Results
Not every subject experienced motion- and/or VR-induced sickness in our comparatively short tests. With the optimal working parameters for the bone conduction transducer, no subject felt worse with our device. For the subjects that did experience motion sickness, over 95% displayed significant improvement with the device active. For the subjects that experienced VR-sickness, all of them experienced significant improvement when wearing the active device.

Conclusions
We are developing a non-pharmaceutical intervention that is remarkably effective at mitigating and sometimes completely preventing motion- and virtual reality- induced sickness. In the near future, we hope to expand our research to medical conditions for which reduction of dizziness would result in improvement of quality of life, such as vestibular migraines, vestibular neuritis and Ménière';s disease.
Conflict of Interest

All authors have a financial interest in OtolithLabs, a start-up dedicated to improving the quality of life of those suffering from motion sickness and VR-induced sickness.

Aging: Processes & Prevention

PD 110

CBA/CaJ mice (Mus musculus) as a behavioral model for hearing loss

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Age related hearing loss (ARHL), or presbycusis, is the most common disorder among older humans. Thus, it is critical to establish a reliable anatomical, physiological, and behavioral animal model for ARHL in order to understand the basis of presbycusis, and for developing future diagnostic and treatment strategies. Mice are frequently used to study and model ARHL due to similarities in human and mouse cochleae and in genetic makeup. Mice also emit ultrasonic vocalizations (USVs) that may be used for communication purposes, similar to speech in humans. Previous electrophysiological research established that the CBA/CaJ mouse strain is an appropriate model for late-onset hearing loss. These mice exhibit ARHL sex differences in auditory brainstem responses (ABRs) for pure tones between 12 and 15 months of age, with males showing higher ABR thresholds than females. Although much is known about electrophysiological measures of hearing loss in mice, behavioral research has been severely underrepresented in the aging literature. The only longitudinal behavioral study to date by Kobrina and Dent (2016) used operant conditioning procedures with positive reinforcement to show that CBA/CaJ mice exhibit ARHL, however much later in life than established by ABR studies in the same strain of mouse. In fact, this strain is capable of detecting 42 kHz pure tones and USVs up to 34 month of age. The behaviorally measured ARHL sex differences were present for detecting USVs, but not for 42 kHz tones, conflicting with previous ABR findings. The goal of current research is to use operant conditioning procedures to establish a complete pure tone audiogram, to examine the effects of stimulus duration on signal detection across lifespan, and to assess the effects of aging on USV and pure tone detection in quiet and noise in adult CBA/CaJ mice. The results revealed that adult mice retain their hearing late into their lifespan as assessed by behavioral methodologies. Similarly to humans, mice lose hearing for high frequency pure tones earlier than for low frequency pure tones. Not surprisingly, mice showed lower thresholds for longer pure tone stimuli than for shorter ones. This duration benefit disappears with age, particularly at a faster rate for high frequency tones. Mice are also capable of detecting pure tones and USVs in silence and noise across their lifespan, with older mice exhibiting higher thresholds in noise than in silence. The results highlight the necessity for behavioral measures of hearing in mouse models of ARHL.

PD 111

Hearing Loss and Associated Risk Factors among Older Adults: The Age, Gene/Environment Susceptibility-Reykjavik Study (AGES-RS)

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Introduction

Age-related hearing loss (ARHL) is a common sensorineural disorder in older adults, who typically experience gradual rather than sudden onset of disabling hearing impairment (HI).

Objective

To estimate prevalence and identify risk factors associated with HI in a well-characterized cohort of older adults. Methods: The Age, Gene/Environment Susceptibility–Reykjavik Study (AGES-RS) 2002–2006, interviewed and examined a population-based cohort of 5,764 adults aged 66–96 years. We performed analysis on 5,171 subjects who completed air-conduction, pure-tone audiometric examinations after removal of clinically significant cerumen. Hearing in the better ear was analyzed using the pure-tone average (PTA: 0.5–1–2–4 kHz) threshold classification recommended by the Global Burden of Disease (GBD) 2010 Hearing Loss Expert Group: “mild” (20–34 dB hearing level [HL]), “moderate” (35–49 dB HL), “moderately severe” (50–64 dB HL), “severe” (65–79 dB HL), “profound” (80–94 dB HL), and “deaf” (≥95 dB HL). Disabling HI has been defined as BE, PTA ≥35 dB HL. Multivariable-adjusted prevalence ratios (PRs) and 95% confidence intervals (CI)s were calculated using logistic regression models.

