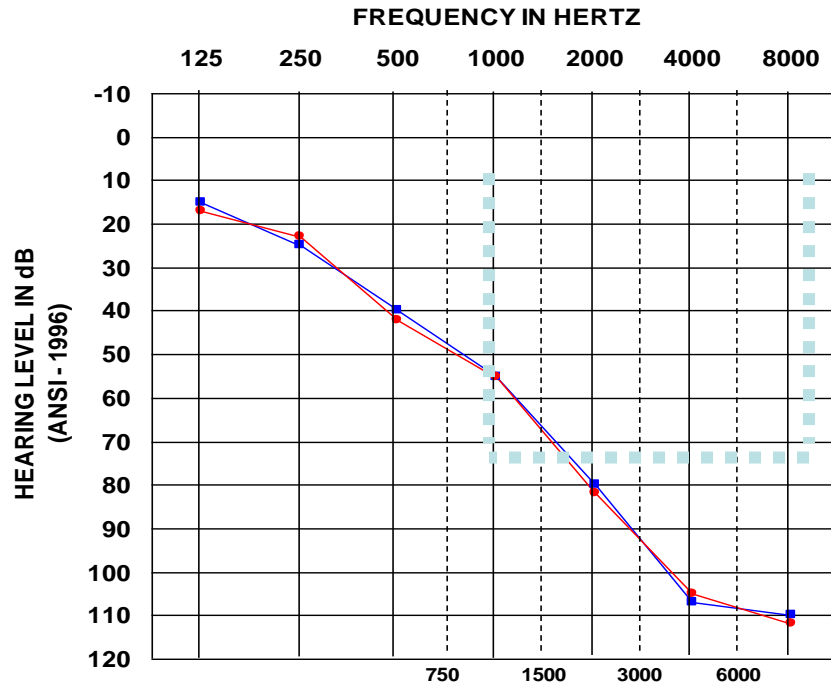
**Word
Recognition
Score**

R = 78%

L = 74%



Presbycusis



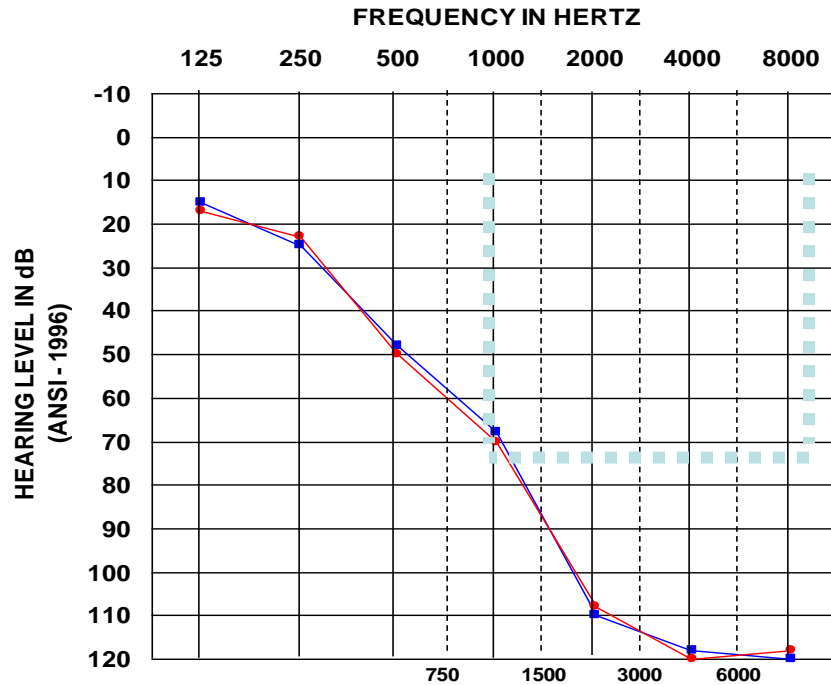
**Word
Recognition
Score**

R = 64%

L = 60%



Presbycusis

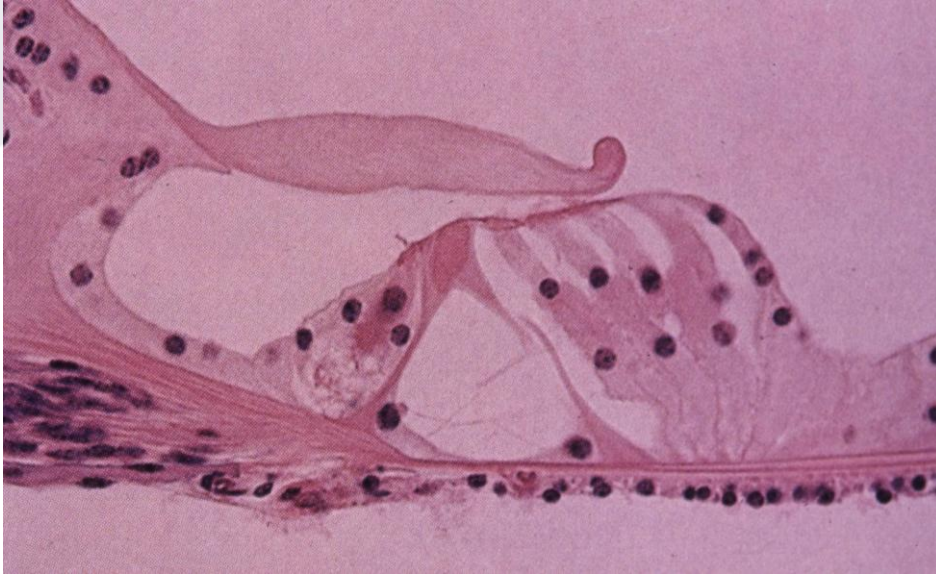


**Word
Recognition
Score**

**R = 46%
L = 42%**

Presbycusis Alone Seldom Worse Than This





Organ of Corti



Recent Findings

ORIGINAL ARTICLE

Central Auditory Dysfunction as a Harbinger of Alzheimer Dementia

George A. Gates, MD; Melissa L. Anderson, MS; Susan M. McCurry, PhD; M. Patrick Feeney, PhD; Eric B. Larson, MD, MPH

