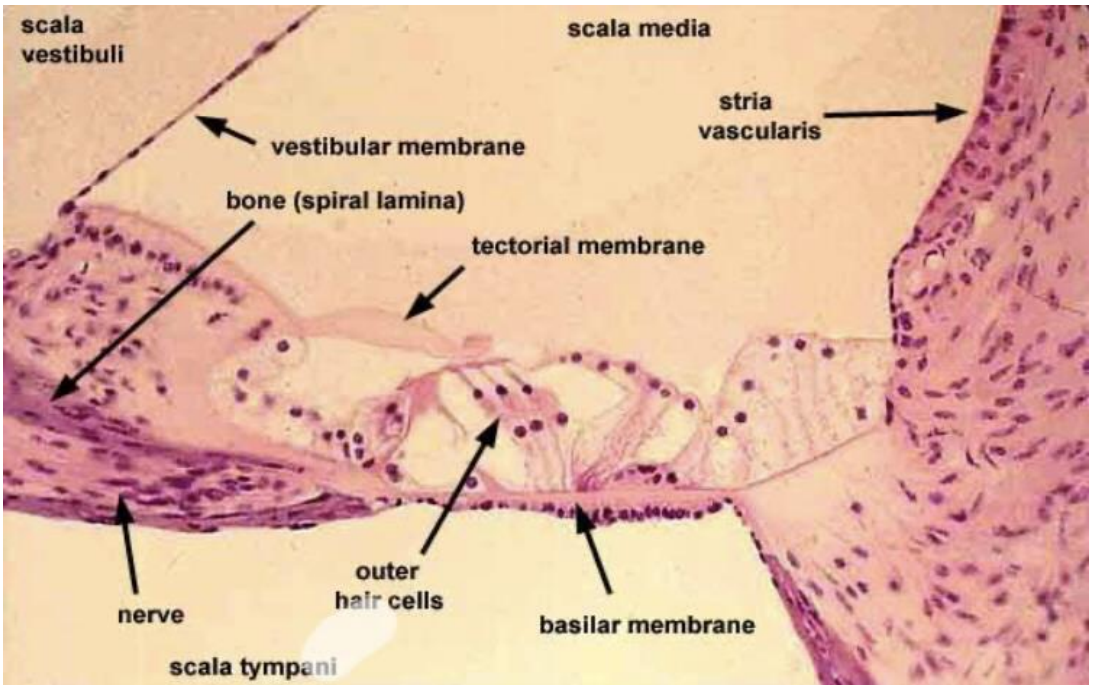
Description

DEFINITION
The **Organ of Corti** is a part of the **cochlea** and it mediates the **sense of hearing** transducing pressure waves to action potentials. This structure is localized in the scala media and it is formed by a series of hair cells, nervous terminations of spiral ganglion and supporting cells.

ORGAN OF CORTI



Organ of Corti consists of different types of cells:
*Inner hair cells
*Outer hair cells
*Supporting cells

Inner Hair Cell
These cells are specialized in the mechanoelectrical transduction. There are almost 3500 cells disposed in one line along all the basilar membrane. They are connected to type I neuron peripheral fibers of spiral ganglion, these connection are very divergent (10/1). The luminal part of the cell is immerged in endolymph, the basal one is immerged in normal extracellular fluid. The luminal portion is formed by bundles of stereocilia(inner_ear), whose tips are connected by filamentous structures called tip-links.

Outer Hair Cell
These cells are acoustical pre-amplifiers. They are almost 12000, disposed in three parallel lines. These cells are connected to type II amyelinic neurons, the connections are very convergent. They have also an afference from superior olivary nucleus. They have contractile activity.

Supporting cells

These cells are of four different types: Corti pillars, Hensen cells, Deiters cells and Claudius cells.

Endolymph

Endolymph fills the **scala media** and it is produced by **stria vascularis**.

Potassium secreted into the endolymph by the stria vascularis enters the hair cells through apical mechanosensitive channels. It is recycled back to the stria vascularis through supporting cells and fibrocytes of the spiral ligament for another round of secretion. Hair cells and stria vascularis are tied together in a "push-pull" or "pump-leak" balance that determines endocochlear potential (EP +85mV), endolymph composition and ultimately the sensivity and stability of hair cells and hearing over a lifetime.

The evolutionary strategy of using K receptors currents is due to the fact that it reduces metabolic requirements because it has a passive outflow from hair cells to the basal membrane, instead of active Na extrusion.

Endolymph has a **particular ion concentration**

Ion	Perilymph (mM)	Endolymph (mM)
Na	154	1
K	3	161
Cl	128	131

There is a potential difference of -140 mV between endolymph and inner receptor.

