
Hearing loss and the Brain, Cognitive function, Dementia

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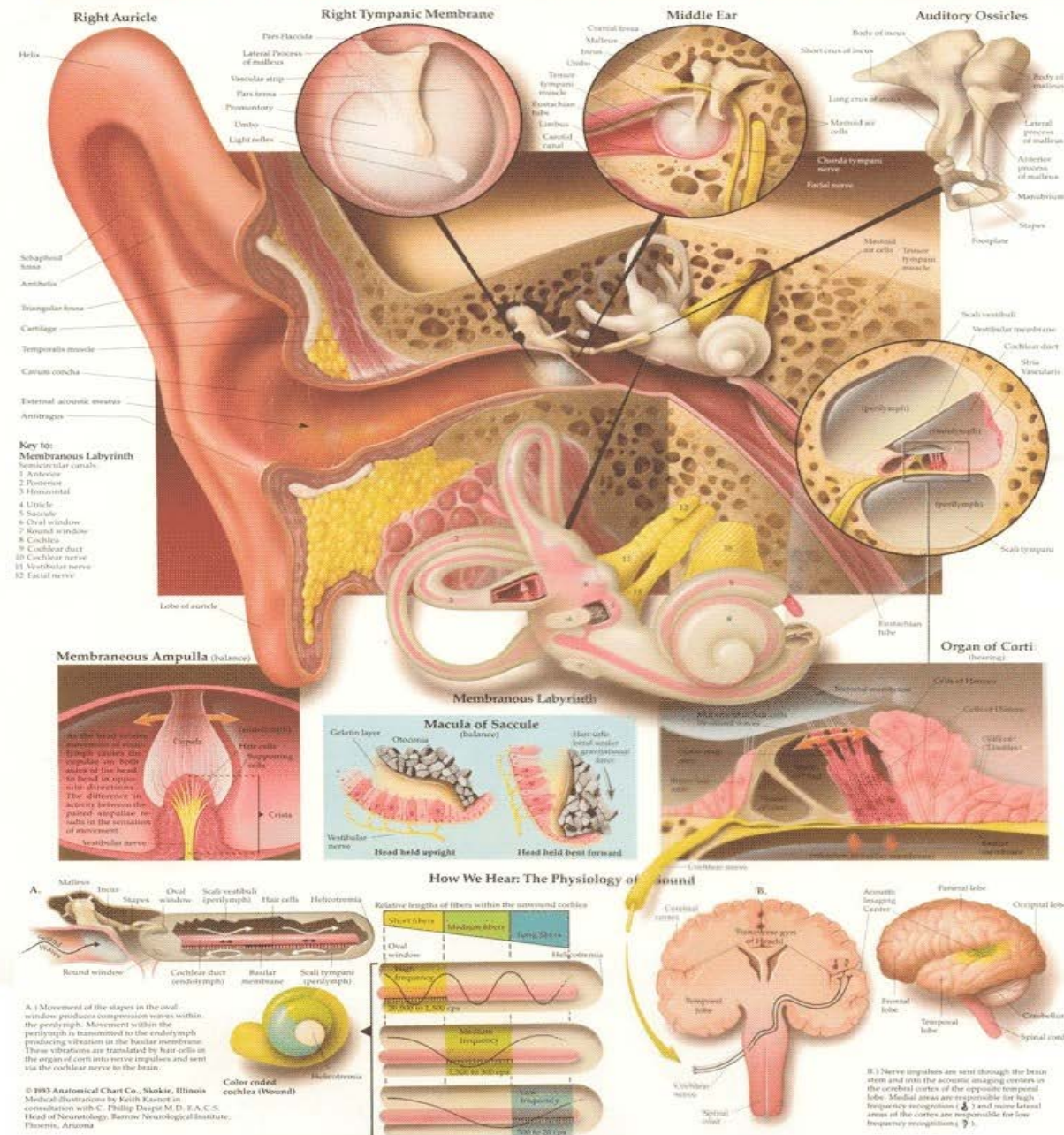
Deafness separates people from people

