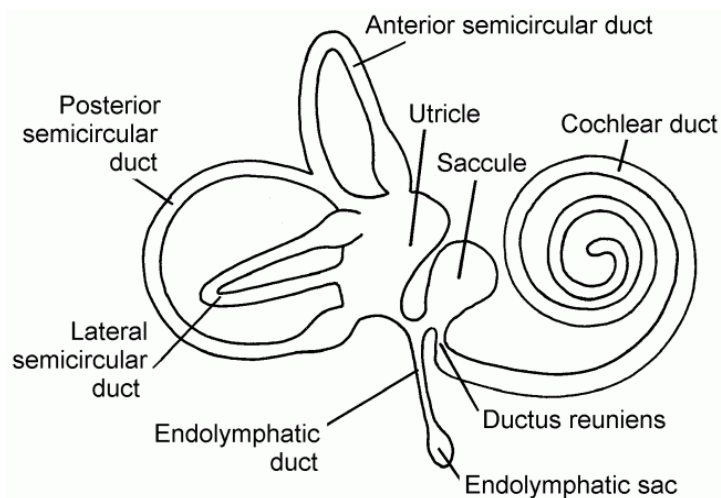
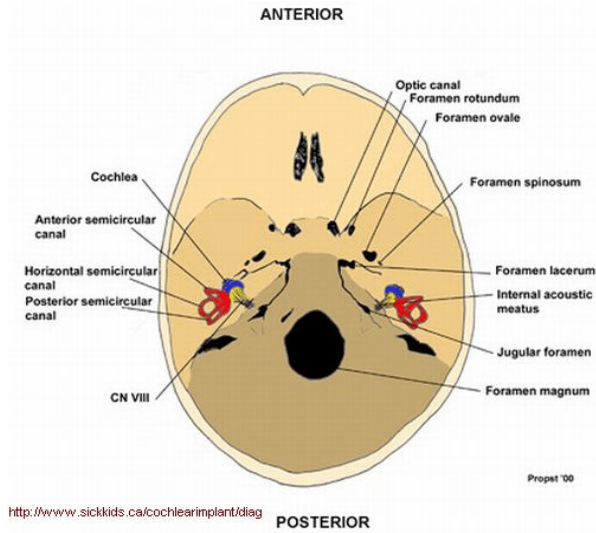
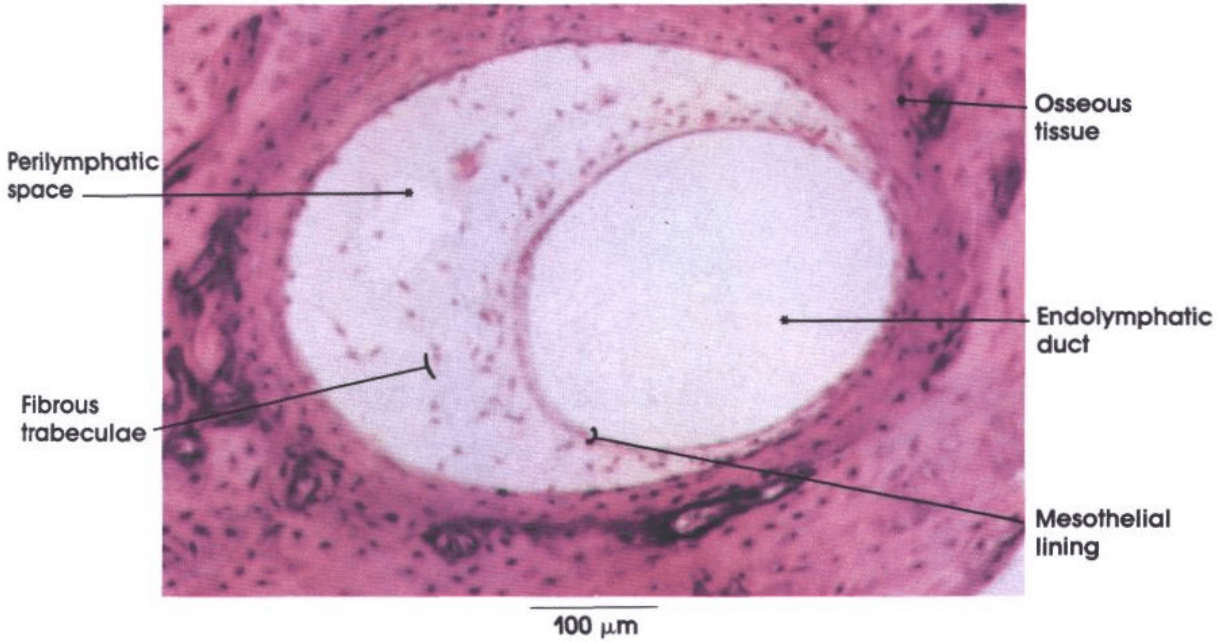