Neuropsychology
2011, Vol. 25, No. 6, 763–770

In the public domain
DOI: 10.1037/a0024238

Hearing Loss and Cognition in the Baltimore Longitudinal Study of Aging

Frank R. Lin
Johns Hopkins University

Luigi Ferrucci, E. Jeffrey Metter, Yang An,
Alan B. Zonderman, and Susan M. Resnick
National Institute on Aging, Baltimore, Maryland

ORIGINAL INVESTIGATION

ONLINE FIRST

Hearing Loss and Cognitive Decline in Older Adults

Frank R. Lin, MD, PhD; Kristine Yaffe, MD; Jin Xia, MS; Qian-Li Xue, PhD; Tamara B. Harris, MD, MS; Elizabeth Purchase-Helzner, PhD; Suzanne Satterfield, MD, DrPH; Hilsa N. Ayonayon, PhD; Luigi Ferrucci, MD, PhD; Eleanor M. Simonsick, PhD; for the Health ABC Study Group



The New York Times

AGING | FEBRUARY 11, 2013, 4:05 PM | 320 Comments

Straining to Hear and Fend Off Dementia

By KATHERINE BOUTON



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Dementia and Hearing Loss

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Call 801-266-3751 Today!

Alzheimer's Disease and Dementia

ARE YOU AT RISK?

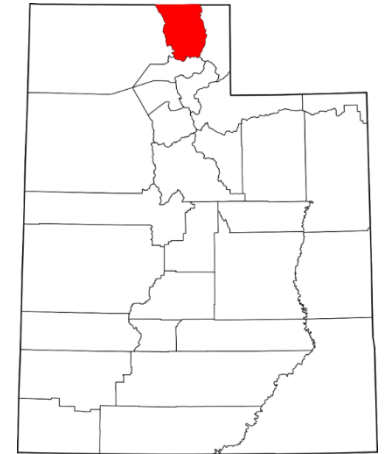
Have you noticed a change in your ability to remember?



Relationship of Hearing Loss and Dementia: A Prospective, Population-Based Study

*Richard Klaus Gurgel, *Preston Daniel Ward, †Sarah Schwartz,
†‡§Maria C. Norton, ||Norman L. Foster, and †§JoAnn T. Tschanz

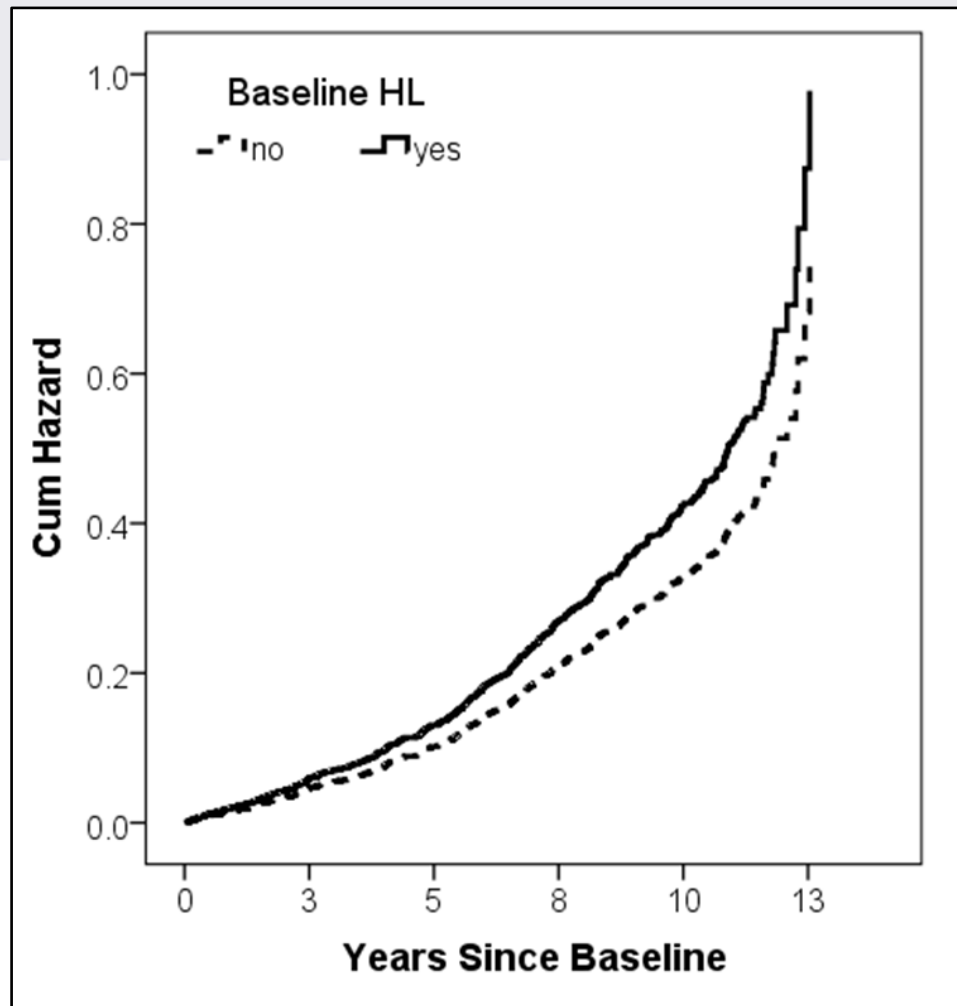
- Cache County Study on Memory, Health, and Aging
- Began in 1995
- ≥ 65 years old
- 90% of residents enrolled



Results

- 4,463 subjects
 - 836 with hearing loss (HL)
- Subjects with HL
 - 16.3% developed dementia vs. 12.1% without HL ($p < 0.001$)
- Mean time to dementia
 - 10.3 years HL vs. 11.9 years without HL ($p < 0.001$)

