

Understanding the Relationship Between Hearing Loss and Dementia

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Outline for Today

1. Hearing system refresher
2. The (very close) link between hearing and the brain
3. How hearing loss changes the brain
4. The association between hearing loss and dementia
5. What can we do about it?



Disclosure Statement

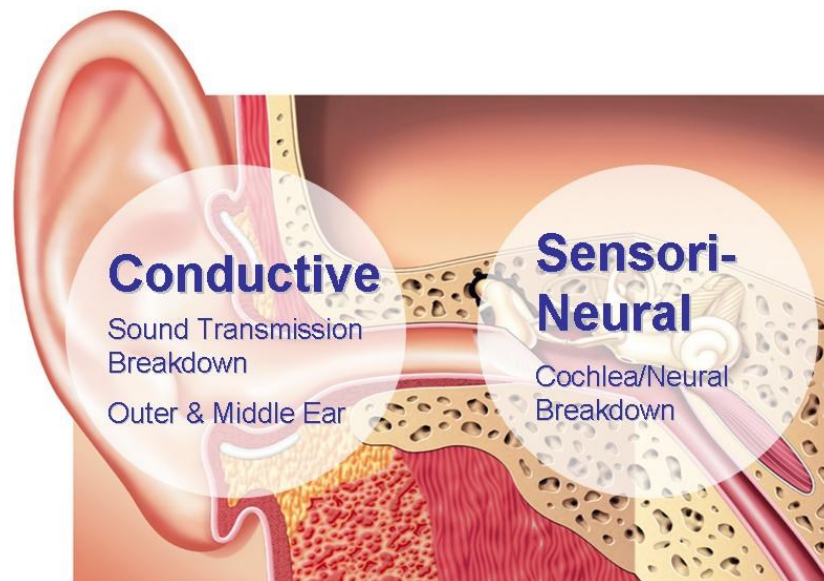
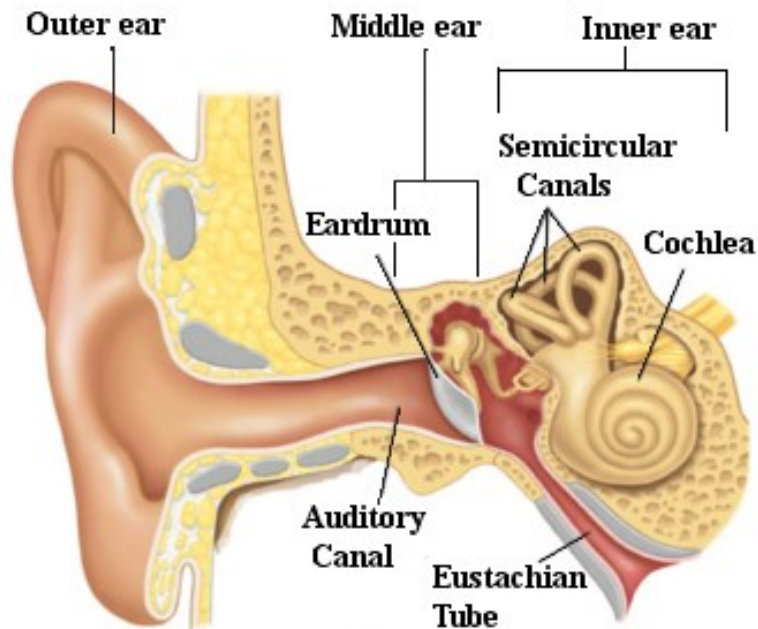


- I am employed by Bay Audiology, which is part of the Amplifon Group. **We are independent of any Hearing Aid Manufacturer.**
- This session will not promote products, brands or incentives, and will give a balanced view of all therapeutic options available for good quality patient management.
- Information presented is unbiased and based on scientific evidence.



Part 1: Hearing System Refresher





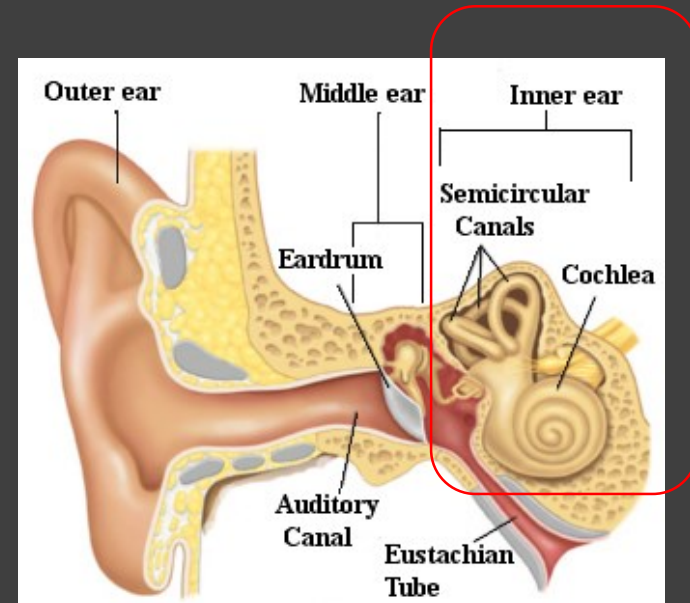
Conductive Hearing Loss

- Wax
- Eustachian tube dysfunction
- Cholesteatoma
- Otitis media
- Otosclerosis
- Ossicular disorders