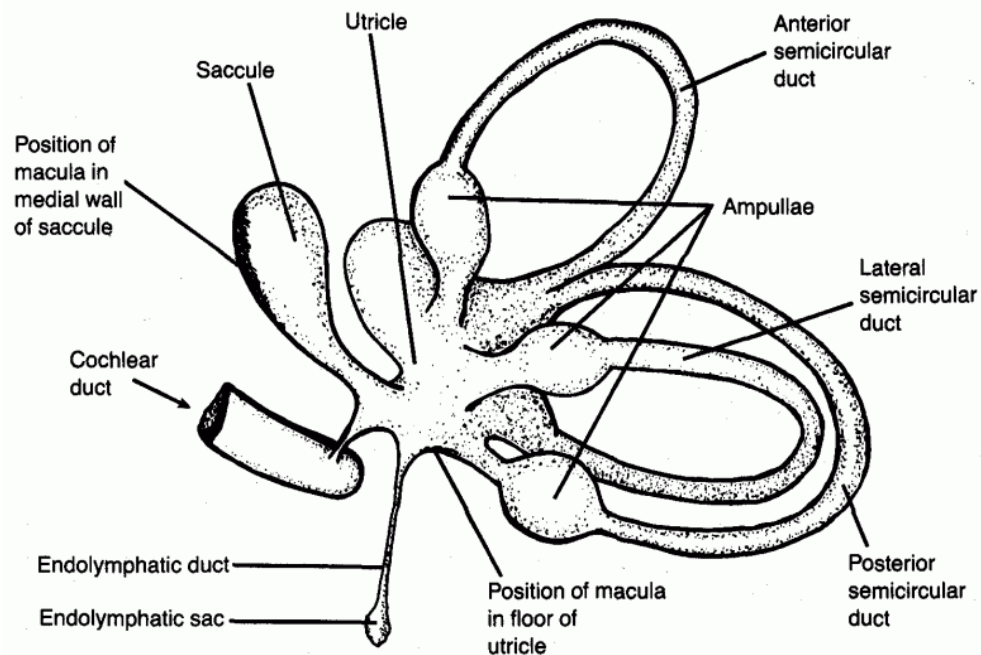
VESTIBULAR SYSTEM



Section through a non-sensory part of a semicircular canal, showing the spaces occupied by perilymph and endolymph.

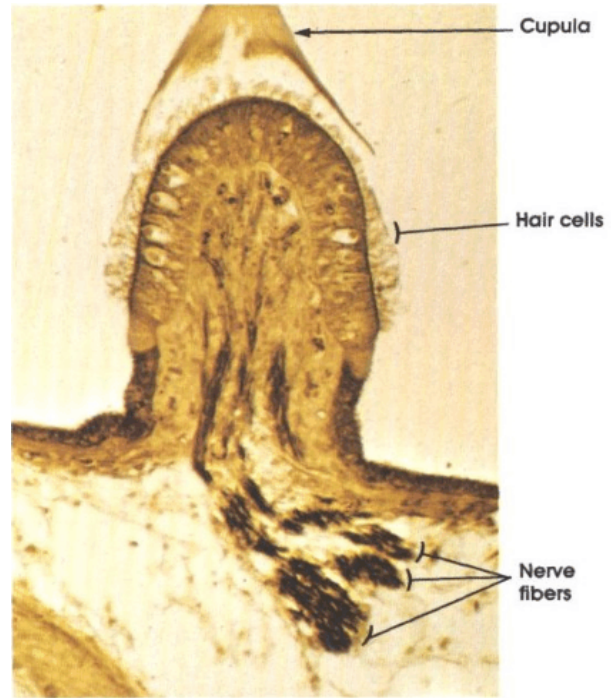
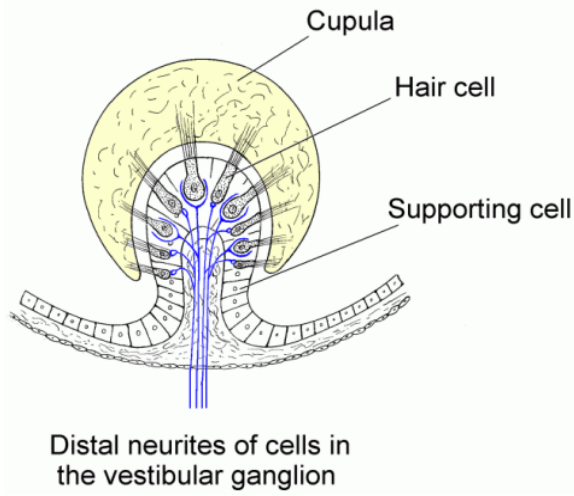


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The vestibular labyrinth

CRISTA AMPULLARIS in ampulla of a semicircular duct.

