

## ***Aging and Deafness***

**Burkard, R., & Sims, D.** (2001). The human auditory brainstem response to high click rates: Aging effects. *American Journal of Audiology*, 10(2):53-61. [AN 1809]\*  
*In 1999 J. Walton, M. Orlando, & R. Burkard (Hearing Research, 127, 86-94) investigated aging effects on auditory brainstem response (ABR) wave V latency using a tone-on-toneburst forward-masking paradigm. They found that at short forward-masking intervals, wave V latency shift was greater in normal-hearing older adults than in normal-hearing young adults for moderate level, high-frequency toneburst maskers and probes. It was not possible to evaluate wave I latency because stimulation and recording procedures did not produce a consistently observable wave I. In order to optimize the recording of wave I, the present study used a high-level (115 dB pSPL) click stimulus, combined with a tympanic membrane inverting electrode, and investigated the latencies and amplitudes of waves I and V across click rate. Young adults had hearing thresholds within normal limits, whereas older adults had normal hearing or mild threshold elevation. All data were collected and analyzed with a Nicolet Bravo. Using conventional recording procedures, ABRs were obtained at click rates of 11, 25, 50, and 75 Hz. Using maximum length sequences (MLSs), ABRs were obtained at 100, 200, 300, 400, and 500 Hz. Results across age groups were very similar. With increasing click rate, peak latencies increased, the I-V interval increased and peak amplitudes decreased. The most notable difference between age groups was that wave I amplitude was substantially smaller in the older subjects. It appears that changes in the ABR with increasing rate are remarkably similar in young and older adults when audiometric thresholds are normal or near-normal in both age groups.*

**Burkard, R., & Sims, D.** (2002). A comparison of the effects of broadband masking noise on the auditory brainstem response in young and older adults. *American Journal of Audiology*, 11(1):13-22. [AN 1810]  
*We examined the effects of ipsilateral-direct, continuous, broadband noise on auditory brainstem response (ABR) wave I and V latencies and amplitudes in young adult versus older adult humans. It was hypothesized that age might influence the effects of masking noise on ABR peak latencies and/or amplitudes, given the frequent complaint of older persons' ability to process speech in background noise. Young adults had hearing thresholds of 20 dB HL or better for the octave frequencies from 250 to 8,000 Hz. A subset of older study participants had thresholds of 20 dB HL or better across frequency, but others had thresholds up to 45 dB HL. All data were collected and analyzed with a Nicolet Bravo. An electrode was placed on the tympanic membrane (as well as on high forehead and contralateral mastoid), and a click level of 115 dB pSPL was used to maximize wave I amplitude. Masker conditions included a no-noise control and noise levels ranging from 20 to 70 dB effective masking, in 10 dB steps. With increasing noise level, both age groups showed minimal changes in wave I latency, but substantial increases in wave V latency and I-V interval. Peak amplitudes decreased with increasing noise level. Mean amplitudes were smaller for the older group, most notably for wave I. Mean peak latencies were greater in the older group, but the I-V interval was similar across age groups, as was the change in peak latencies and I-V interval across noise level. ABR parameters for the older adults with hearing meeting the 20-dB HL criterion*

*at all frequencies (older-better) were compared to those who didn't meet this criterion (older-worse). Mean wave I latency was greater and wave V latency and I-V interval were smaller for the older-worse group at all noise levels. Mean wave I and V amplitudes were similar for the older-better and older-worse groups. In participants with normal or near-normal hearing, ABR changes with increasing age included small latency increases and a substantial reduction in wave I amplitude. The effects of ipsilateral-direct masking noise on the click-evoked ABR are similar for young and older adults.*

**Sims, D., & Burkard, R.** (2001). Rehabilitation for presbycusis. In P. R. Hof, and C. V. Mobbs (Eds.) *Functional neurobiology of aging* (pp. 635-645). San Diego, CA: Academic Press. [AN 1717]

*Current and promising future treatments for presbycusis are reviewed. Proceeding from the evidence that compensatory functional reorganization of the brain takes place with aging, rehabilitation efforts should include appropriate treatment of the peripheral and central components of age-related hearing handicaps. Treatment may include addressing age-related declines in neurochemistry, but also may include behavioral training in compensatory communication strategies following the establishment of successful hearing aid use. This chapter has one section that summarizes animal experiments which may lead to human biochemical, bioelectric, or other interventions to reduce or reverse the effects of aging in the auditory system; the second section summarizes current and potentially fruitful future approaches to audiological rehabilitation. In this chapter, we provide the reader with cross-discipline vantage points in order to facilitate collaborative, applied research.*