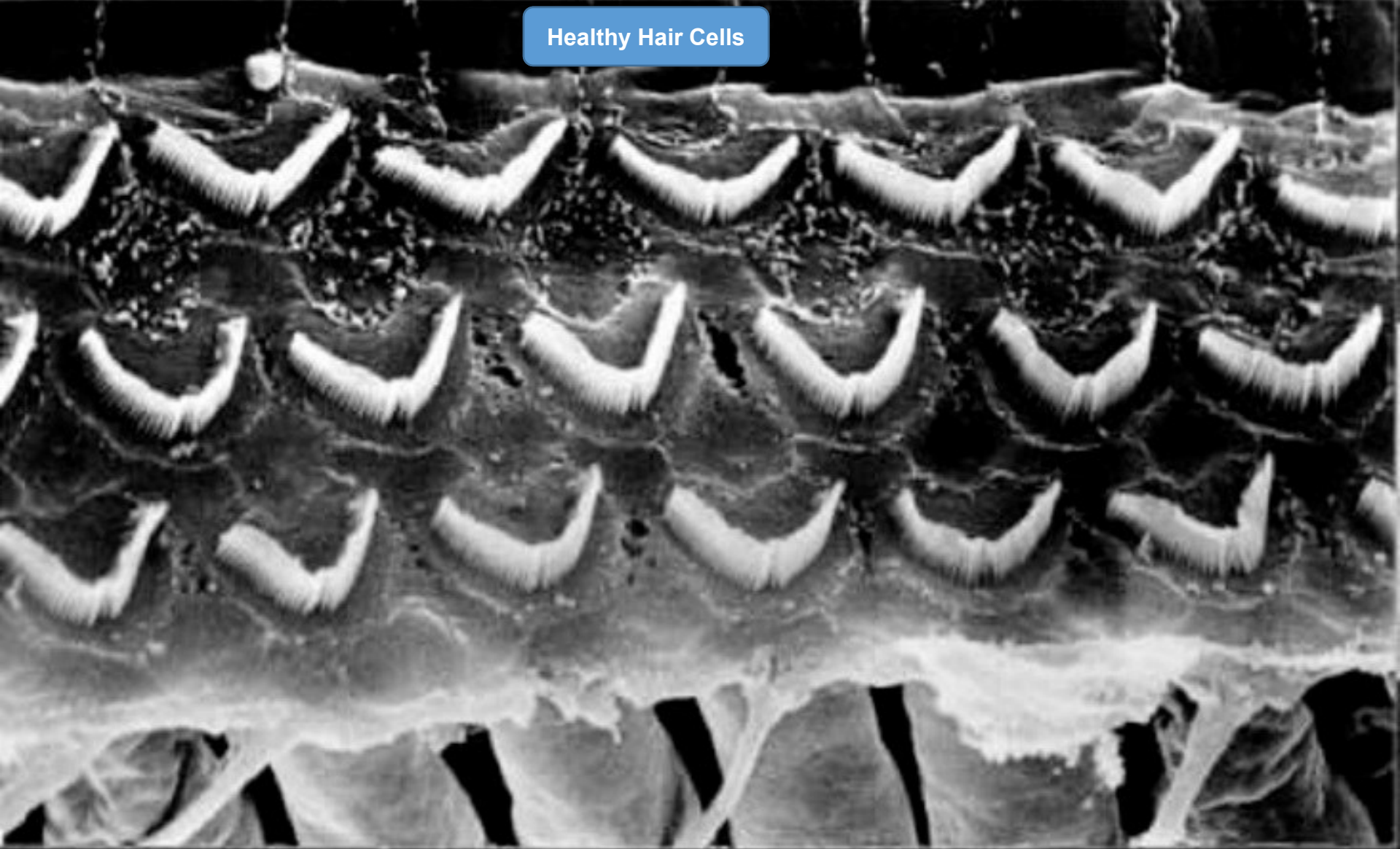


Sensorineural Hearing Loss

- Aging/Presbycusis
- Noise Induced Hearing Loss (NIHL)
- Hereditary
- Virus
- Ototoxic drugs



