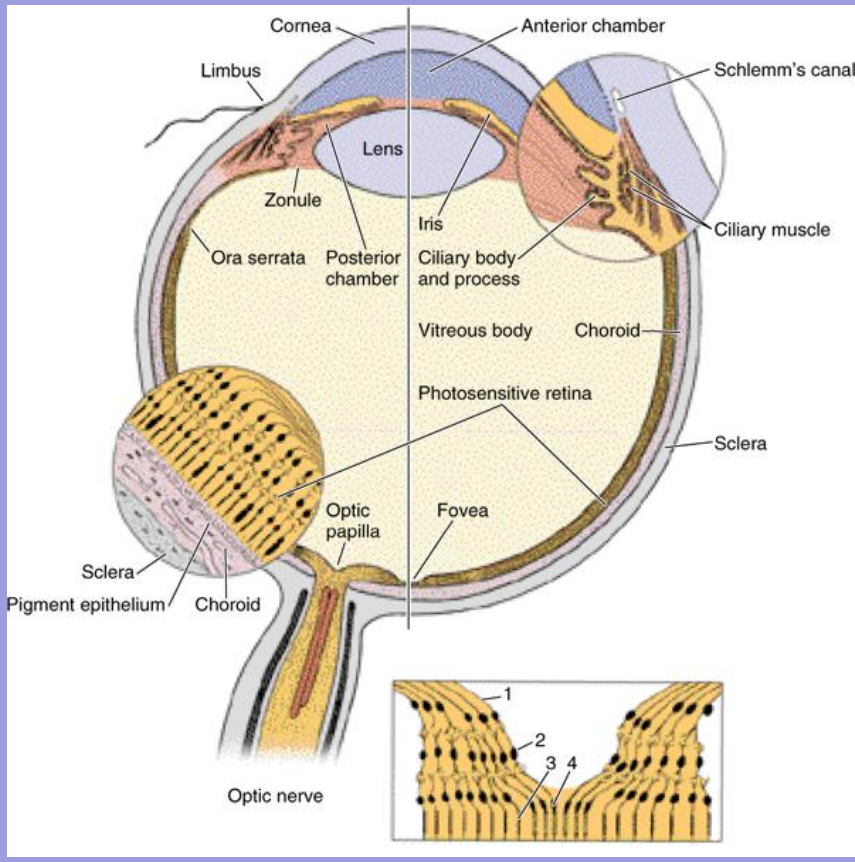
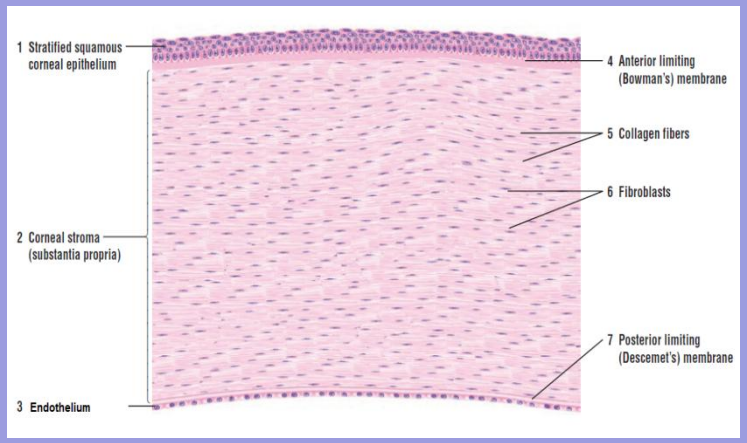
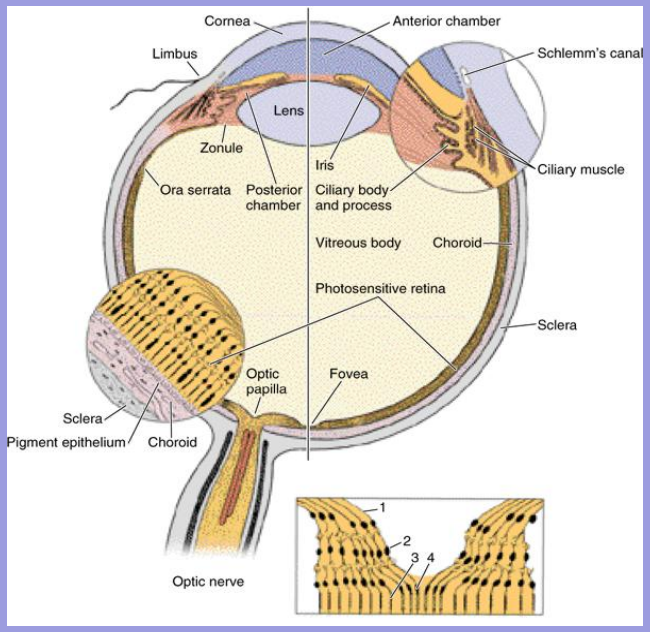
Special sense

