Earthquakes in the Inner Ear: A Novel Finite Element Simulation Modelling the Mechanism of the Basilar Membrane & Hair Cells

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Typical teenagers can use up to 6 hours of headphones in their everyday life, setting the volume to 75-100%. According to Stanford Medicine researchers, the trend of inner-ear (sensorineural) hearing loss in new generations is increasing exponentially. Sensorineural hearing loss is a novel process that medical researchers are currently trying to understand. Presently, researchers have theorized that the deterioration of the basilar membrane and hair cells directly contributes to sensorineural hearing loss. Seismic waves also deteriorate buildings, leading civil engineers to create computer simulations to sufficiently engineer structures. Computational modelling of novel human body structures has been an advancement in the medical fields. For a better understanding of sensorineural hearing loss, the usage of seismic wave simulations could be an option. High amplitude earthquakes are similar to loud sound waves(mechanical) due to creating ground motion for standing structures. The way inner ear structures respond to loud sounds is similar to how buildings react to high amplitude earthquakes. When modelling with the simulator, three criteria are met: the tonotopic map, mechanical bending of the cilia, and responsiveness to amplitude. The results showed a novel approach to analyzing the destruction of the basilar membrane and hair cells by altering the buildings' dynamic properties. The amplitude affects the structural integrity of inner ear structures, but the resonance phenomenon is present in the inner ear, which is an additional contribution.