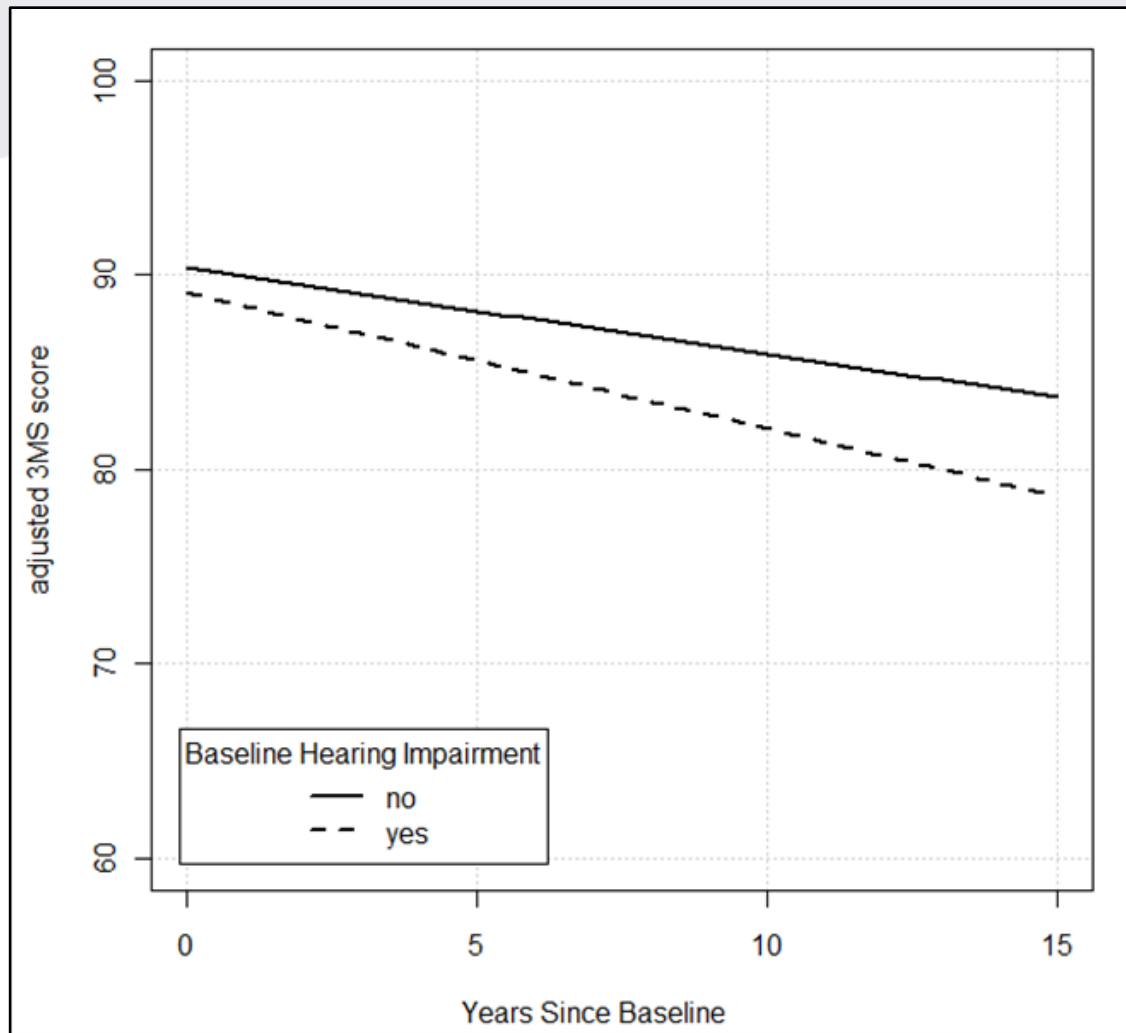




HR = 1.30

p = 0.013

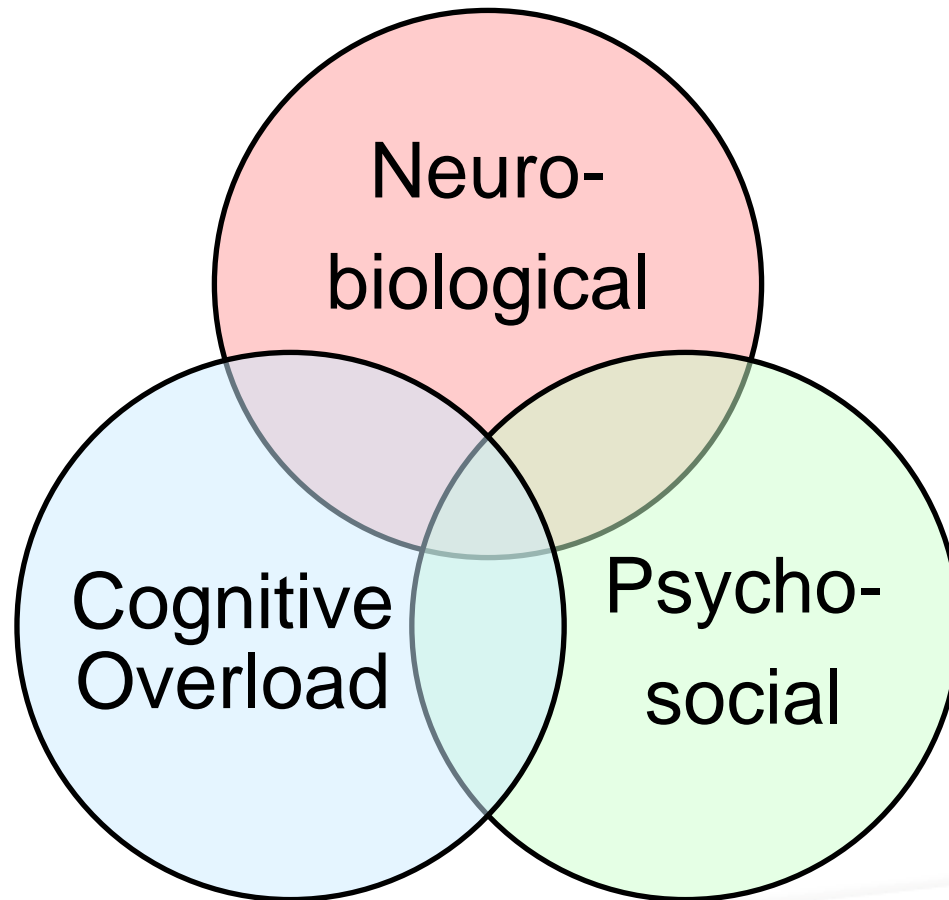