Helen Keller

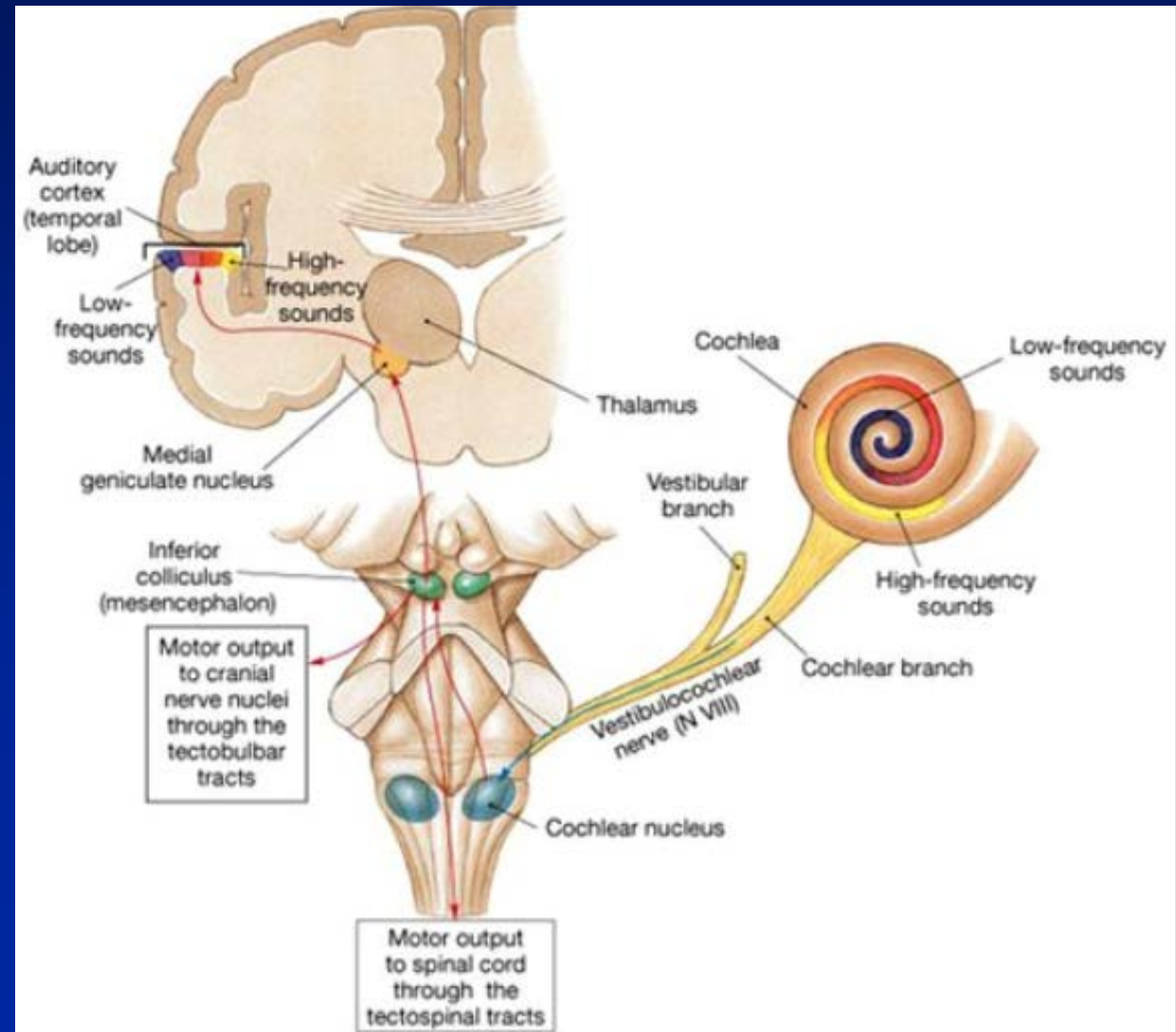
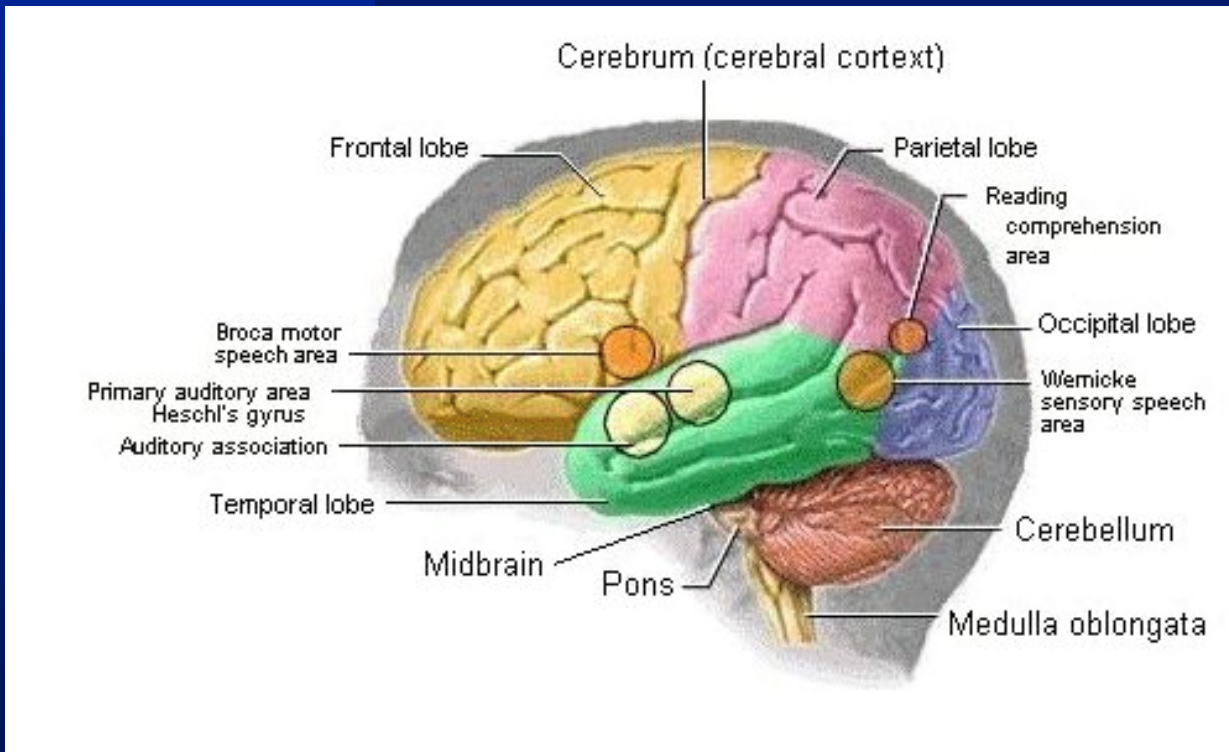


