

Sistema Auditivo

Luis Robles W.
Instituto de Ciencias Biomédicas
Facultad de Medicina
Universidad de Chile

Ondas Sonoras

Oído humano

Frecuencias:

20 a 16.000 ciclos/seg

Intensidades:

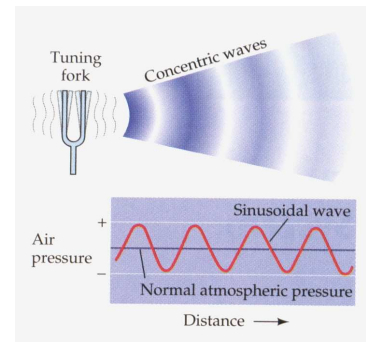
1×10^{-12} a 1 watts/m^2

20×10^{-6} a $20 \text{ Pascal (N/m}^2\text{)}$

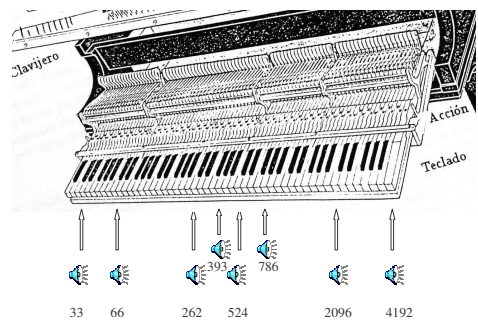
Intensidades en dB:

120 dB re $20 \mu\text{Pa}$

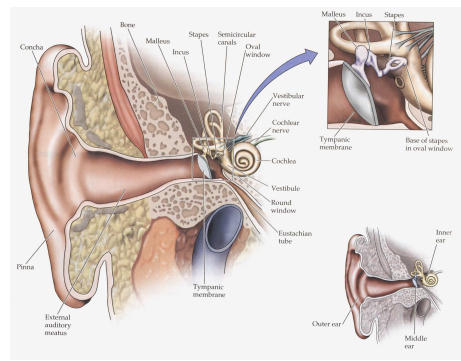
$I(\text{dB}) = 10 \log (I / I_{\text{ref}})$



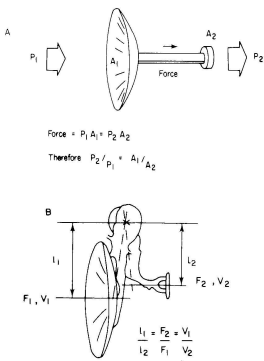
Piano



El Oído Humano



Oído Medio



En el hombre:

$$A_1 / A_2 = 17$$

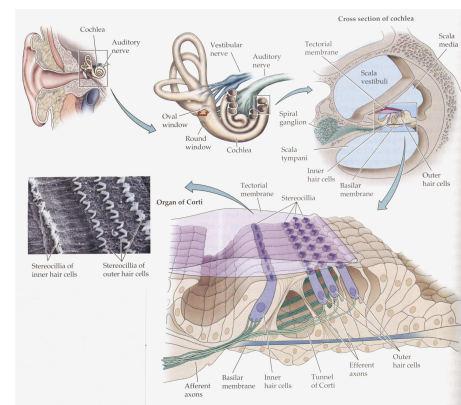
$$I_1 / I_2 = 1,3$$

Aumento de Presión:

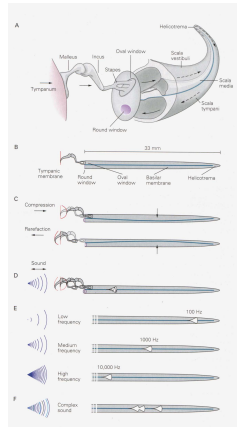
$$P_2 / P_1 = 22$$

$$P_2 / P_1 = 27 \text{ dB}$$

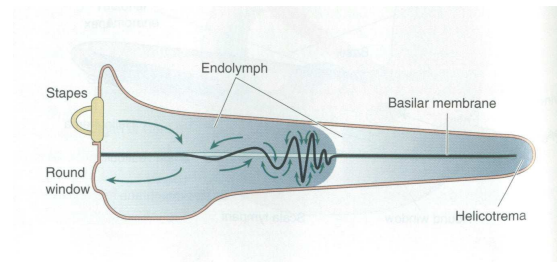
Estructura del Oído Interno



Vibración Coclear



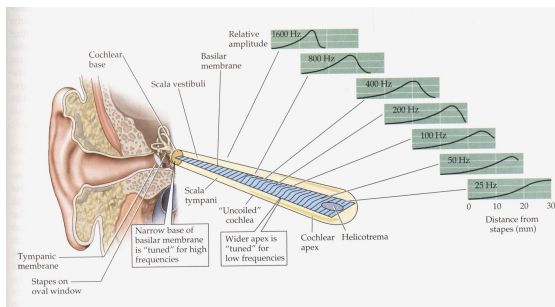
Onda viajera coclear



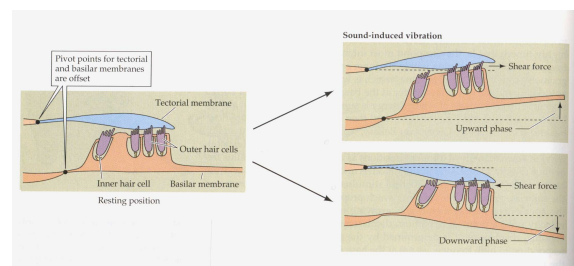
Tonotopía: producida por aumento de elasticidad de la membrana basilar de la base al ápice