Results

The prevalence of (only) mild HI was 43.2% (males, 44.0%; females, 42.5%), while disabling HI was 32.5% (males, 38.9%; females, 27.8%). Males had higher prevalence of disabling HI compared to females (PR:1.43; 95% CI:1.32-1.54). Prevalence of disabling HI increased with age (66-69, 70-74, 75-79, 80-84, and 85+ years): males, 13.0%, 24.0%, 39.1%, 55.4%, and 73.7%; females, 5.7%, 13.6%, 24.7%, 45.9%, and 70.9%, respectively. After adjusting for age, sex, and education, the risk factors associated with disabling HI were: “fair” (PR:1.15; 95% CI:1.03-1.28) and “poor” general health status (PR:1.22; 95% CI:1.03-1.45); underweight (PR:1.37; 95% CI: 1.07-1.75); hypertension (PR:1.16; 95% CI:1.02-1.33); mild (PR:1.16; 95% CI:1.04-1.30) and moderate-to-severe depression (PR:1.39; 95% CI:1.08-1.79); mild (PR:1.44; 95% CI:1.29-1.61) and greater cognitive impairment (PR:1.27; 95% CI:1.10-1.47); vertigo (PR:1.10; 95% CI:1.01-1.19); frequent falls (PR:1.31;95% CI:1.14-1.51); tinnitus (PR:1.37; 95% CI:1.25-1.50); self-reported hearing loss (PR:4.69; 95% CI:4.09-5.37); wearing hearing aids (PR:3.67; 95% CI:3.42-3.93); history of repeated ear infections (PR:1.35; 95% CI:1.18-1.55); and history of work-related noise exposure (PR:1.43; 95% CI:1.32-1.54). Lifetime moderate or higher physical activity was protective, i.e., associated with decreased prevalence (PR:0.91; 95% CI:0.83-0.99).

Conclusion

In AGES-RS, disabling HI prevalence increased markedly with age. ARHL is a permanent condition with limited rehabilitation success. Hence, reliable information for ways to delay onset of ARHL is a priority. Findings from epidemiological studies can suggest preventive strategies, e.g., moderate or higher physical activity.

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Exaggerated temporal processing deficits as animals age after synaptopathic noise

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Background

Normal aging results in a progressive loss of synapses between inner hair cells and auditory nerve fibers. An early overexposure to sound exacerbates this loss, even when thresholds recover. The functional consequences of this synaptopathy are poorly understood, though it is thought to affect suprathreshold coding of sound, especially in challenging listening conditions like the presence of background noise. Here, population level auditory brainstem responses (ABRs) and envelope following responses (EFRs) were used to study suprathreshold temporal processing with aging after an early noise exposure in a rodent model of synaptopathy.

Methods

ABRs and EFRs were obtained from an age-graded series of CBA/CaJ mice with or without a single exposure to a known synaptopathic noise that does not cause permanent hearing threshold elevations. ABRs were obtained to tone pips at various sound levels and frequencies. EFR stimuli were sinusoidally amplitude modulated (sAM) tones. Stimuli were centred on synaptopathic or non-synaptopathic cochlear regions. The modulation frequency, depth, sound levels and signal-to-noise ratio of the sAM stimuli were systematically varied to test temporal processing with degraded envelope cues. DPOAE thresholds and growth functions provided information about outer hair cell (OHC) functional integrity, and immunostained cochlear whole-mounts were used to quantify hair cells and synapses.

