TOPICAL REVIEW

Exploring applications of in situ delivery of neurotrophins NT-3 and BDNF for use in cochlear implants

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Clinical applications have proven that the cochlear implant rescues audition in the congenitally deaf or severely hearing impaired. However, current implant models offer poor spectral representation, causing frequency distortion and confusion of similar tones. Current research suggests that applications of proteins neurotrophin-3 (NT-3) and brain-derived neurotrophic factor (BDNF) not only contribute to spiral ganglion neurogenesis, but also regulate the frequency response of auditory nerves along the length of the basilar membrane. We hypothesize maintaining well-defined concentration ratios of NT-3 and BDNF are responsible for this tuning. We discovered that specific ratios of NT-3 to BDNF influence metabolic pathways of important signaling proteins that control firing rates and frequency responses of inner hair cells. A controlled release of NT-3 and BDNF through ports along the length of cochlear implants may allow greater differentiation of frequency tuning among auditory spiral ganglion cells. Such tuning may aid in the rescue of high frequency noise in particular, and may aid in the central nervous system's ability to distinguish between similar frequency sounds.