- **The eye :**
- The eye is a complex and highly developed photosensitive organ that permits an accurate analysis of the form , light intensity , and color reflected from objects .
- Each eye is composed of three concentric layers : an external layer ; middle layer , and inner layer of nerve tissue .
- **External layer :**
- The posterior five-sixths of the external layer of the eye is the sclera . The sclera consists of tough , dense connective tissue, a moderate amount of ground substance , and few fibroblasts .



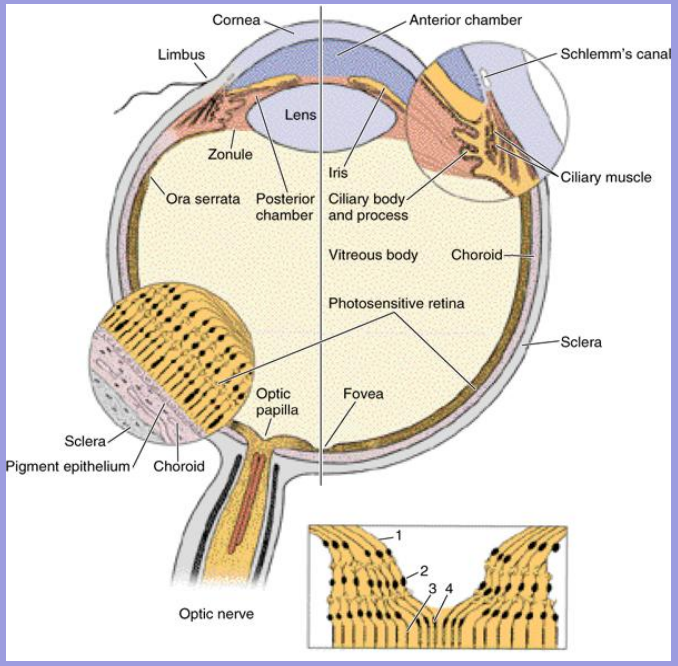
- The anterior one sixth –the cornea – it consists of five layers :
- **the corneal epithelium** ,.
- **Bowman's membrane** ,
- **Stroma**
- **Descemet's membrane**.
- **The endothelium**
- The corneoscleral junction OR limbus , is an area of transition from the transparent cornea to the white opaque sclera .
- The cornea , an avascular structure , receive its metabolites by diffusion from adjacent vessels and from the fluid of the anterior chamber of the eye .
- In the region of the limbus, irregular endothelium-lined channels , the trabecular meshwork , merge to form **Schlemm's** canal . Schlemen's canal communicate externally with the venous system .