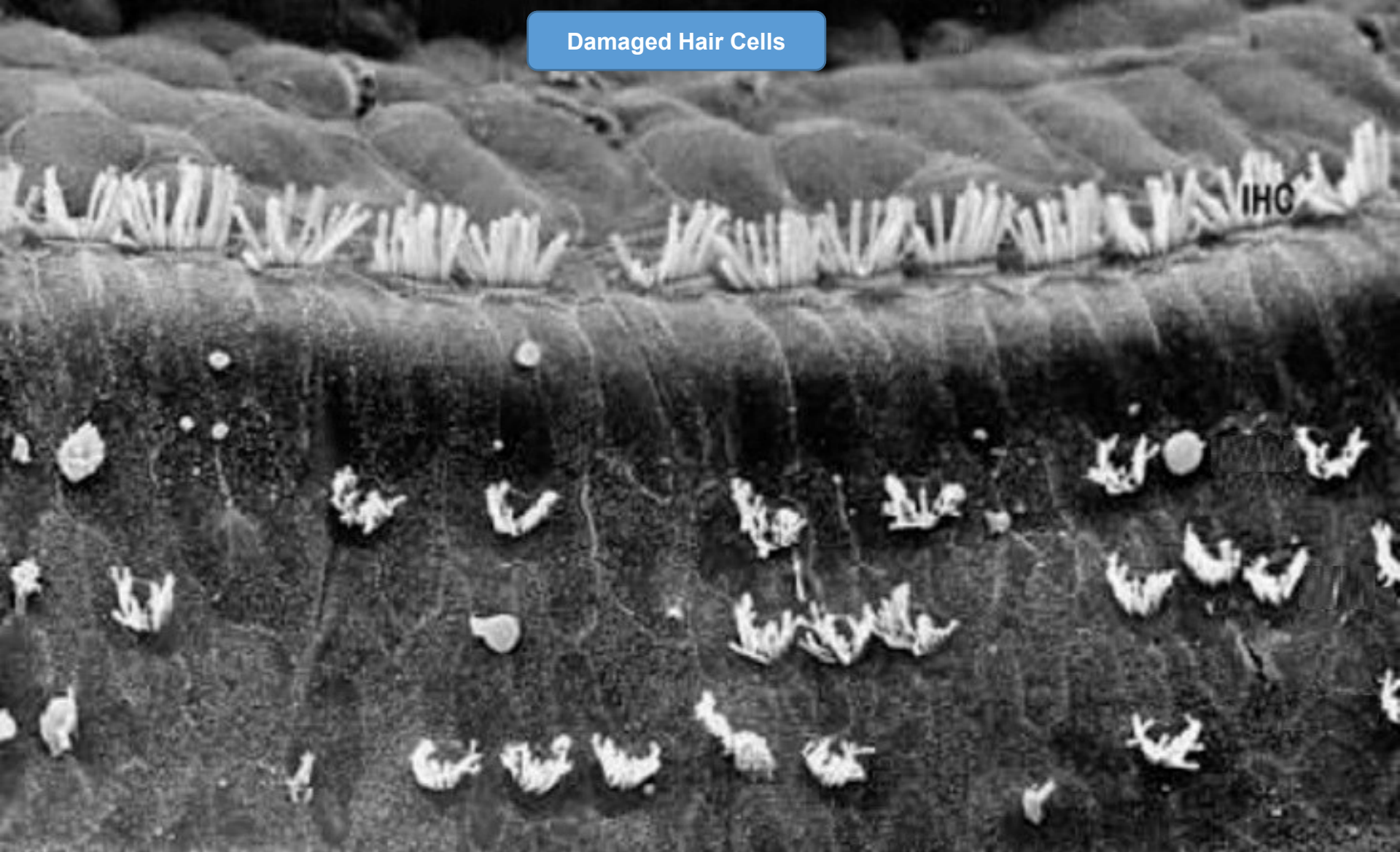
Healthy Hair Cells



Normal Sensory Nerves

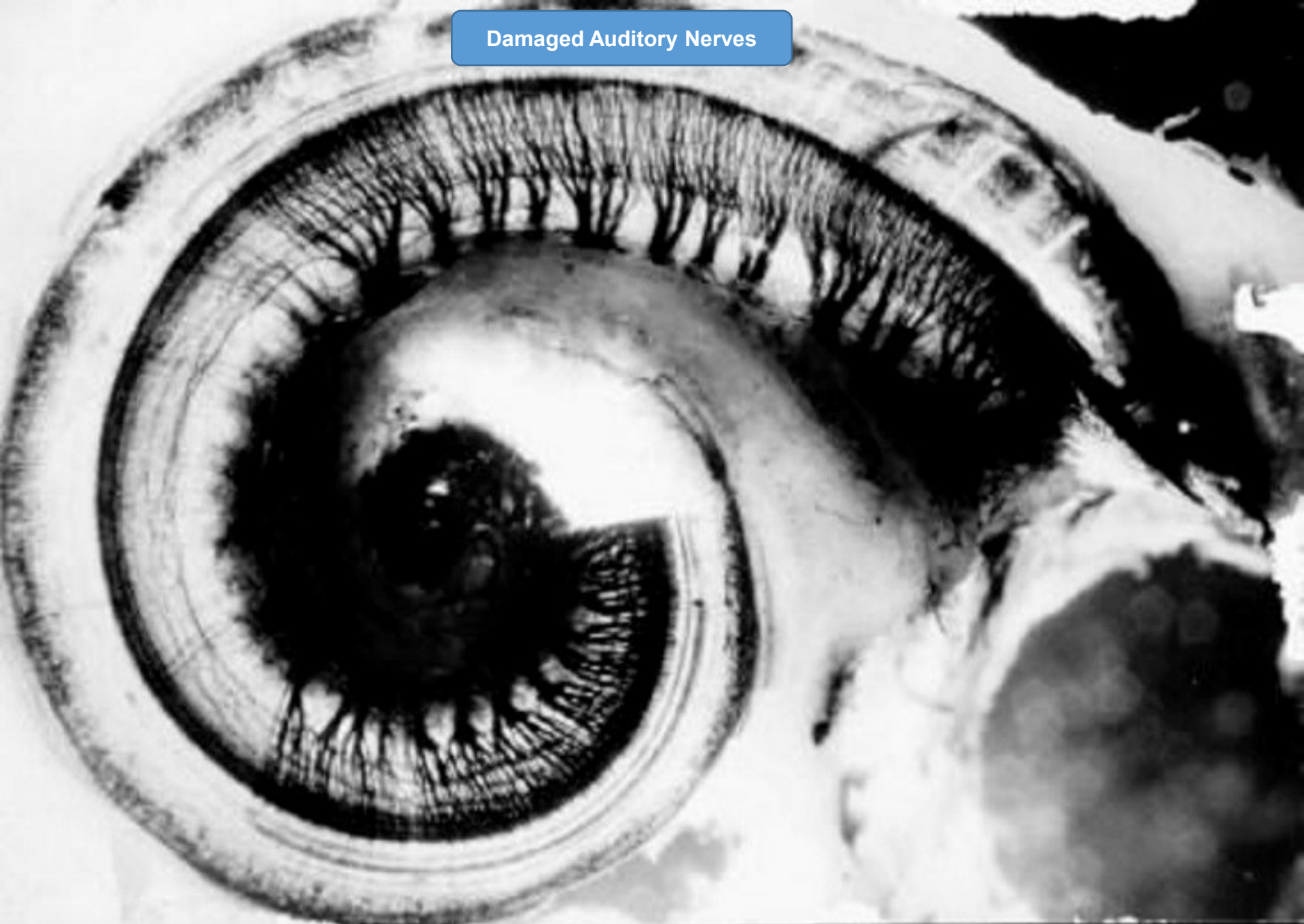


Damaged Hair Cells