- The hearing system , one of the earliest to develop.
- Crucial in the survival instinct of all animals
- Affects language , communication skills, learning skills, and emotions:

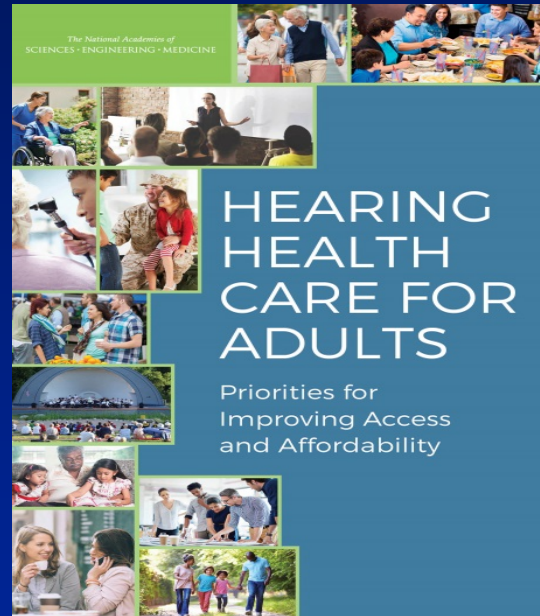
THE EAR—ORGANS OF HEARING AND BALANCE



Central Auditory Pathways



Hearing Health Care for Adults: Priorities for Improving Access and Affordability