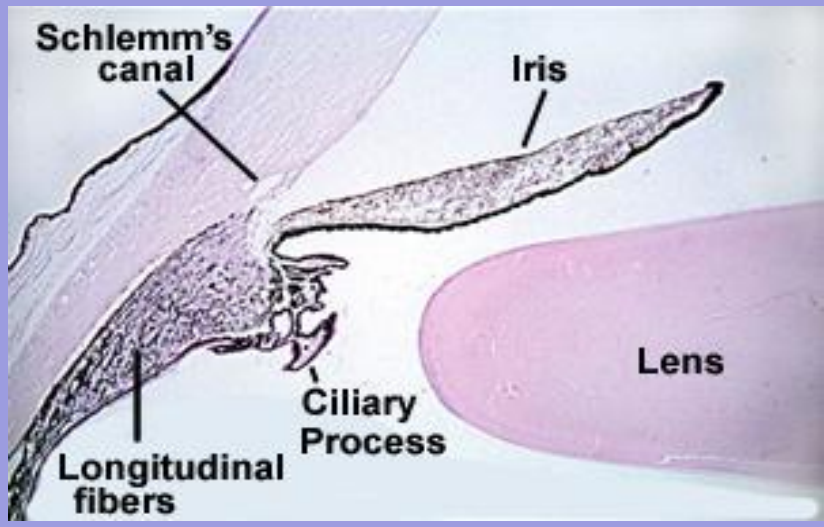


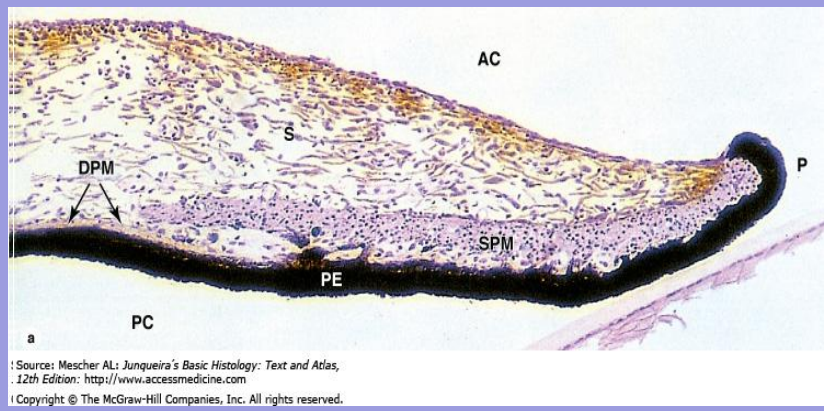
- **Middle , or Vascular layer :**
- consists of three parts : choroids , ciliary body , and iris (uveal tract) .
- **Choroid :**
- The choroids is a highly vascularized coat is rich in fibroblasts , macrophages , lymphocytes , mast cells , plasma cells , collagen fibers and elastic fibers . Melanocytes are abundant .The inner layer is richer than the outer in small blood vessels and is called the choriocapillary layer . It has an important function in nutrition of the retina .A thin hyaline membrane separate the choriocapillary layer from the retina .This is known as Bruch's membrane.

- **Ciliary body:**
- An anterior expansion of the choroids. rich in elastic fibers, vessels, and melanocytes (surrounding the ciliary muscle).
- One of these bundles has the function of stretching the choroids; another bundle, when contracted, relaxes the tension on the lens. These muscular movements are important in visual accommodation.
- **Ciliary processes:**
- Are ridgelike extensions of the ciliary body. They have numerous fenestrated capillaries that are covered by the two simple epithelial layers (pigmented and non pigmented).
- The non pigmented cells are actively transport certain constituents of plasma into the posterior chamber, thus forming the **aqueous humer**.



- **Iris :**
- The anterior surface of the iris is irregular and rough .The smooth posterior surface of the iris is covered by two layers of epithelium :The inner epithelium is heavily pigmented with melanin granules ,The outer epithelial cellsare filled with overlapping myofilaments ,creating the dilator pupilae muscle.
- The melanocyte of the stroma of the iris are responsible for the color of the eyes .
- The iris contains smooth muscle bundles disposed in circles concentric with the papillary muscle of the iris .