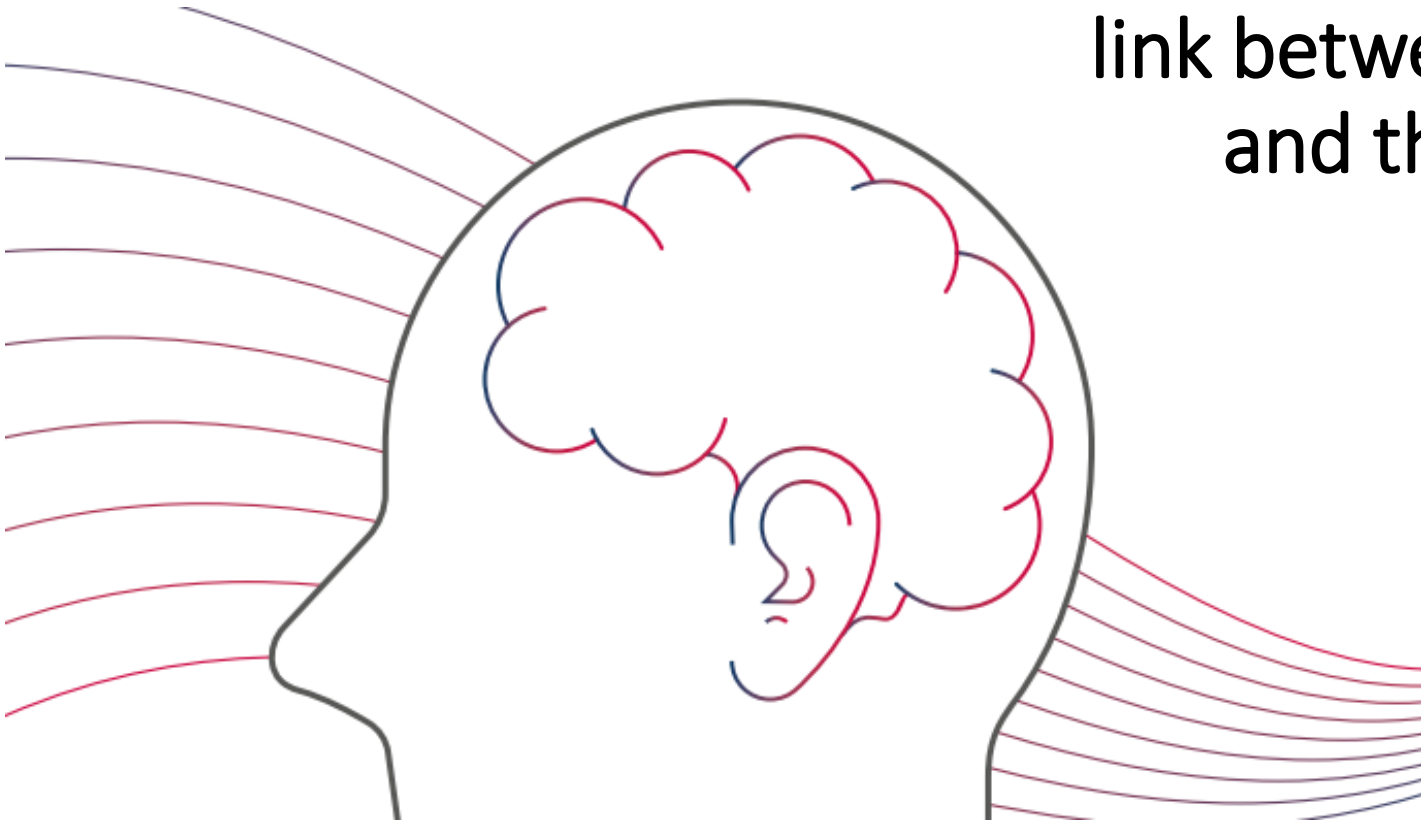


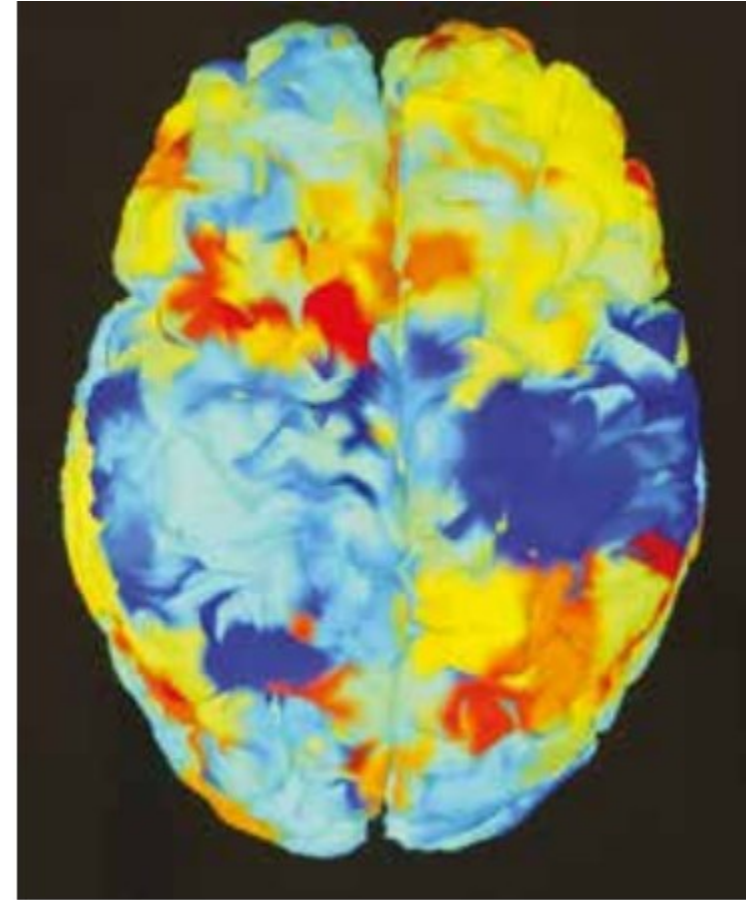
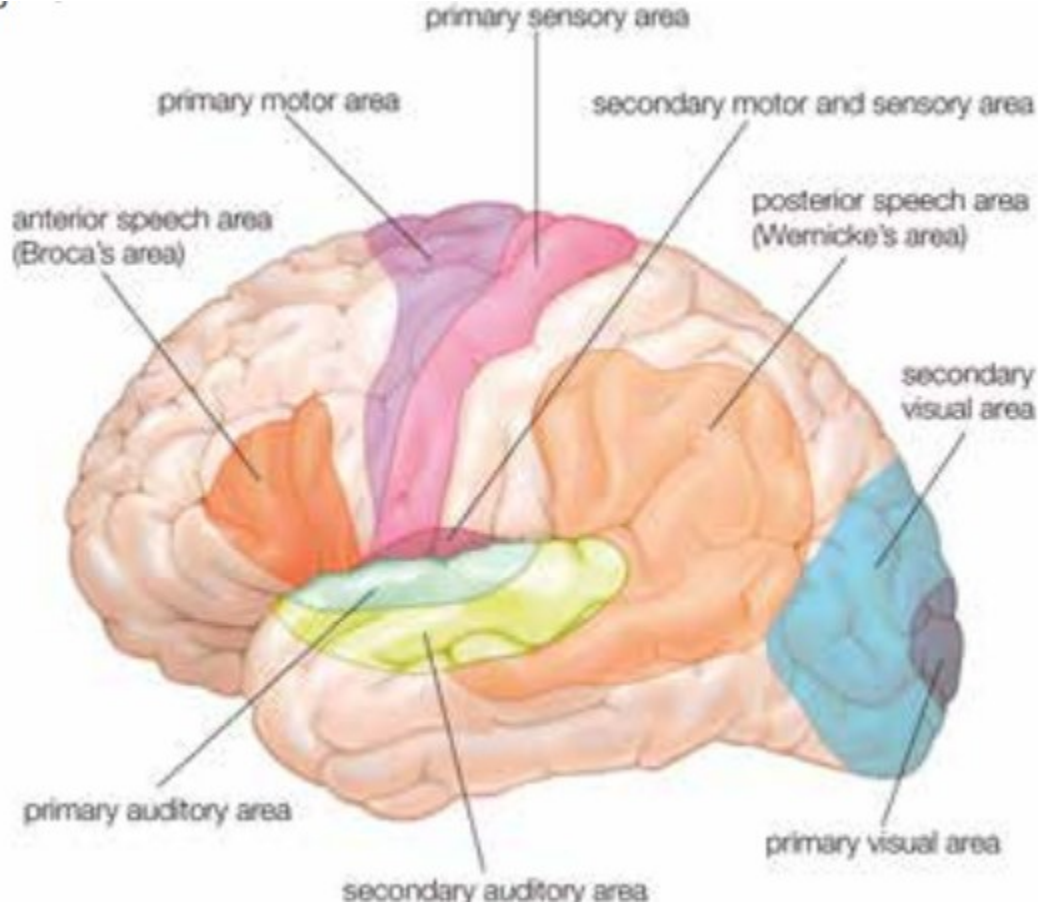
Coming into age