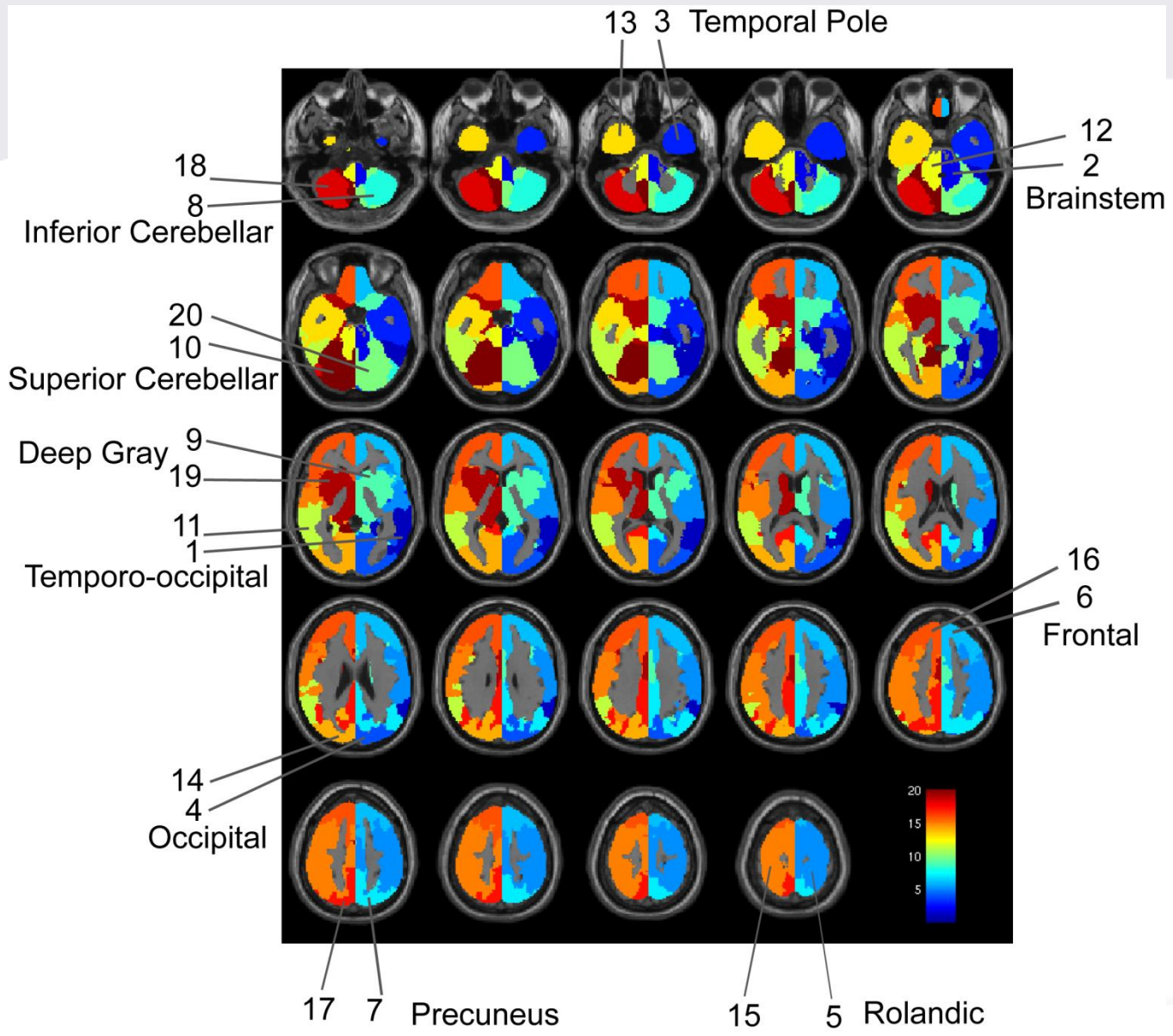


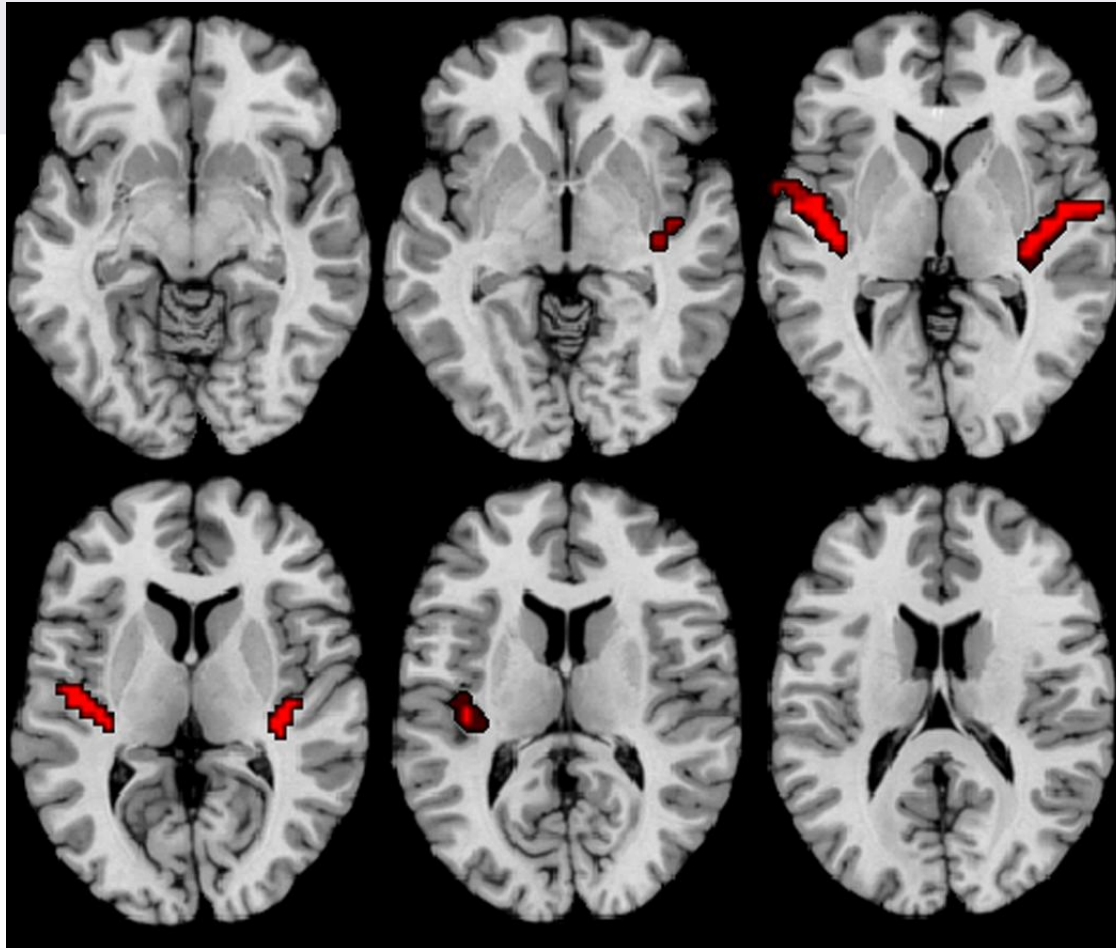
HL 0.26 points/year worse than without HL