onda.mov

Tonotopía Coclear

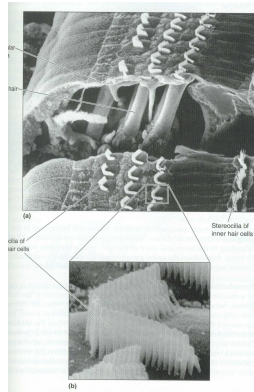


Vibración Radial de los Estereocilios

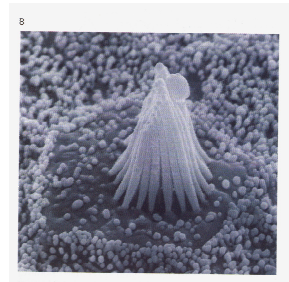
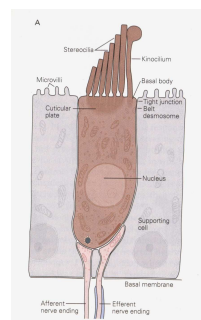


Células Ciliadas Cocleares

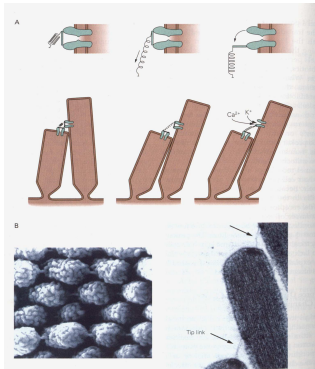
Lámina reticular
Células ciliadas
externas



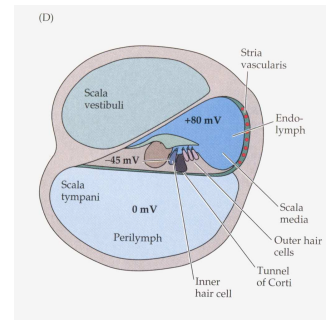
Células Ciliadas Vestibulares



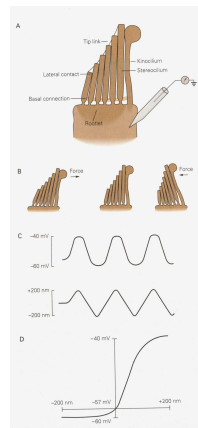
Canales de Transducción



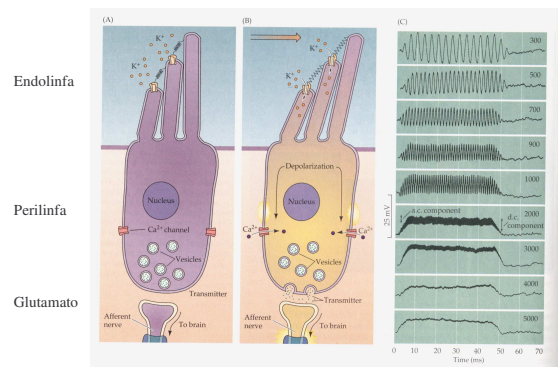
Potencial Endococlear



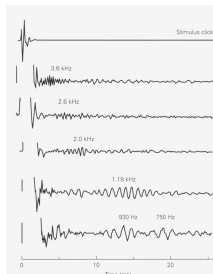
Potencial de Receptor



Potencial de Receptor (Microfónicas)



Emisiones Otoacústicas



Kemp, J. Acoust. Soc. Am. 64, 1978.

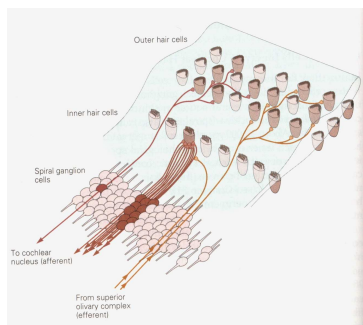
Figure 30-8 Evoked otoacoustic emissions are evidence for a cochlear amplifier. Mechanical amplification of vibrations within the cochlea is an active process that enhances the sensitivity of hearing (see Figure 30-3b). The records here show the otoacoustic emissions in the ears of five subjects. For each subject, a brief click was played into an ear through a miniature speaker. A few milliseconds later a tiny microphone in the external auditory meatus detected one or more bursts of sound emission from the ear. (From Wilson 1980.)