Damaged Auditory Nerves



Part 2: The (very close) link between hearing and the brain





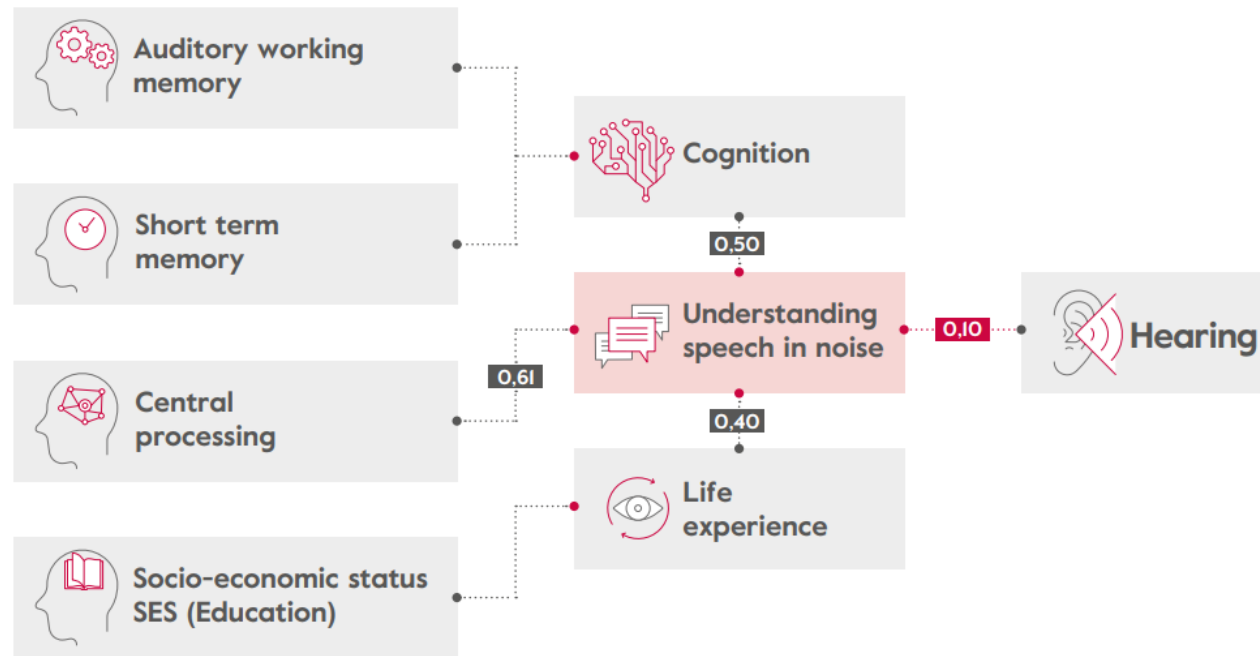
Left: map of cerebral cortical areas that perform several sensory and motor functions, as known until a few years ago.

Right: Revised map of the brain indicating multiple areas that respond to hearing.

A study on people aged 50 to 79 included testing peripheral hearing levels, central auditory processing and cognitive skills.

The most predictive factor of speech comprehension in a noisy environment was **central processing** of sound information, followed by **cognitive skills** (such as **working memory** and **short-term memory**), and by **life experiences**.

(Anderson et al., 2013)



72 first-time hearing aid users were tested for speech recognition in noise with and without hearing aids.

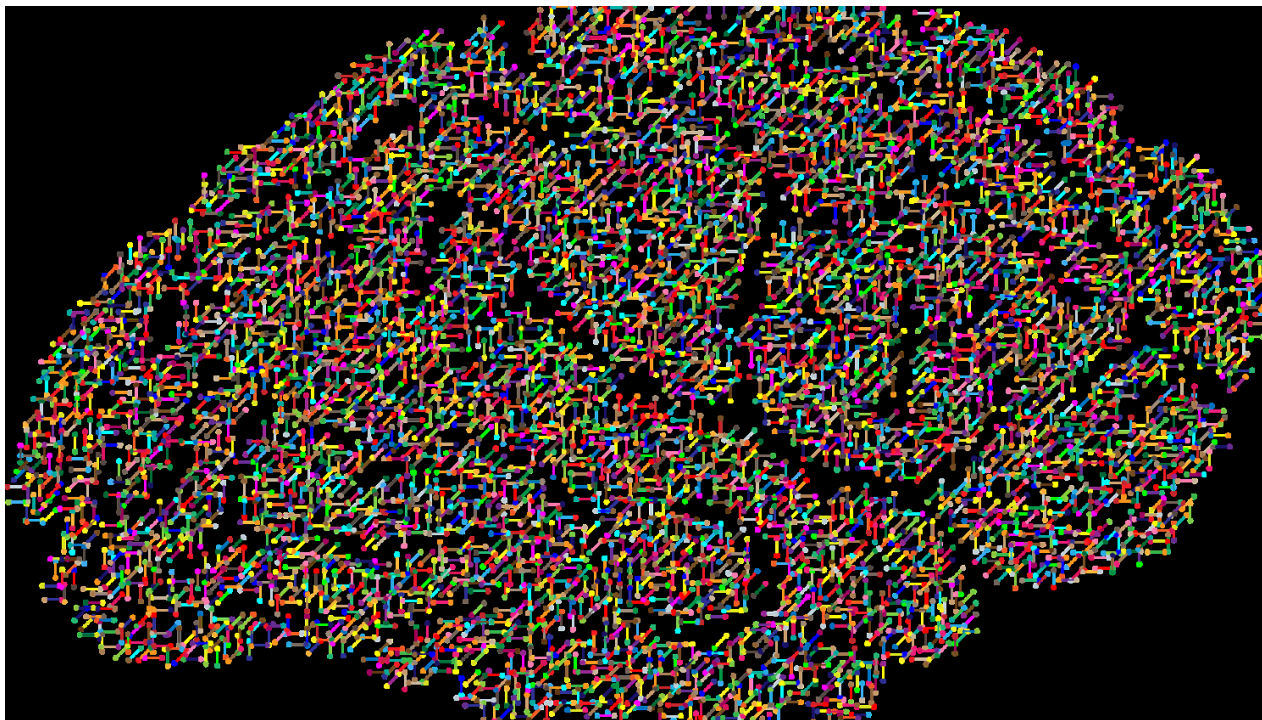
Cognitive function was assessed by tests of working memory and verbal information-processing speed.