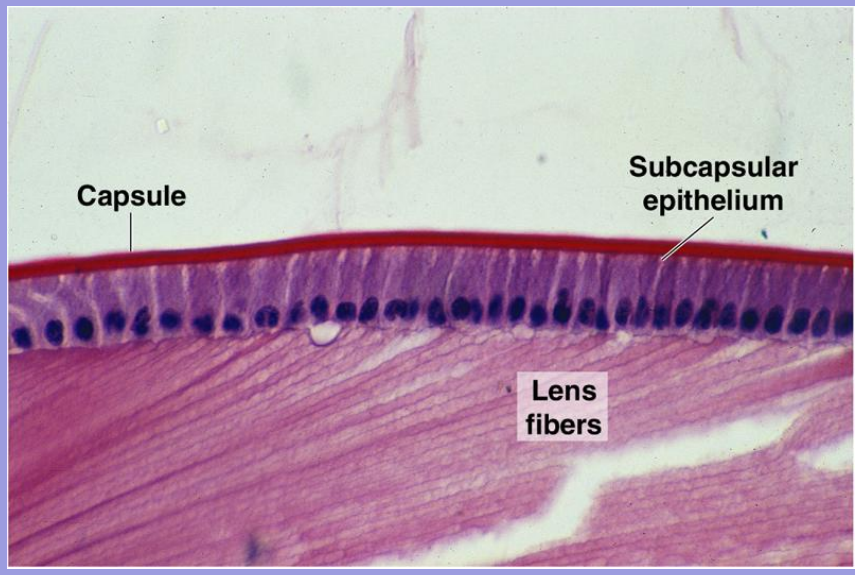


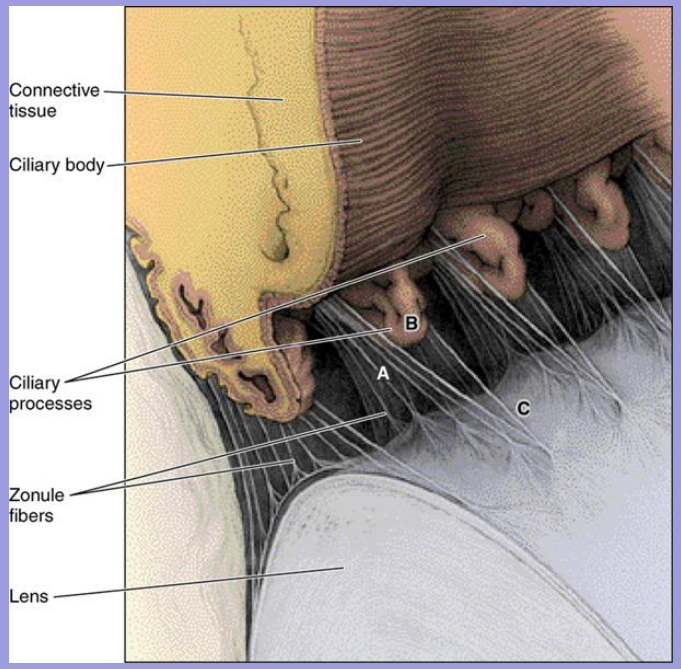


Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas, 12th Edition:* http://www.accessmedicine.com

- **Lens :**
- The lens is a biconvex structure characterized by great elasticity .The lens has three principal components :
- ***Lens capsule*** :
- ***Subcapsular epithelium*** :

  single layer of cuboidal epithelium .
- ***Lens fibers*** : Lens fibers are elongated structures derived from cells of the subcapsular epithelium ,these cells are filled with a group of proteins called crystallins .
- The lens is held in place by group of fibers (the zonule) , that inserts on one side on the lens capsule and on the other on the ciliary body . These fibers are important in the process known as accommodation , which permits focusing on near and far objects by changing the curvature of the lens .



