

Full name: Nguyen Nhat Hoang

Team: 7 - Uranus

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### **1. What is age-related hearing loss?**

Age-related hearing loss, also known as presbycusis, is a gradual decline in hearing ability that occurs as people grow older. It typically affects both ears symmetrically and often starts with difficulty hearing high-frequency sounds, like birds chirping or a phone ringing. Over time, it can make understanding speech, especially in noisy environments, more challenging. It's a common condition among older adults and is considered a natural part of aging, though its severity varies between individuals.

### **2. Why does aging lead hearing loss?**

Aging leads to hearing loss primarily due to the natural degeneration of the inner ear's structures, particularly the hair cells in the cochlea that convert sound waves into electrical signals for the brain to interpret. These cells don't regenerate, and their loss accumulates over time. Other contributing factors include genetic predisposition—some people are more prone due to family history—and environmental influences, like prolonged exposure to loud noises (e.g., from concerts or headphones). Additionally, age-related conditions like high blood pressure or diabetes, as well as certain medications (like chemotherapy drugs), can damage inner ear cells or auditory nerves, accelerating the process. It's a mix of biology wearing down and a lifetime of wear-and-tear on the auditory system.

### **3. Why are high frequency components used for alarm signals?**

High-frequency components are used for alarm signals because the human ear is generally more sensitive to these frequencies, typically in the range of 2,000 to 5,000 Hz. This sensitivity makes high-pitched sounds—like sirens or smoke alarms—stand out more, even in noisy environments, grabbing attention quickly during emergencies. They also travel further and penetrate background noise better than low-frequency sounds. However,

there's a caveat: for older adults with age-related hearing loss, who often struggle with high frequencies, lower-frequency alarms (around 500 Hz) are sometimes recommended, especially for waking someone from sleep. Still, high frequencies remain the go-to for most alarms because they're more universally effective at alerting people.