Suggested citation: National Academies of Sciences, Engineering, and Medicine. 2016. *Hearing Health Care for Adults: Priorities for Improving Access and Affordability*. Washington, DC: The National Academies Press.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

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- It is estimated that 30 million people in the United States have hearing loss.
 - Hearing loss has been identified as the fifth leading cause, globally, of years lived with disability.
 - Furthermore, as the U.S. population of older adults increases, hearing loss will become an area of greater concern.
 - Hearing is a vital human sense that can be important to communication and health and can affect quality of life.

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- Yet for a variety of reasons, many people with hearing loss do not seek out or receive hearing health care.
 - Estimates of hearing aid use are that 67 to 86 percent of adults (50 years and older) who may benefit from hearing aids do not use them, and many hearing assistive technologies as well as auditory rehabilitation services are not fully utilized.
 - Long seen as an issue for individuals (and to some extent their families and friends), there is a growing recognition that hearing loss is a significant public health concern that can be addressed by actions at multiple levels.

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- The National Academies of Sciences, Engineering, and Medicine convened an expert committee to study the accessibility and affordability of hearing health care for adults in the United States.
 - Using a set of guiding principles to help shape its work, the committee recommends key institutional, technological, and regulatory changes that would enable consumers to find and fully use the appropriate, affordable, and high-quality services, technologies, and supports they need.

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- Hearing loss must be recognized as a public health concern, influenced and affected by decisions and actions at multiple levels.
 - Improving the accessibility and affordability of hearing health care will require solutions that span society: collaborative and sustained work from stakeholders in the public and private sectors and across professions.

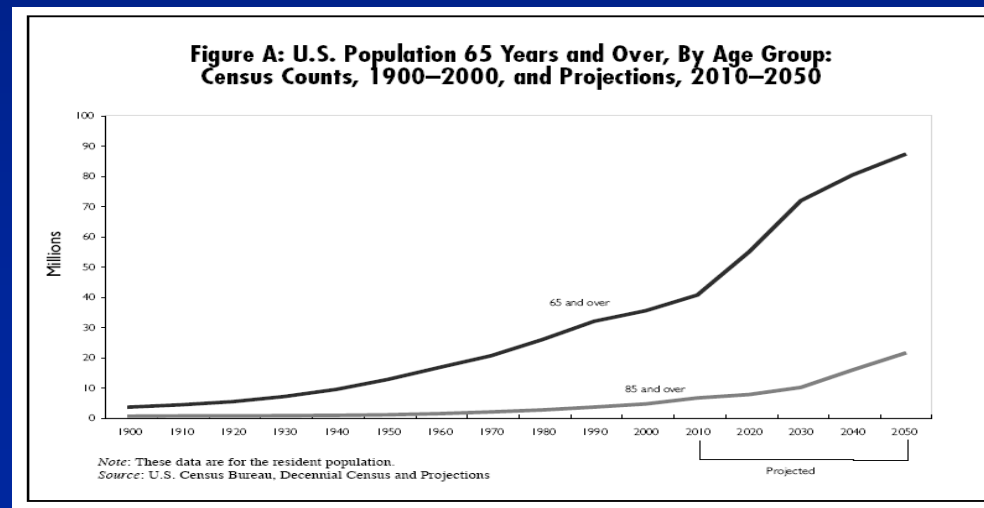
US population statistics

- US population 65 years and older grew 10 fold between 1900 -2000
- US population under 65 grew 3 fold in same time frame.
- US population 85 and older grew 30 fold in same time frame.
- By 2030, the older population (>65) will double what it was in 2000, while the total US population growth is projected to be slower.

