Age-related Hearing Loss: Ear and Brain Mechanisms

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Sensory system aging changes

- Peripheral – Ear
  - Cochlea
  - Efferent system

- Central – Brain
  - Auditory cortex

- Comorbid conditions
  - Metabolic
  - Hormone
Auditory efferent system

Auditory cortex

Superior olivary complex (SOC)

Cochlea
Olivocochlear efferent system
Measuring function of MOC

- Efferent control
- Modulate sensory input
- Contralateral suppression
  - Distortion-product otoacoustic emission (DPOAE)
    - $2F_1 - F_2$
  - Difference of DPOAE measured in
    - Quiet
    - Wideband noise to contralateral ear
Measuring function of MOC
Aging changes in MOC function

- Using contralateral suppression
- Subjects with intact cochlear function

- Contralateral suppression declines with age
- **MOC function declines with age**
Aging changes in MOC function

- CBA mouse strains
  - Good peripheral hearing

- MOC function declines with age
Molecular bases for MOC decline

- $K_v1.1$, $K_v3.3$, $K_v3.1$ channels
  - High-frequency action potential generation
- Immunocytochemical stain
  - Decline for $K_v3.1$ in MOC with age
- $K_v3.1$ knockout mice
  - $+/+$
  - Heterozygotes
  - Knockout

![Graph](image)

- MOC function decline
- Superior Paraolivary Nucleus (SPN) declines
- Ventral Nucleus of the Trapezoid Body (VNTB)
Comorbid conditions and hearing

- Hormonal imbalances
  - Type 2 diabetes mellitus
  - Aldosterone
  - Hormone replacement therapy

- Hearing studies
  - Peripheral
  - Central
Summary and Conclusions

- Many mechanisms for age-related hearing loss
  - Environmental factors
  - Cochlea function decline
    - Hair cells, neurons, stria vascularis
  - Loss of efferent feedback from brain
    - MOC system function decline
      - $K_v 3.1$
Summary and Conclusions

- Age-related hormonal imbalances
- Reversibility of sensory impairments?
- Learn more in neural, genetic, molecular bases of age-related hearing loss
End of presentation

Thank you for your attention