Results showed high cognitive performance was associated with high performance in the speech recognition task, even **after controlling for age and hearing loss**.

Significant correlations exist between the measures of cognitive performance and speech recognition in noise, both with and without hearing aids.

(Lunner 2009)





In summary, there is a “dual track” association between hearing and cognition.

On the one side auditory stimuli are important because they activate the entire cerebral cortex, and on the other, cognitive processes influence “how” we hear

Part 3: How hearing loss changes the brain

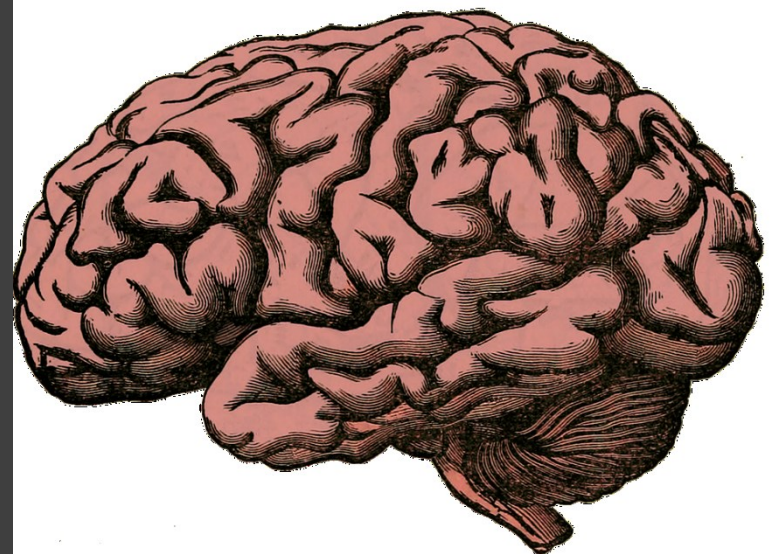


Reduced volume of the Auditory Cortex

Epidemiologist and ENT Frank Lin of Johns Hopkins University analysed brain volume measurements from magnetic resonance brain scans of individuals with normal hearing versus hearing impairment scanned annually for 10 years as part of the Baltimore Longitudinal Study of Aging (n=126)

Peripheral hearing impairment was independently associated with accelerated brain atrophy in whole brain and regional volumes concentrated in the right temporal lobe

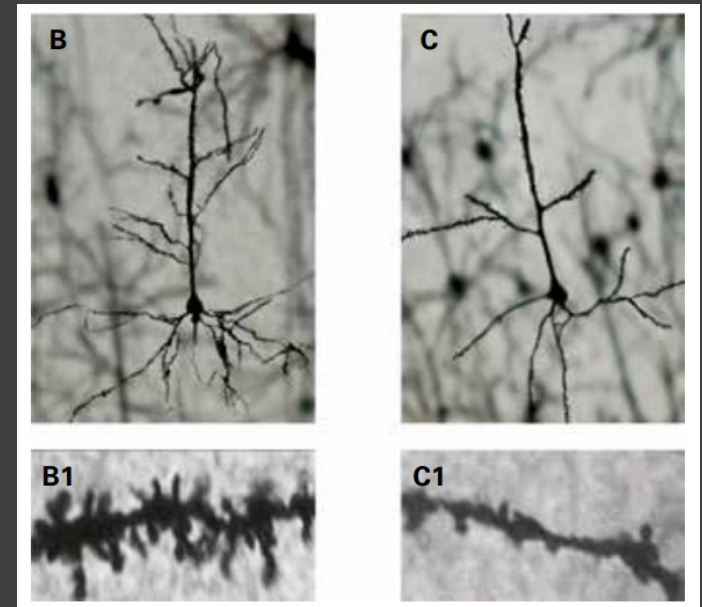
(Lin 2014)



Reduced integrity of neuronal connections

Magnetic resonance diffusion tensor imaging (MRDTI) technique analyses the diffusion and direction of water molecules in tissues in vivo to study of the microstructural architecture of the brain (to map connections and reconstruct the 3D structure of the white matter).

This has revealed that the integrity of white matter networks in the hearing area is altered in people with hearing loss (Chang Y, 2004)



Increased Cognitive Load

Hearing loss has a negative impact on neuronal resources used for cognitive control which effects the capacity to perceive and process sounds. Greater cognitive effort is needed to suppress irrelevant information in auditory signals (background noise) and other types of sensory signals leaving a lower percentage of residual attention for the remaining cognitive activities (Cardin 2013)