Electromotilidad de Células Ciliadas Externas

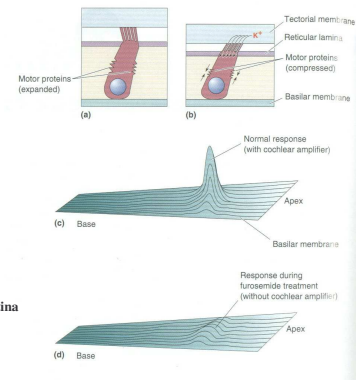


Figure 30-9 Cochlear amplification is mediated by movement of hair cells. When this isolated outer hair cell is depolarized by the electrode at its base, its cell body shortens (left). Hyperpolarization, on the other hand, causes the cell to lengthen (right). The oscillatory motions of outer hair cells may provide the mechanical energy that amplifies basilar membrane motion and thus enhance the sensitivity of human hearing. (From Holey and Ashmore 1988.)

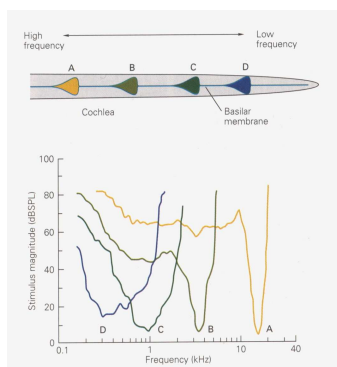
Inervación de las células ciliadas



Inervación de las células ciliadas

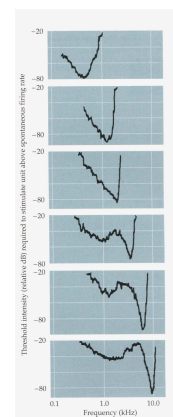


Tonotopía de las Células Ciliadas

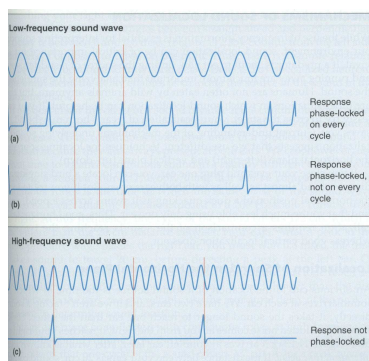


Sintonización de frecuencia de las diferentes fibras del nervio auditivo

Cada neurona del ganglio espiral tiene una frecuencia característica



Sincronización temporal de fibras cocleares



Vía Auditiva

Mesencéfalo:

N. Geniculado medial

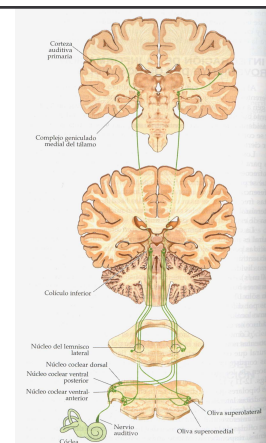
Colículo inferior

Tronco encefálico:

N. del Lemnisco lateral

N. Oliva superior

N. Coclear dorsal
ventral anterior
ventral posterior

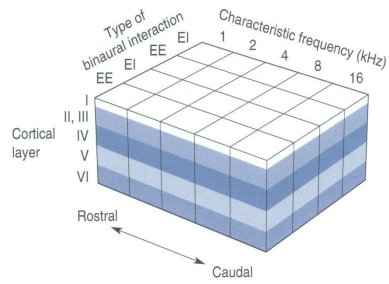


Organización Corteza Auditiva Primaria

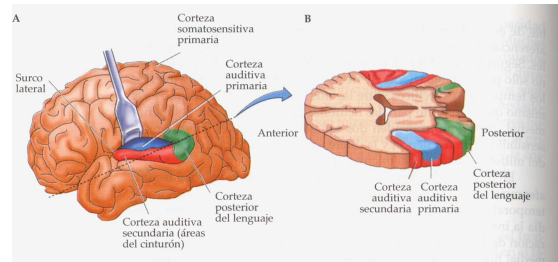
Organización Columnar

capas:

- IV aferencias del tálamo
- II y III conex. intracorticales
- V a núcleos subcorticales
- VI retrógrada al tálamo

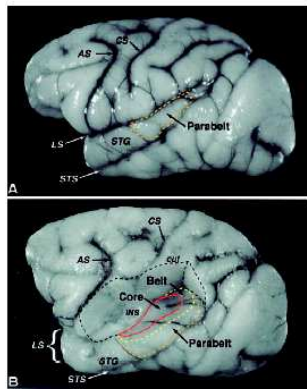


Corteza auditiva humana



Corteza Auditiva en Macaco

Cinturón lateral:
En circunvolución temporal superior



Corteza parietal sobre surco lateral removida:
Núcleo: Auditiva primaria
Cinturón: Auditivas circundantes
Cinturón lateral: Áreas multimodales
En borde ventral del surco lateral.