Hearing Loss and Dementia: Correlation or Causation?





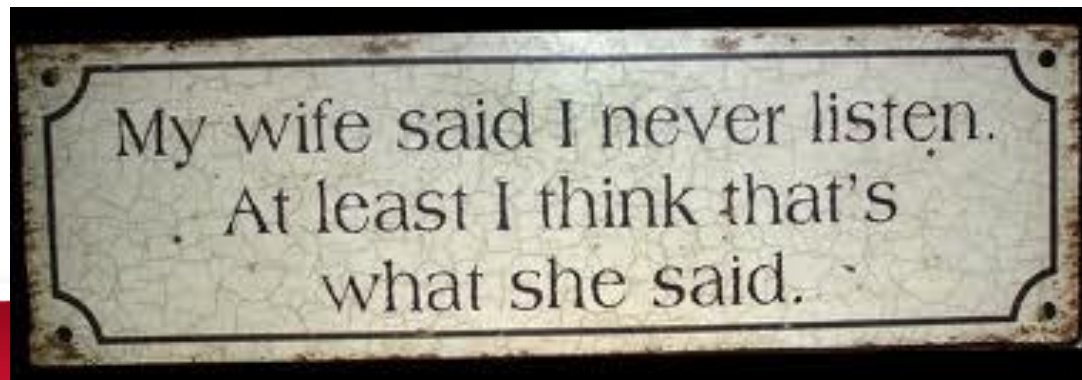


A1 + Auditory Association Cortex



Implications

- The auditory association cortex is a site of ***selective vulnerability*** in Alzheimer's disease
- Older adults with cognitive impairment and dementia may hear, but how they process what they hear may be impaired



Overall Goal:

- Is hearing loss a *remedial* risk factor for dementia?
- Hearing loss may be one of the few late-life modifiable risk factors



Practical Application

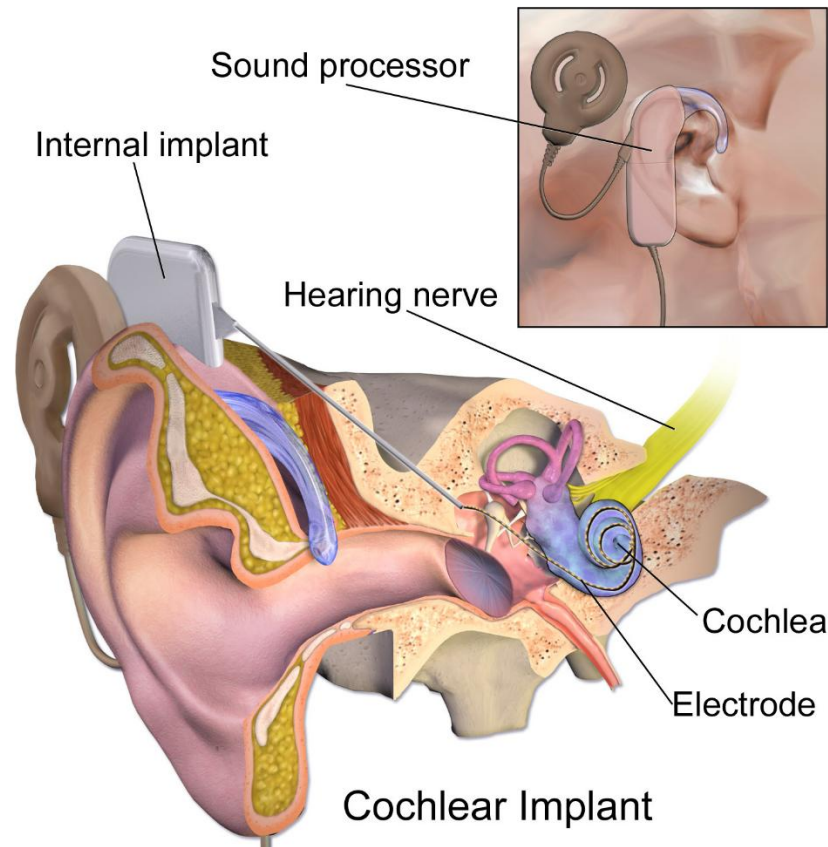
- If you had an older patient with hearing loss and you could intervene, you may make a difference in their cognition
- Possibility to change practice and policy