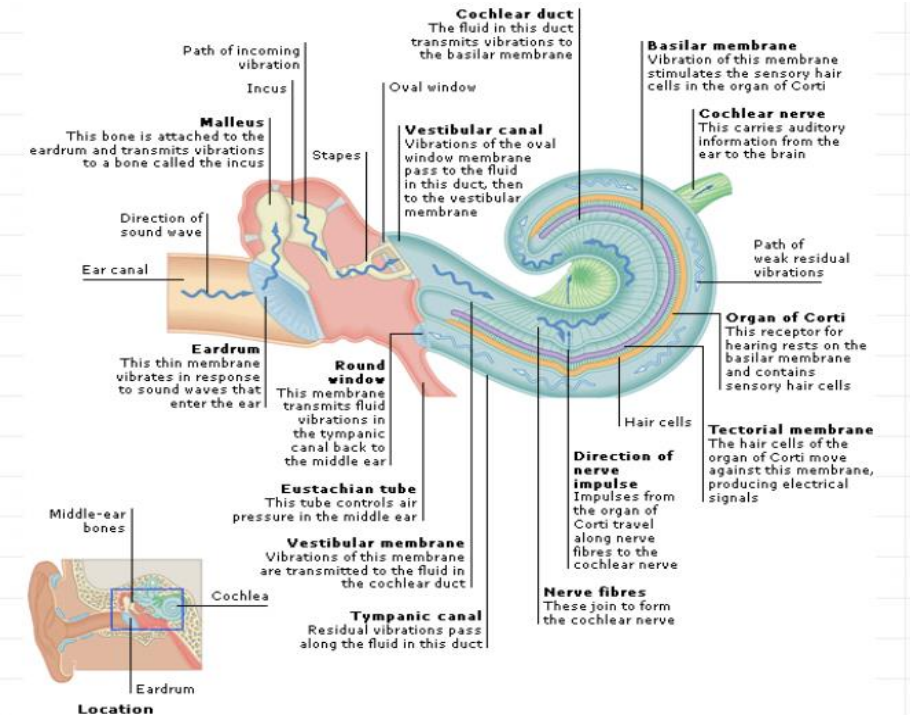
A basolateral **Na/K-ATPase** pumps K and creates a **Na** gradient to drive **K** and **Cl** into the cell in a **co-transport** process. Chloride is recycled by basolateral **Cl channels**, and K is secreted apically by **KCNQ1/KCNE1 K channels**, which are open at the unusual apical membrane voltage of marginal cells (inside positive by about +10 mV). This allows for a **net secretion into the endolymph** in spite of its high K concentration.

KCNQ proteins have six transmembrane domains and a pore-forming P-loop. Mutations on KCNQ1 and KCNQ4 lead to deafness. Indeed KCNQ4 was mapped to human chromosome 1p34; it is one of over 30 loci for dominant deafness.

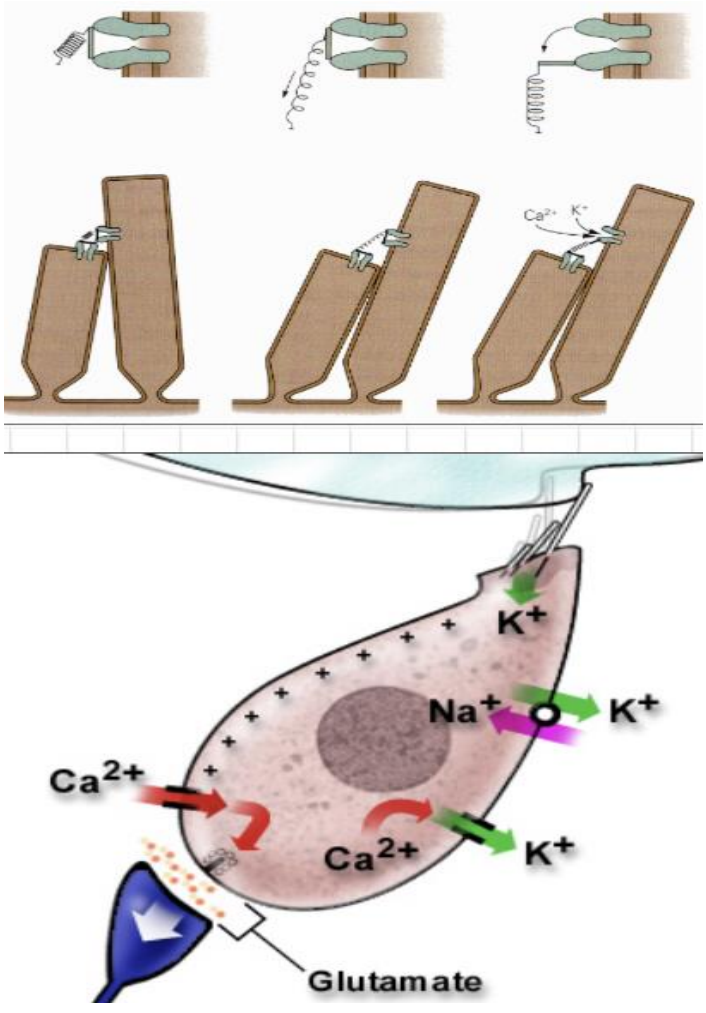
Hypoxia reduces endocochlear potential, due to a drop in metabolism and strial current; whereas a depletion of vascular K does not drop EP, showing that K comes from spiral ligament rather than from blood.

SENSE OF HEARING

The role of the sense of hearing is translating pressure waves of perilymph and endolymph to electrical signal and acoustic sensation.



Mechanism of transduction



- Deflection: tip-links open K channels and k enters the cell
- Depolarization: Ca enters the cell through voltage-dependet channels
- Higher Ca concentration: K extrusion toward basolateral portion and Glutamate release in synaptic cleft
- Action potential along acoustic nerve (VIII)

ABNORMALITIES

Deafness is a partial or total inability to hear.

AHL is the age-related hearing loss, also known as presbycusis. Many K channels, like KCNQ1, were found to be down-regulated in stria vascularis with aging. Moreover a reduced KCNQ4 current may lead to a slow degenerative process. Although in some cases the EP is maintained and this is a paradoxical phenomenon, it would appear that this is attributable to the SV which may generate a much lower current to establish a new balance for potassium influx and efflux at a relatively lower level. It is not clear if an atrophied stria vascularis could recover sufficient function by up-regulating these potassium transporters expression to maintain a normal endocochlear potential.