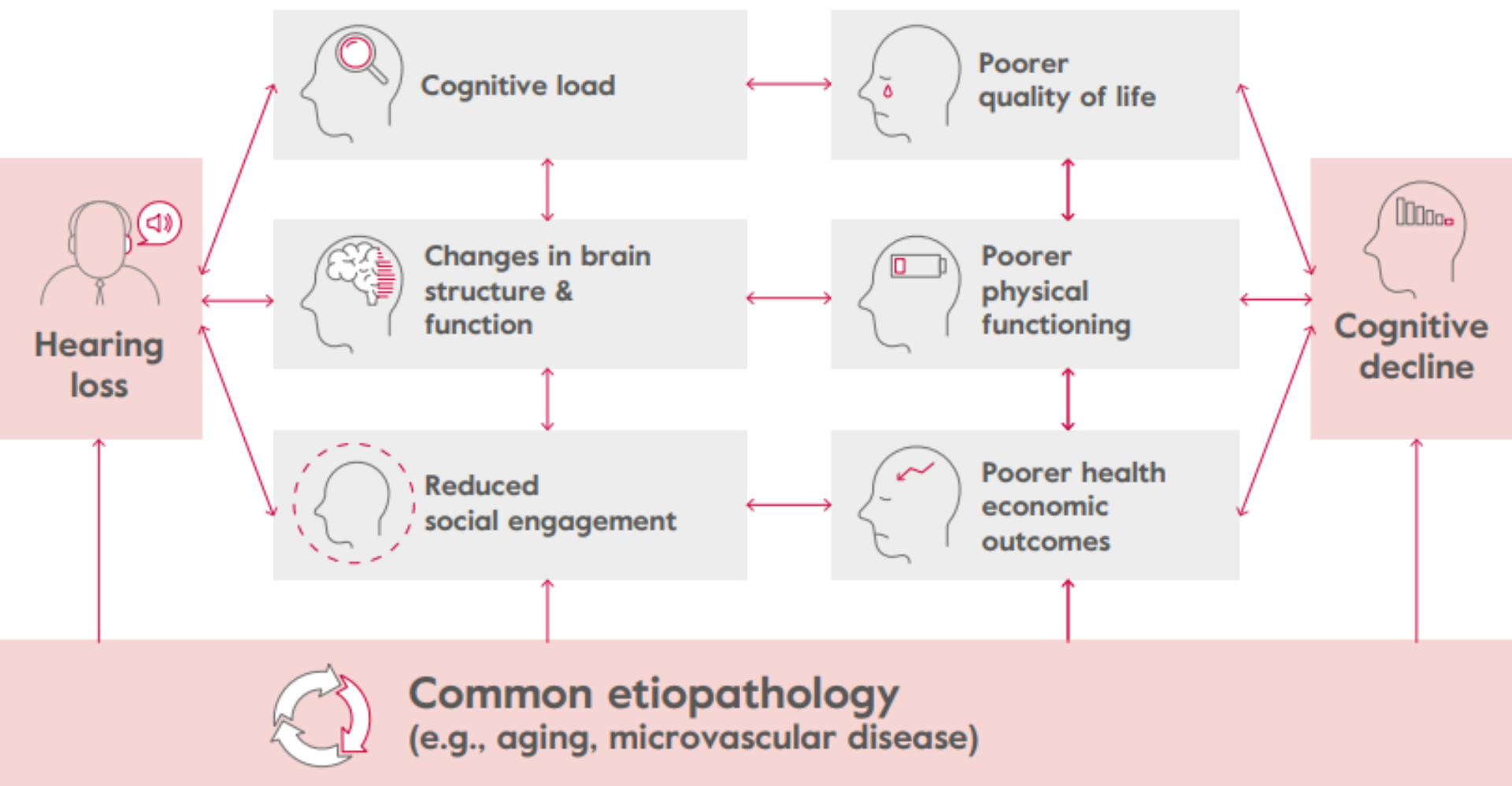
People with a hearing loss present a 24% higher probability of demonstrating impairment in cognitive skills such as concentration, memory and planning capacity (Lin 2013)



Green: Grey matter volume reduction, and Red: Compensatory increments in people with unilateral hearing loss

(Wang et al., 2016)

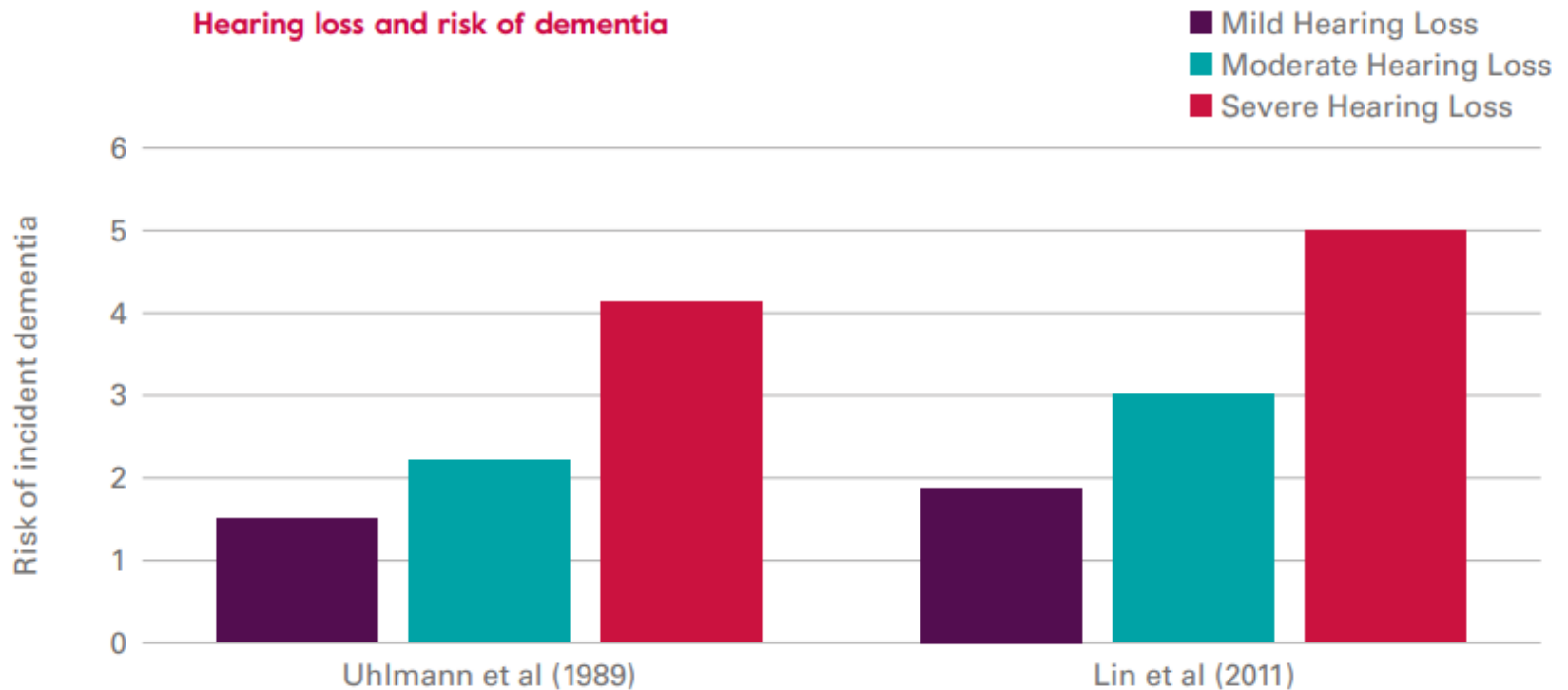




The complex vicious circle that leads to hearing loss and cognitive decline

Part 4: The Association Between Hearing Loss and Dementia





Prof Frank Lin monitored, for twelve years, more than 600 older adults with no initial diagnosis of dementia. He found that a mild, moderate or severe hearing loss was associated with a risk of cognitive decline that was respectively two, three and five-fold higher than in people who had no hearing disorders.