US population statistics

(US Census Bureau 2003)

- Florida has the highest proportion of older people (16.7%)
- Numerically, California has the largest number of older people (3.6 million), followed by Florida (2.8 million) and New York (2.3 million)



Presbycusis

- Age related hearing loss
- Most common cause of hearing loss, and the 3rd most common chronic condition in the non-institutionalized older population
- Strains interpersonal relationship
- Social isolation
- Depression

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- Numerous studies have confirmed a relationship between hearing loss, cognitive decline and dementia with aging.

Hypotheses of auditory and cognitive associations

- Common cause hypothesis:
 - Auditory and cognitive declines are secondary to a widespread neural degeneration
- Degradation hypothesis:
 - Poor auditory performance compromises cognitive function by reducing the information available for processing.
- Cognitive load hypothesis:
 - Poor working memory limits auditory performance

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- Gates et al (2002) proposed that Central auditory speech processing deficits may be an early manifestation of probable Alzheimer's disease and may precede the onset of dementia by many years.

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- Gates et al (2011), hearing in noise requires substantial attentional and behavioral processing resources.
 - Study suggests that people with poor hearing in noise(<50%) be evaluated for early cognitive disorders.

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- Choi et al (2011): Is cognitive function in adults with hearing impairment improved by the use of hearing aids?
 - 18 individuals with HL fitted with hearing aids
 - 11 control patients not fitted with hearing aids.
 - Speech related cognitive function improved after using hearing aids.

Health ABC study (Health, Aging, and Body Composition)

- Lin et al (2013)
- Prospective, longitudinal study,
 - 3075 older adults aged 70-79 years
 - ▣ Audiometry
 - ▣ 3MS (Modified Mini Mental State Examination)
 - ▣ DSS (Digit Symbol Substitution)
 - Hearing loss is independently associated with accelerated cognitive decline.
 - ▣ HL group : 7.7 years to decline by 5 pts on 3MS
 - ▣ Normal hearing group: 10.9 years to decline.

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- Hearing loss → social isolation and loneliness
→ cognitive load
 - Greater resources are dedicated to auditory perceptual processing, to the detriment of other cognitive processes such as working memory.

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- An intact auditory system and proper cognition function of the brain are essential for language communication skills.
 - Deprivation of auditory input leads to reorganization of the topographic map of the auditory cortex.

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- Martini et al (2014):
 - Restoring hearing can reduce the “cognitive load”
 - ▣ Hearing aids
 - ▣ Cochlear implants.

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- Gurgel et al (2014):
 - Longitudinal study
 - 4,463 subjects age 65+ without dementia at baseline
 - HL was an independent predictor of developing dementia

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- Dawes et al (2015):
 - 164,770 adults in UK
 - Hearing aid use was associated with better cognition
 - ☐ Independent of social isolation and depression
 - ☐ Improved audibility and self efficacy
 - ☐ More cognitively able people seek and use hearing aids

- Shmulian et al (meta-analysis 2015)
 - Cognition is significantly poorer in:
 - ☐ Individuals with untreated hearing loss
 - ☐ Treated hearing impairment compared to normal hearing
 - The degree of cognitive deficit is significantly associated with the degree of hearing loss in both treated and untreated individuals
 - Hearing intervention significantly improves cognition
 - Hearing impairment impacted on all domains of cognition

Conclusion

- Hearing loss affects the quality of life, social interactions, motor skills, psychological aspects, and function and morphology in specific brain areas.
- Long term hearing deprivation can impact cognitive performance by decreasing the quality of communication leading to social isolation, depression and facilitate dementia.

Conclusion

- Effective intervention with hearing aids or cochlear implants may improve social and emotional function, communication, cognitive function and quality of life.