Current Efforts

- Evaluating the cognitive impact of cochlear implantation in older adults



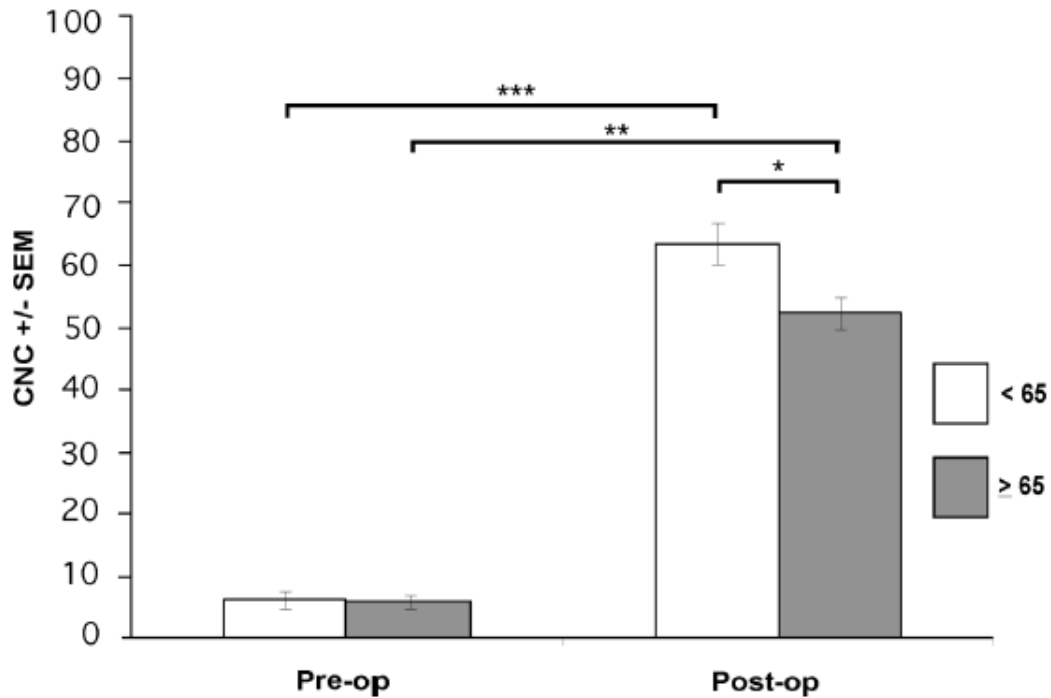


University of Utah: 115 per year, 33 in adults >65 years old



Differential Cochlear Implant Outcomes in Older Adults

Daniel S. Roberts, MD, PhD; Harrison W. Lin, MD; Barbara S. Herrmann, PhD; Daniel J. Lee, MD



Cochlear Implantation in the Octogenarian and Nonagenarian

Matthew L. Carlson, Joseph T. Breen, Rene H. Gifford, Colin L. W. Driscoll, Brian A. Neff, Charles W. Beatty, Anna Mary Peterson, and Amy P. Olund

Department of Otolaryngology Head and Neck Surgery, Mayo Clinic School of Medicine, Rochester, Minnesota, U.S.A.

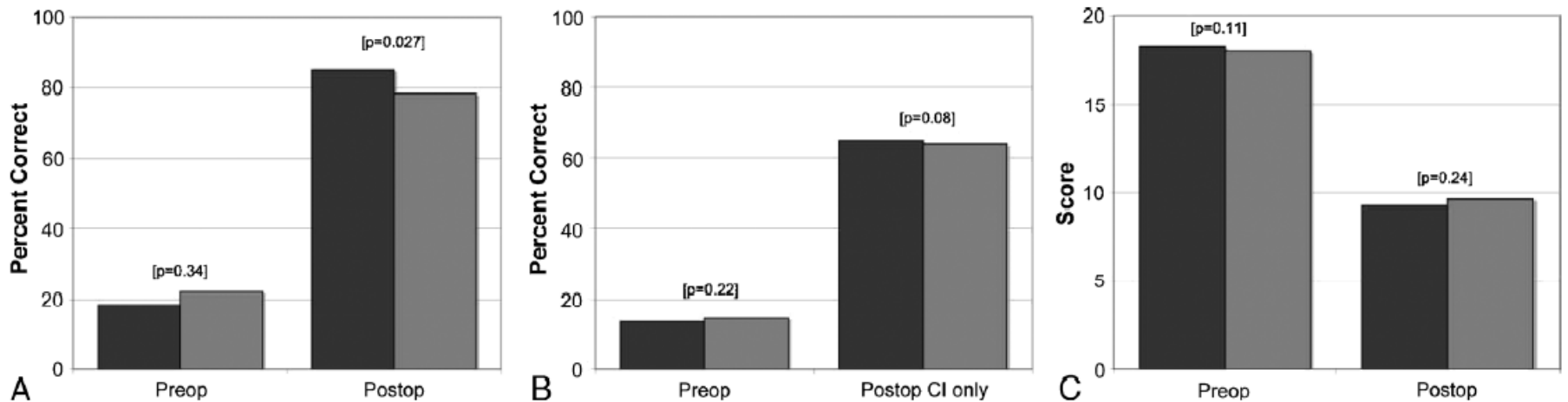
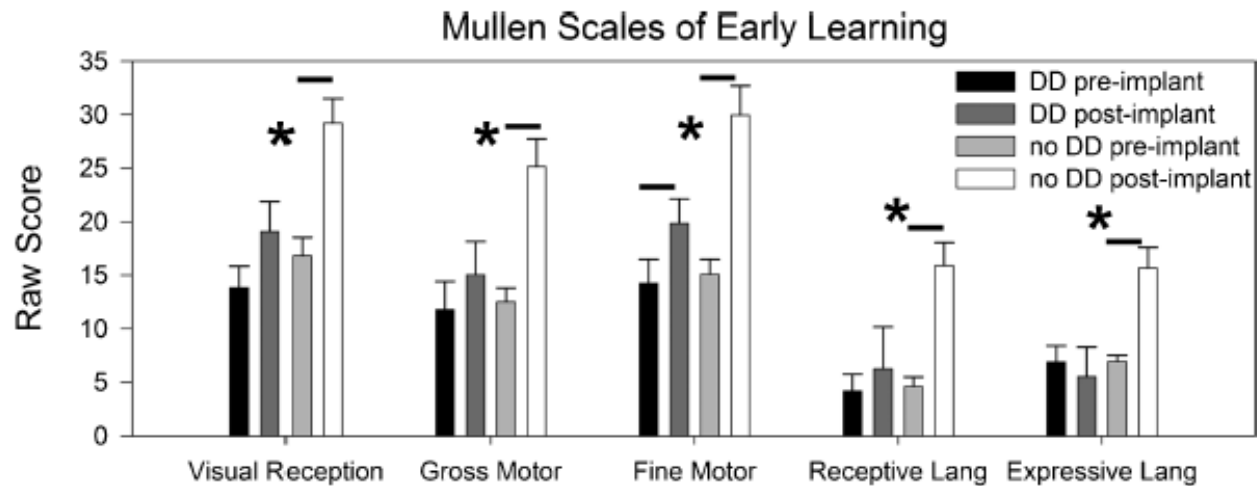


FIG. 3. Preoperative and postoperative (≥ 6 mo) audiometric results using AzBio (A), CNC (B), and BKB-SIN testing (C) among patients between the ages of 18 and 79 years (black) compared with those 80 years or older (gray).