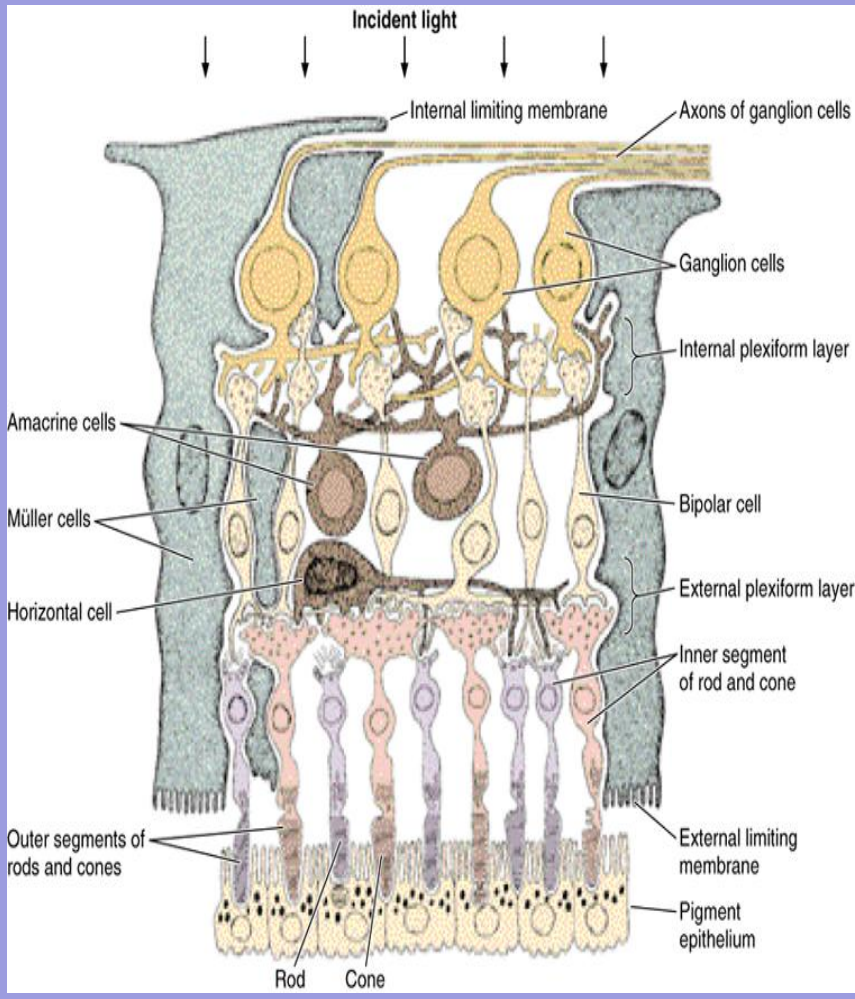


- **Retina :**
- The retina , the inner layer of the eye consists of two portions . photosensitive ; and photo non sensitive .
- In adult it is composed from the pigment epithelium and the optical or functioning part of the retina-the neural retina .

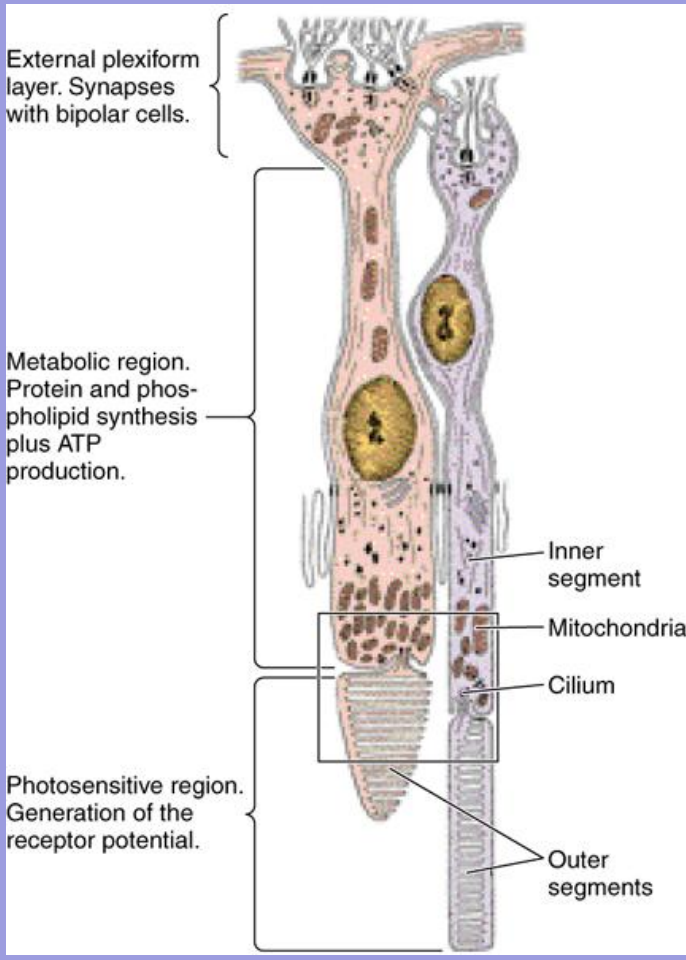
1-The pigment epithelium consists of columnar cells with numerous basal invaginations .Mitochondria are more abundant (ion transporting activity). The cytoplasm has abundant smooth endoplasmic reticulum , believed to be a site of vitamin A esterification .