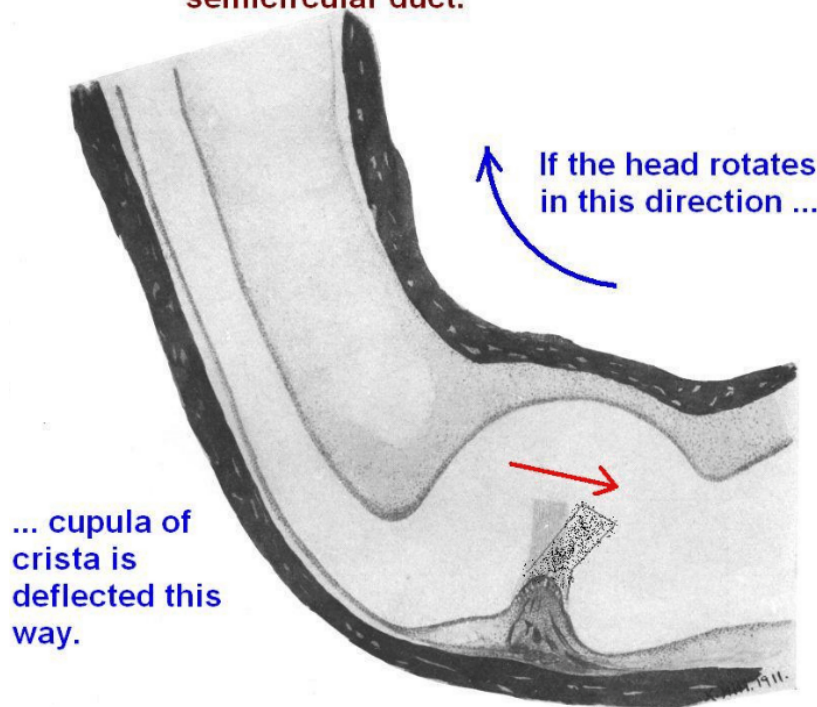


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Current in the endolymph moves the cupula and the sensory hairs.

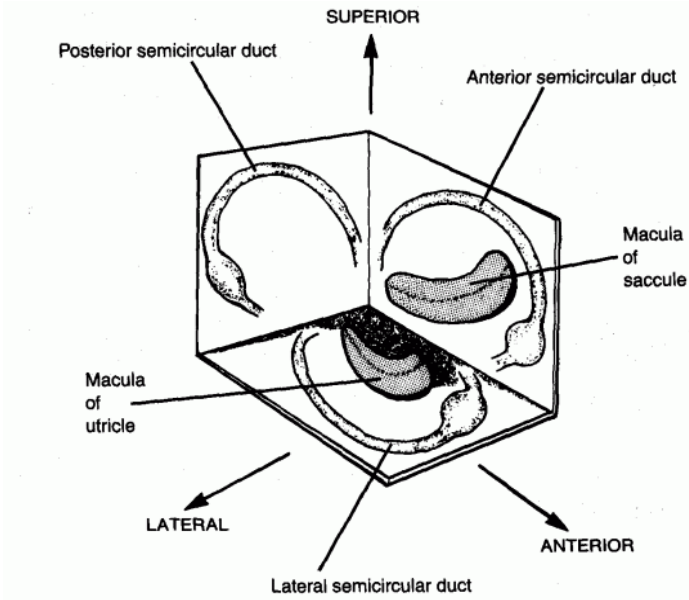
Otoliths are not present in the cupula.

Longitudinal section of ampulla of a semicircular duct.



With a slow rotation the endolymph stays still while the wall of the semicircular duct moves, dragging the cupula of the crista ampullaris.