**Snell, K.** (2002). Dichotic gap detection and speech recognition in noise. Association for Research in Otolaryngol. Abs.:81. [AN 1789]

*In an earlier study, we found that speech understanding in a fluctuating background is related to temporal processing as measured by the detection of gaps in noise bursts. Fifty adults with normal or mild high-frequency hearing loss served as subjects. Gap detection thresholds in noise were obtained using a 150-ms noise burst with the gap placed close to carrier onset. NU-6 word scores for the subjects were obtained at a presentation level of 55 dB HL in competing babble levels of 50, 55 and 60 dB HL. A repeated measures analysis of covariance of the word scores examined the effects of age, absolute sensitivity, and temporal sensitivity. The results of the analysis indicated that word scores in competing babble decreased significantly with increases in babble level, age, and gap detection thresholds. The effects of absolute sensitivity on word scores in competing babble were not significant. These results suggest that in the absence of clinically significant hearing loss, age and temporal processing influence speech understanding in fluctuating backgrounds. In a more recent study, gap detection thresholds were obtained in comparable dichotic conditions with similar groups of younger, middle-aged, and older listeners. The relationship between dichotically obtained gap thresholds and speech scores will be presented. Finally, a third study was designed to determine the effect of moderate to severe hearing loss on temporal acuity and its relationship to speech discrimination in noise. Gap detection thresholds and word scores were obtained across a range of background noise levels in 13 young subjects. Five had normal hearing; eight had moderate to severe bilateral hearing losses. The relationship between gap detection*

*thresholds and speech scores in younger adults with moderate to severe hearing loss will be discussed. This research was supported by the Rochester International Center for Hearing and Speech Research and a grant from NIA.*

**Snell, K., & Frisina, D. (2000).** Relationships among age-related differences in gap detection and word recognition. *The Journal of the Acoustical Society of America*, 107(3), 1615-1626. Ipswich, MA: EBSCO Publishing. [AN 1787]  
*The relationships among age-related differences in gap detection and word recognition in subjects with normal hearing or mild sensorineural hearing loss were explored in two studies. In the first study, gap thresholds were obtained for 40 younger and 40 older subjects. The gaps were carried by 150-ms, modulated, low-pass noise bursts with cutoff frequencies of 1 or 6 kHz. The noise bursts were presented at an overall level of 80 dB SPL in three background conditions. Mean gap thresholds ranged between 2.6 and 7.8 ms for the younger age group and between 3.4 and 10.0 ms for the older group. Mean gap thresholds were significantly larger for the older group in all six conditions. Gap thresholds were not significantly correlated with audiometric thresholds in either age group but the 1-kHz gap thresholds increased with age in the younger group. In the second study, the relationships among gap thresholds, spondee-in-babble thresholds, and audiometric thresholds of 66 subjects were examined. Compared with the older subjects, the younger group recognized the spondees at significantly lower (more difficult) spondee-to-babble ratios. In the younger group, spondee-in-babble thresholds were significantly correlated with gap thresholds in conditions of high-frequency masking. In the older group, spondee-in-babble thresholds, gap thresholds, and audiometric thresholds were not significantly correlated, but the spondee-in-babble thresholds and two audiometric thresholds increased significantly with age. These results demonstrate that significant age-related changes in auditory processing occur throughout adulthood. Specifically, age-related changes in temporal acuity may begin decades earlier than age-related changes in word recognition.*

**Snell, K., Mapes, F., Hickman, E., & Frisina, D. (2002).** Word recognition in competing babble and the effects of age, temporal processing, and absolute sensitivity. *The Journal of the Acoustical Society of America*, 112(2), 720-727. [AN 1786]  
*This study was designed to clarify whether speech understanding in a fluctuating background is related to temporal processing as measured by the detection of gaps in noise bursts. Fifty adults with normal hearing or mild high-frequency hearing loss served as subjects. Gap detection thresholds were obtained using a three-interval, forced-choice paradigm. A 150-ms noise burst was used as the gap carrier with the gap placed close to carrier onset. A high-frequency masker without a temporal gap was gated on and off with the noise bursts. A continuous white-noise floor was present in the background. Word scores for the subjects were obtained at a presentation level of 55 dB HL in competing babble levels of 50, 55, and 60 dB HL. A repeated measures analysis of covariance of the word scores examined the effects of age, absolute sensitivity, and temporal sensitivity. The results of the analysis indicated that word scores in competing babble decreased significantly with increases in babble level, age, and gap detection thresholds. The effects of absolute sensitivity on word scores in competing babble were not significant. These*

*results suggest that age and temporal processing influence speech understanding in fluctuating backgrounds in adults with normal hearing or mild high-frequency hearing loss.*