2- The optical part of the retina consists of an outer layer of photosensitive cells , the rods and cones ;

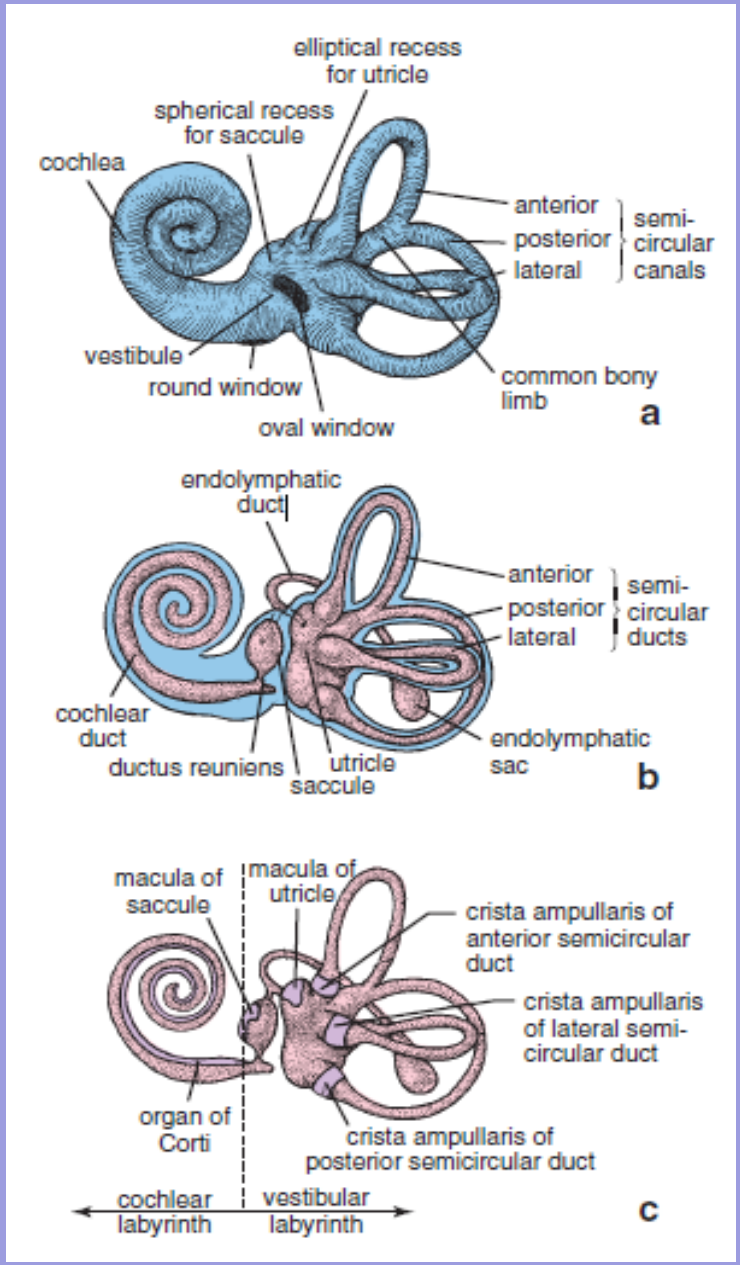
3- An intermediate layer of bipolar neurons which connect the rods and cones to the ganglionic cells and an internal layer .