The correlation remained even taking into account other risk factors, including age, sex, diabetes, hypertension

Data collected on a group of 1000+ men who were monitored for 17 years indicated a strong association between hearing loss, cognitive decline and dementia. **The risk of developing dementia was 2.7-fold higher for every 10 dB of hearing loss** (Gallacher J. et al, 2012)

A study on almost 600 people without dementia who were monitored for a mean period of eight years. People diagnosed with dementia had a hearing problem in 77% of cases versus 46% of those who did not present cognitive disorders. After accounting for confounding factors, such as age, gender and lifestyle, the presence of **age-related hearing loss was associated with an over 3-fold increase in the probability of manifesting dementia** (Meusy A. et al, 2016)

A survey on more than 3,600 people aged 65+ tested hearing at beginning the study, monitored and reassessed the presence of cognitive disorders every two years, confirming that worse hearing was associated with lower cognitive efficiency scores and with **greater decline in cerebral activity over a period of 25 years** (Amieva H. et al, 2015)

Hearing Loss as a Risk Factor for Dementia: A Systematic Review

Rhett S. Thomson, BA; Priscilla Auduong, MD; Alexander T. Miller, BS; Richard K. Gurgel, MD

Objectives: To review evidence of hearing loss as a risk factor for dementia.

Data Sources: PubMed

Review methods: A systematic review was conducted using the PubMed database using the search terms (hearing loss OR presbycusis) AND (dementia OR cognitive decline). Initially, 488 articles were obtained. Only those studies evaluating an association between hearing loss and incident dementia or cognitive decline were included in the analysis. This resulted in 17 articles which were thoroughly evaluated with consideration for study design, method for determining hearing loss and cognitive status, relevant covariates and confounding factors, and key findings.

Results: All of the 17 articles meeting inclusion criteria indicate that hearing loss is associated with dementia or cognitive decline. The methods used among the studies for ascertaining hearing loss and dementia were notably varied. For hearing loss, peripheral auditory function was tested far more than central auditory function. For peripheral audition, pure tone audiometry was the most commonly reported method for defining hearing loss. Only a few studies measured central auditory function by using the Synthetic Sentence Identification with Ipsilateral Competing Message test (SSI-ICM) and the Staggered Spondaic Word Test (SSW). Dementia was most often defined using the Mini Mental State Exam (MMSE). However, many studies used extensive batteries of tests to define cognitive status, often including a neuropsychologist. Confounding variables such as cardiovascular risk factors were measured in 17 studies and family history of dementia was only evaluated in 1 study. Overall, the methods used by studies to ascertain hearing loss, cognitive status and other variables are valid, making their evaluation appear reliable.

Conclusion: While each of the studies included in this study utilized slightly different methods for evaluating participants, each of them demonstrated that hearing loss is associated with higher incidence of dementia in older adults.

Key Words: age-related hearing loss, dementia, cognitive decline, Alzheimer's disease, presbycusis.

Level of Evidence: Level V, systematic review.

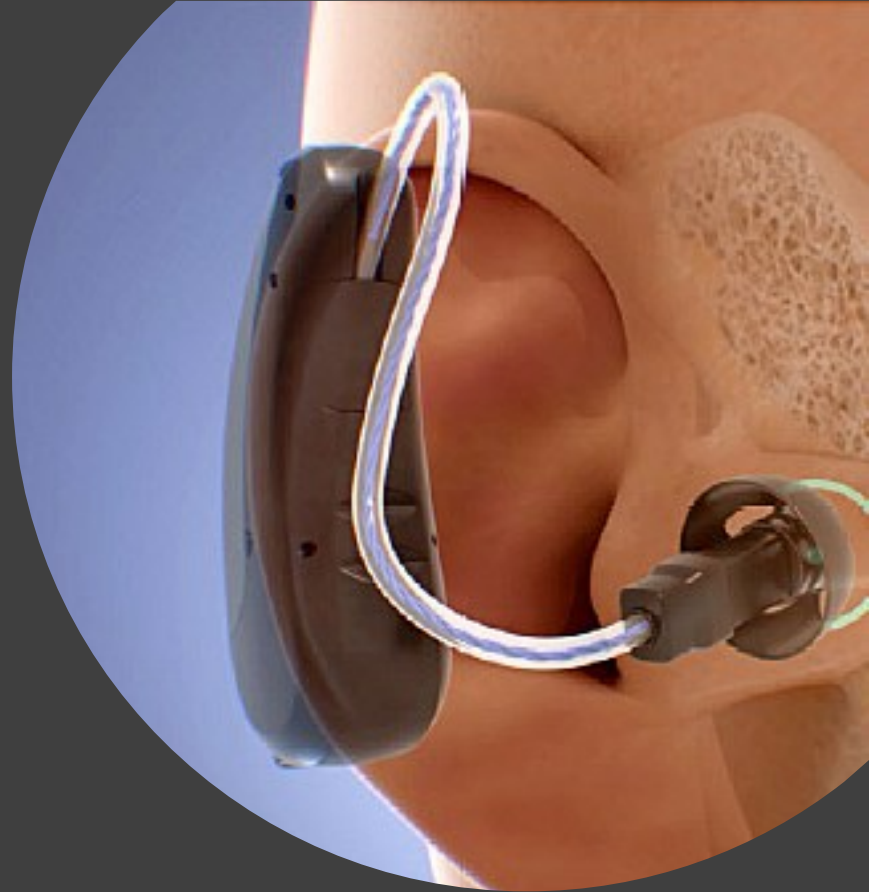
Part 5: What can we do about it?



Emerging Evidence for Amplification

Emerging evidence that treatment of hearing impairment through hearing solutions is effective in delaying the onset of cognitive impairment while maintaining good cerebral function.

Pioneered by Prof Frank Lin in study that the use of hearing aids in people between 60 and 65 years old was associated with a higher score on cognitive tests (Lin 2011) .



Emerging Evidence for Amplification

Supported by a study with analysis of a larger sample of people aged 65+ who were monitored over 25 yrs in the Personnes Agées QUID Study (n=3,670)

Results revealed self-reported hearing loss is associated with accelerated cognitive decline in older adults; hearing aid use attenuates such decline. (Amieva H. et al, 2015)

Those with hearing loss who wear hearing aids demonstrated trajectories of cognitive decline which were comparable to those who had no hearing loss.



Prof Hélène Amieva, University of Bordeaux, stated during her lecture at the UNSAF congress in Paris in March 2017:

“one of the few modifiable risks to prevent the early onset of dementia is treating hearing loss with professional hearing care”



Amplification through Hearing Aids



Open Fit Behind the Ear



Receiver in the Ear



In the Canal



Behind the Ear



In the Ear



In the Canal



Invisible in the Canal



Advances in Hearing Aid Technology

- Smaller, lighter
- Excellent feedback management
- Rechargeable options
- Better performance in crowds and background noise
- Water and dust resistance
- Wireless - Mobile phones, TV
- CROS and BiCROS systems for no hearing on one side



**Any
Questions?**

Feel free to contact me with questions or for a copy of the presentation:

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