Cognitive Outcomes and Familial Stress After Cochlear Implantation in Deaf Children With and Without Developmental Delays

*†John S. Oghalai, ‡§Susan E. Caudle, †||Barbara Bentley, *†Homer Abaya,
§¶Jerry Lin, §Dian Baker, §Claudia Emery, #**Heather Bortfeld,
and †Jody Winzelberg



Research

Original Investigation

Improvement of Cognitive Function After Cochlear Implantation in Elderly Patients

Isabelle Mosnier, MD; Jean-Pierre Bebear, MD; Mathieu Marx, MD, PhD; Bernard Fraysse, MD; Eric Truy, MD; Geneviève Lina-Granade, MD; Michel Mondain, MD, PhD; Françoise Sterkers-Artières, MD; Philippe Bordure, MD; Alain Robier, MD; Benoit Godey, MD, PhD; Bernard Meyer, MD; Bruno Frachet, MD; Christine Poncet-Wallet, MD; Didier Bouccara, MD; Olivier Sterkers, MD, PhD

JAMA Otolaryngol Head Neck Surg. doi:10.1001/jamaoto.2015.129
Published online March 12, 2015.



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- 94 patients
- Ave. age 72, range, 65-85 years; median, 71 years
- Neurelec, 29 patients MED-EL, 26; Cochlear, 23; and Advanced Bionics, 17

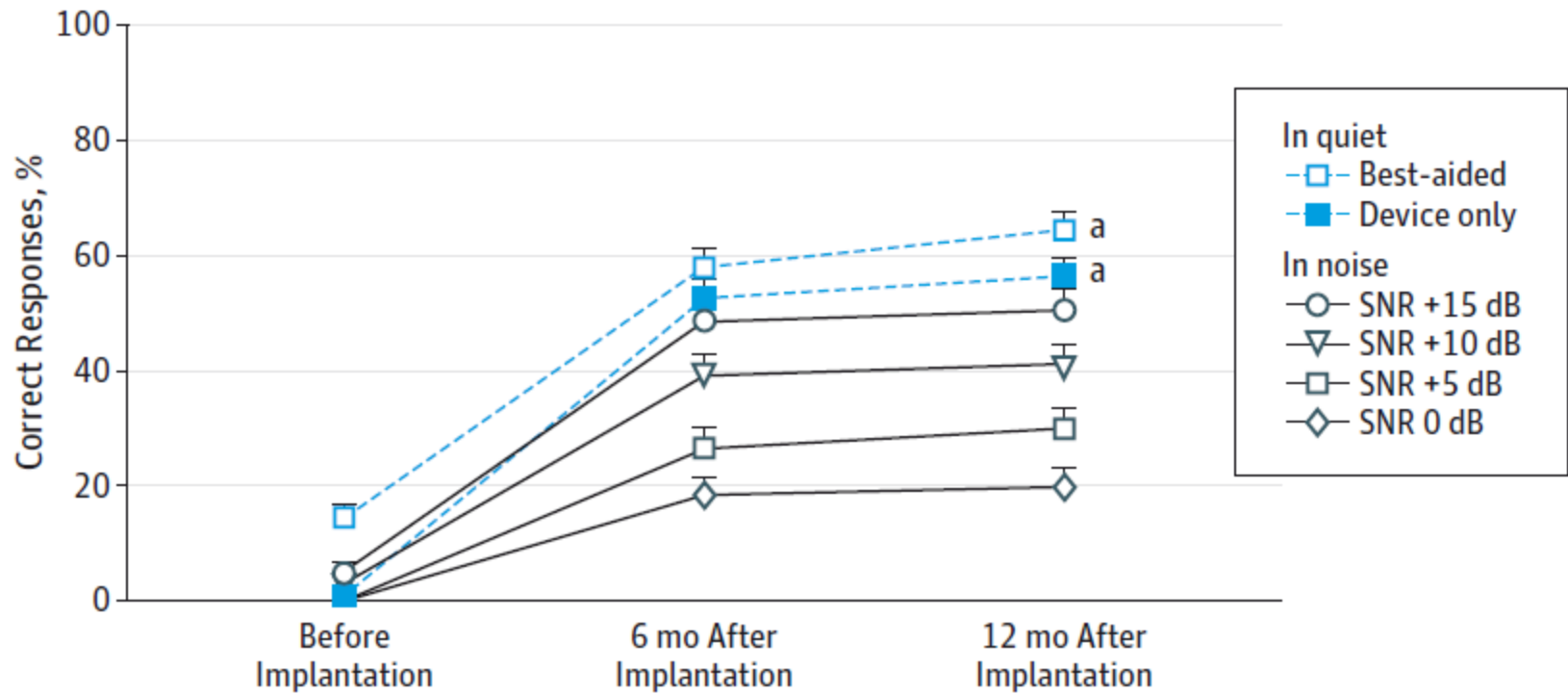
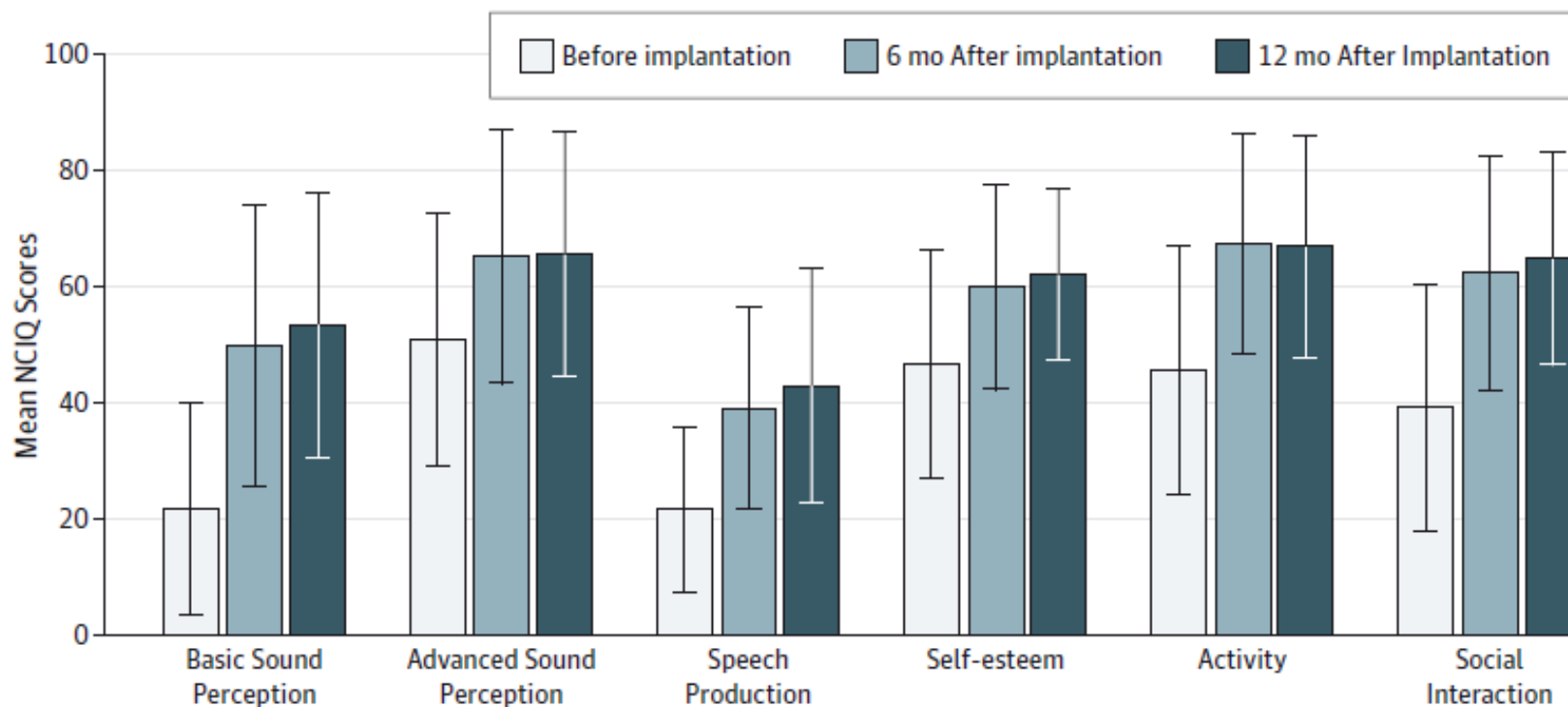