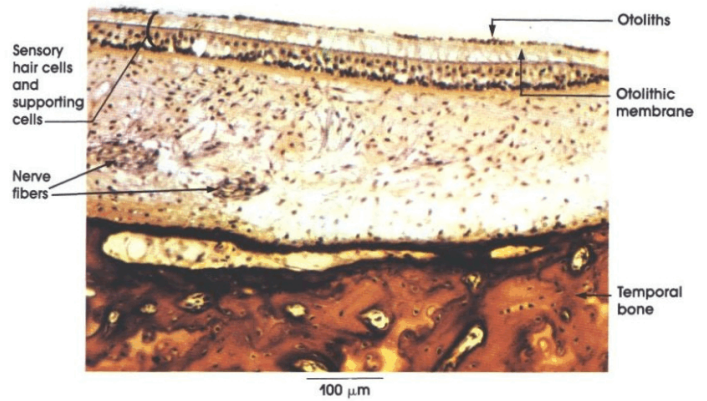
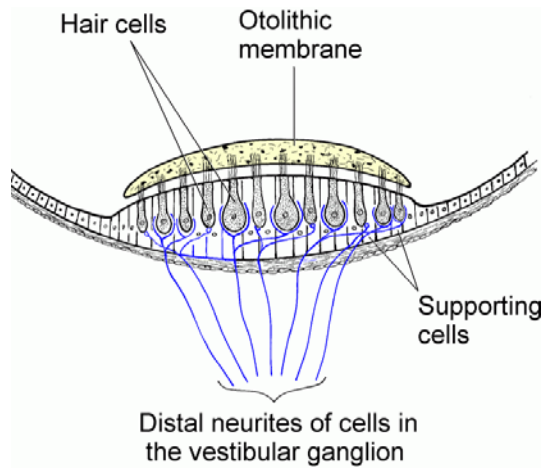
FIG. 469.—Cross section of semi-circular canal and ampulla showing relations of membranous canal and ampulla to the bony canal, crista ampullaris and cupola, pig. Shambaugh, GE 1928. In "Special Cytology," ed. EV Cowdry. Vol. 2, p.951. New York: Hoeber.



The approximate orientations of the receptors of the right vestibular apparatus. The three semicircular ducts lie in mutually perpendicular planes. One macula is horizontal, the other vertical.

(From Kiernan JA 1987. *Introduction to Human Neuroscience*. Philadelphia: Lippincott.)

MACULA OF UTRICLE



Bergman, Afifi & Heidger 1989. *Atlas of Microscopic Anatomy*

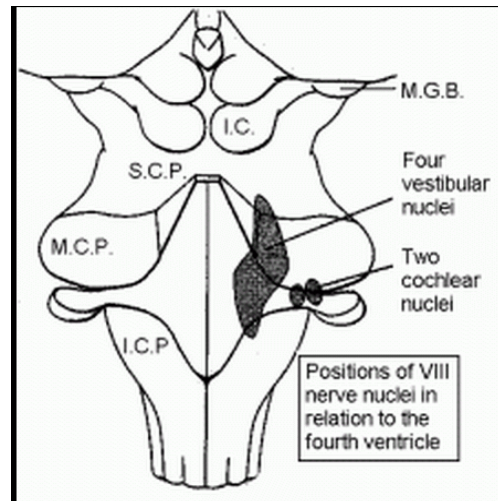
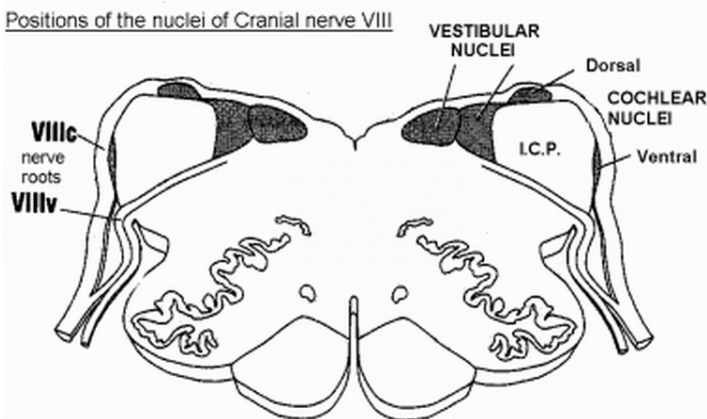
KINETIC LABYRINTH

Receptors in semicircular ducts respond to rotary movement of the head.