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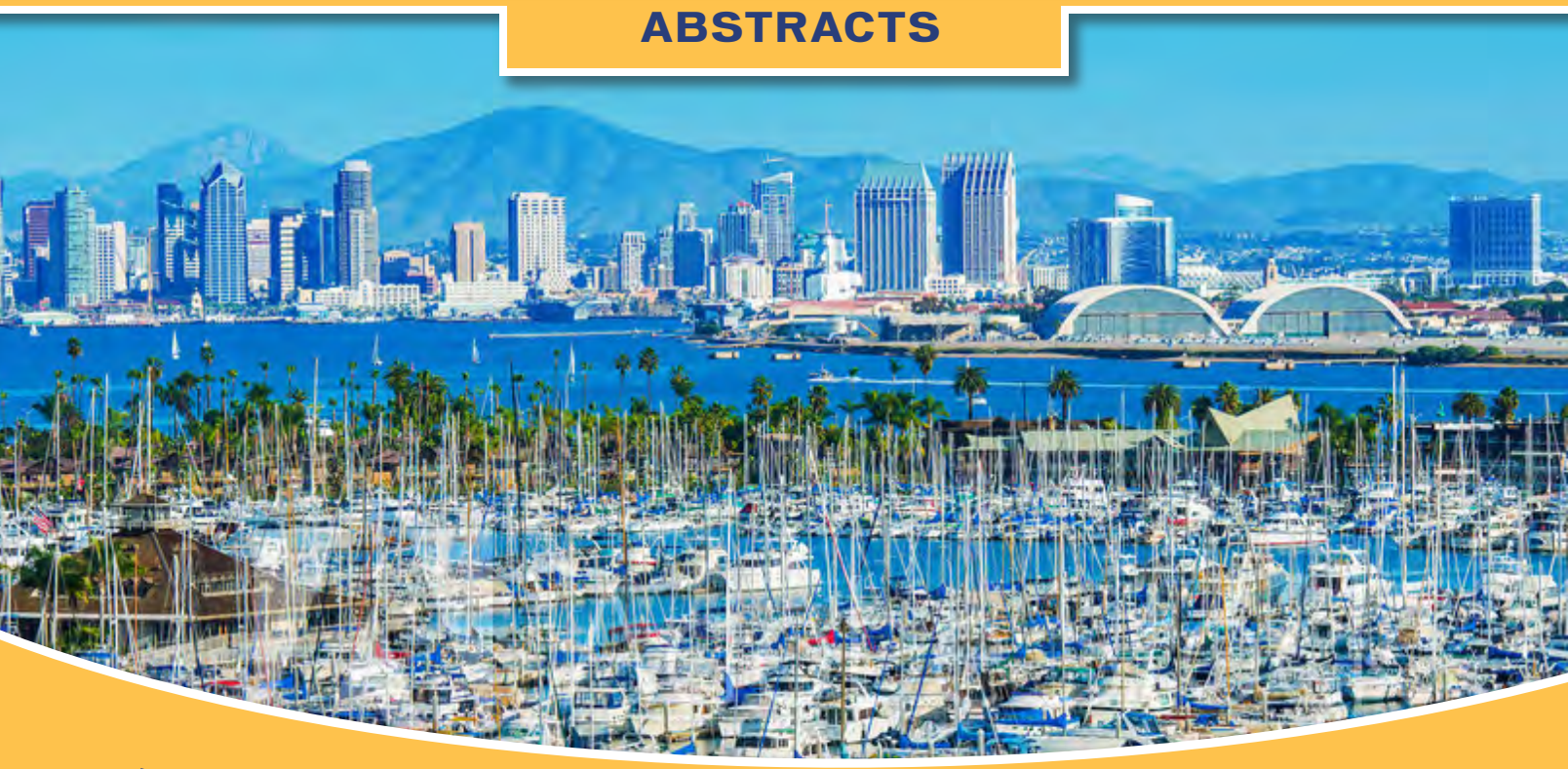
ABSTRACTS



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