Table 2. Effect of Cochlear Implantation on Mean Cognitive Test Scores in 94 Patients

Cognitive Test	Before, Mean (SD)	Group (No.) ^a	6-mo Mean (SD)	Differences, Mean (95% CI)	P Value ^b	12-mo Mean (SD)	Differences, Mean (95% CI)	P Value ^b
MMSE	22.1 (3.4)	Abnormal (13)	25.8 (2.7)	3.7 (0.6 to 6.8)	.02	26.3 (2.7)	3.8 (1.0 to 6.6)	.01
	27.8 (1.7)	Normal (81)	27.9 (1.8)	0.04 (-0.4 to 0.5)	.85	28 (1.8)	0.2 (-0.3 to 0.6)	.45
FWT ^c	8.2 (3.2)	Abnormal (22)	9.6 (0.1)	1.4 (0.5 to 2.3)	.004	9.4 (0.7)	1.3 (0.6 to 1.9)	<.001
	10.0 (0.0)	Normal (72)	9.7 (0.1)	-0.4 (-0.6 to -0.1)	.002	9.7 (0.8)	-0.7 (-0.7 to -0.2)	.002
Clock-drawing test ^d	2.5 (0.6)	Abnormal (4)	3.3 (0.6)	0.7 (-0.8 to 2.1)	0.18	4 (2.6)	1.3 (-6.3 to 9.0)	.53
	6.1 (0.9)	Normal (90)	6.1 (1.0)	0 (-0.3 to 0.3)	1.0	6.3 (0.9)	0.2 (0.03 to 0.4)	.046
d2 Test (errors) ^e	27.7 (9.0)	Abnormal (11)	21.0 (14.6)	-6.6 (-18.3 to 5.0)	.23	9.4 (7.1)	-18.3 (-25.3 to -11.9)	<.001
	6.2 (4.7)	Normal (80)	6.2 (6.2)	-0.2 (-1.8 to 1.4)	.82	5.7 (5.6)	-0.6 (-2.1 to 0.8)	.37
d2 Test of attention (speed) ^e	276 (62.8)	Abnormal (39)	321 (79.0)	46.4 (13.0 to 79.8)	.008	342 (81.7)	60.1 (30.5 to 89.6)	<.001
	429 (81.2)	Normal (52)	411 (82.0)	-19.3 (-44.4 to 4.7)	.11	409 (76.5)	-19.6 (-42.8 to 3.6)	.09
TMT-A ^f	77.3 (43.0)	Abnormal (19)	60.2 (14.1)	-17.9 (-39.7 to 3.8)	.09	52.2 (11.3)	-25.1 (-46.3 to -3.9)	.02
	43.8 (10.9)	Normal (74)	43.1 (12.8)	0.01 (-3.2 to 3.2)	.99	44.3 (12.6)	1.2 (-1.9 to 4.4)	.43
TMT-B ^f	181 (56.0)	Abnormal (23)	152 (64.7)	-29.5 (-55.9 to -3.9)	.03	142 (65.9)	-32.5 (-61.5 to 3.6)	.03
	105 (33.9)	Normal (68)	106 (41.2)	2.7 (-5.9 to 11.3)	.52	111 (46.7)	4.9 (-4.6 to 14.5)	.30



Figure 3. Mean Scores of the 6 Subdomains of the Nijmegen Cochlear Implant Questionnaire (NCIQ) Before and After Cochlear Implantation



Other Interventions?



Summary – Alive Inside

- Auditory signals may be able to activate other critical brain regions
 - Memory
 - Motor control
 - Emotional state



Conclusions

- Hearing loss is associated with cognitive decline in older adults
- Hearing loss may be a remedial risk factor for dementia
- Current efforts are underway to understand the association





Thank you



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