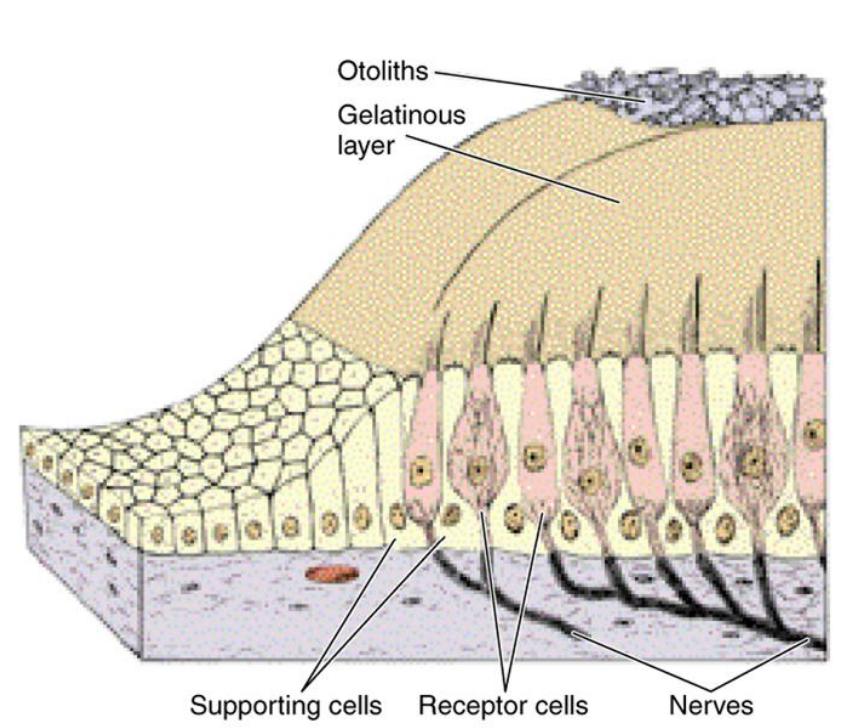
- **Rod cells :**
- Rod cells are thin elongated composed of two portions .The external photosensitive rod shaped portion is composed of numerous flattened membranous disks .The outer segment is separated from the inner segment by a constriction .The inner segment has remarkable accumulation of mitochondria .Polyribosomes present in large numbers which are involved in protein synthesis ..The flattened disks of the rod cells contain the pigment visual purple ,or **rhodopsin** .
- They are extremely sensitive to low level of light .
- **Cones cells :**
- Cone cells are also elongated .The structure is similar to that of rods. Cones differ from rods in their form . The cone photopigment called iodopsin .Cones , sensitive only to light of an intensity higher than required to stimulate rods .

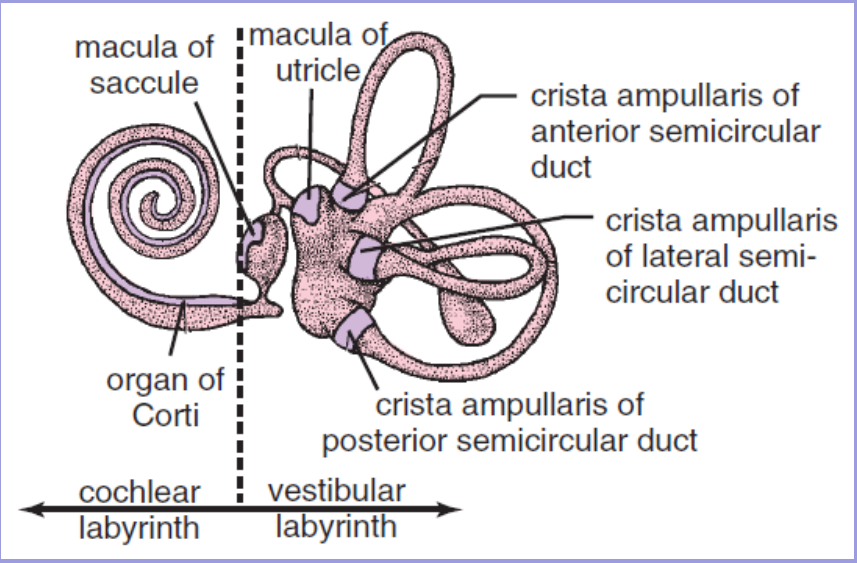


- ***Hearing:*** **The ear (vestibulocochleaar apparatus):**
- **The external ear**, **The middle ear, The internal ear**.
- The internal ear is composed of two labyrinths .The bony labyrinth consists of spaces in the temporal bone .There is irregular central cavity , the vestibule , housing the saccule and the utricle . Behind this , three semicircular canals enclose the semicircular ducts ; the anterolateral cochlea contains the cochlear duct .
- The cochlea , about 35 mm in total length , makes two and one half turns around a bony core known as the modiolus .