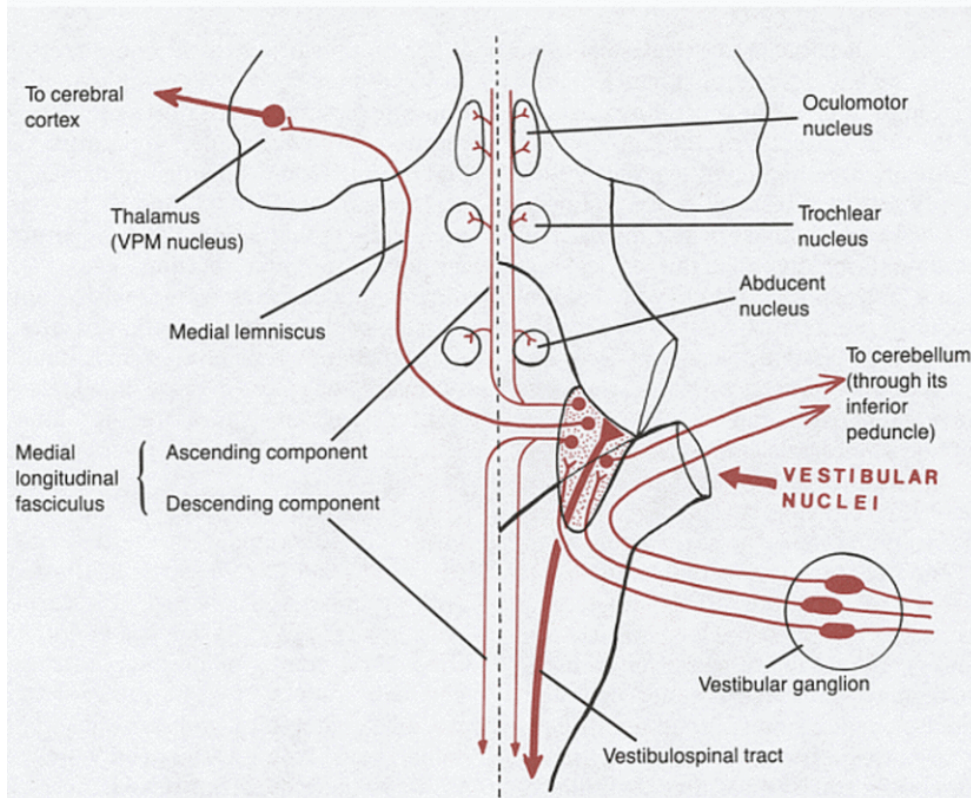
STATIC LABYRINTH

Otolithic receptors in saccule and utricle respond to the pull of gravity; also to acceleration and deceleration.

Positions of the nuclei of Cranial nerve VIII



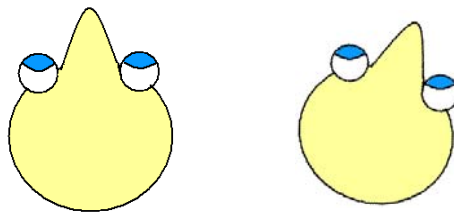
Central connections of the vestibular system



(From Kiernan JA 1987. *Introduction to Human Neuroscience*. Philadelphia: Lippincott.)

VESTIBULO-OCULAR REFLEX

When the head rotates slowly, the eyes move through an equal angle in the opposite direction.



VESTIBULAR NYSTAGMUS

Physiological. Spin rapidly, then stop suddenly. Momentum of endolymph makes it flow past and deflect cupula. This causes a sensation of rotation in the opposite direction (dizziness, vertigo).

For a few seconds there are alternating fast and slow conjugate eye movements in the plane of rotation: **nystagmus**.

The slow component is driven by signals from the vestibular nuclei, by way of the medial longitudinal fasciculus (MLF) to the ocular motor nuclei (III, IV & VI).

The fast component is a correction, originating in the visual cortex. The fast component of vestibular nystagmus does not occur in comatose subjects.

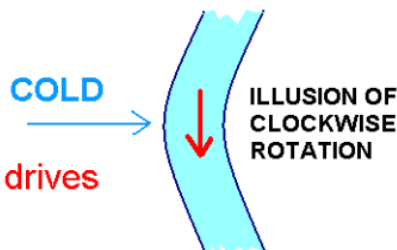
VESTIBULAR NYSTAGMUS

Caloric testing. The lateral semicircular duct is very near the medial wall of the middle ear cavity. Irrigation of the external ear with cold or warm water induces a convection current (down or up, respectively) in the endolymph. The current deflects the cupula in the ampulla.

For example:

Supine subject, head inclined 30°.
Cold water in left ear.

Vestibulo-ocular reflex drives eyes slowly to the left.



Comatose patient.

Eyes move to left (no nystagmus). Indicates integrity of brain stem structures.

Conscious patient.

Nystagmus, named for its fast component (i.e. a right nystagmus).
Mnemonic – **COWS**