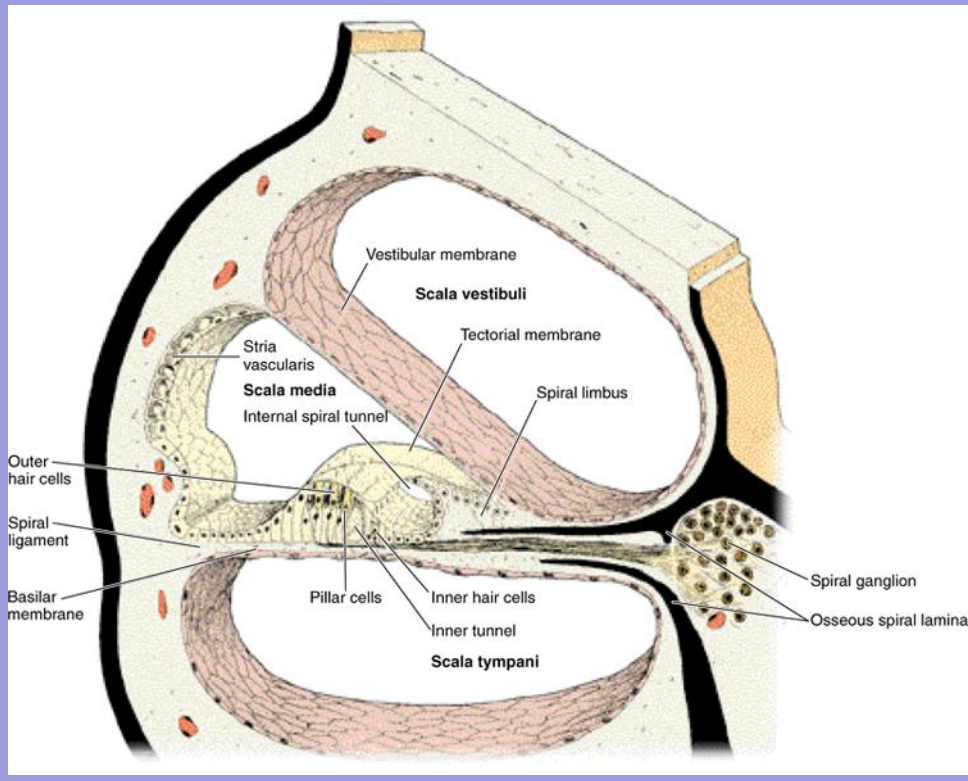


- **Membranous labyrinth :**
- **Saccule and utricle :**
- In the wall of the saccule and utricle can be observed small regions called maculae of differentiated neuroepithelial cells that are innervated by branches of the vestibular nerve .They consist of a thickening of the wall and possess two types of receptor cells (Hair cells) , some supporting cells , and the afferent and efferent nerve endings .
- **Semicircular ducts :**
- Semicircular ducts have the same general form as the corresponding parts of the bony labyrinth .The receptor areas in their ampulae have an elongated ridgelike form and are called cristae ampullares .cristae are structurally similar to maculae .





- **Cochlear duct :**
- The cochlear duct is highly specialized as a sound receptor. The cochlea appears to be divided into three spaces: the scala vestibule (above), the scala media (cochlear duct)in the middle, and the scala tympani. The cochlear duct has the following structure.
- The vestibular membrane consists of two layers of squamous epithelium, one derived from the scala media and the other from the lining of the scala vestibulae.
- The structure of the internal ear that contains special auditory recptors is called the organ of Corti; it contains hair cells which rest on a thick layer of ground substance - the basilar membrane. Supporting cells and two types of hair cells can be distinguished.



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